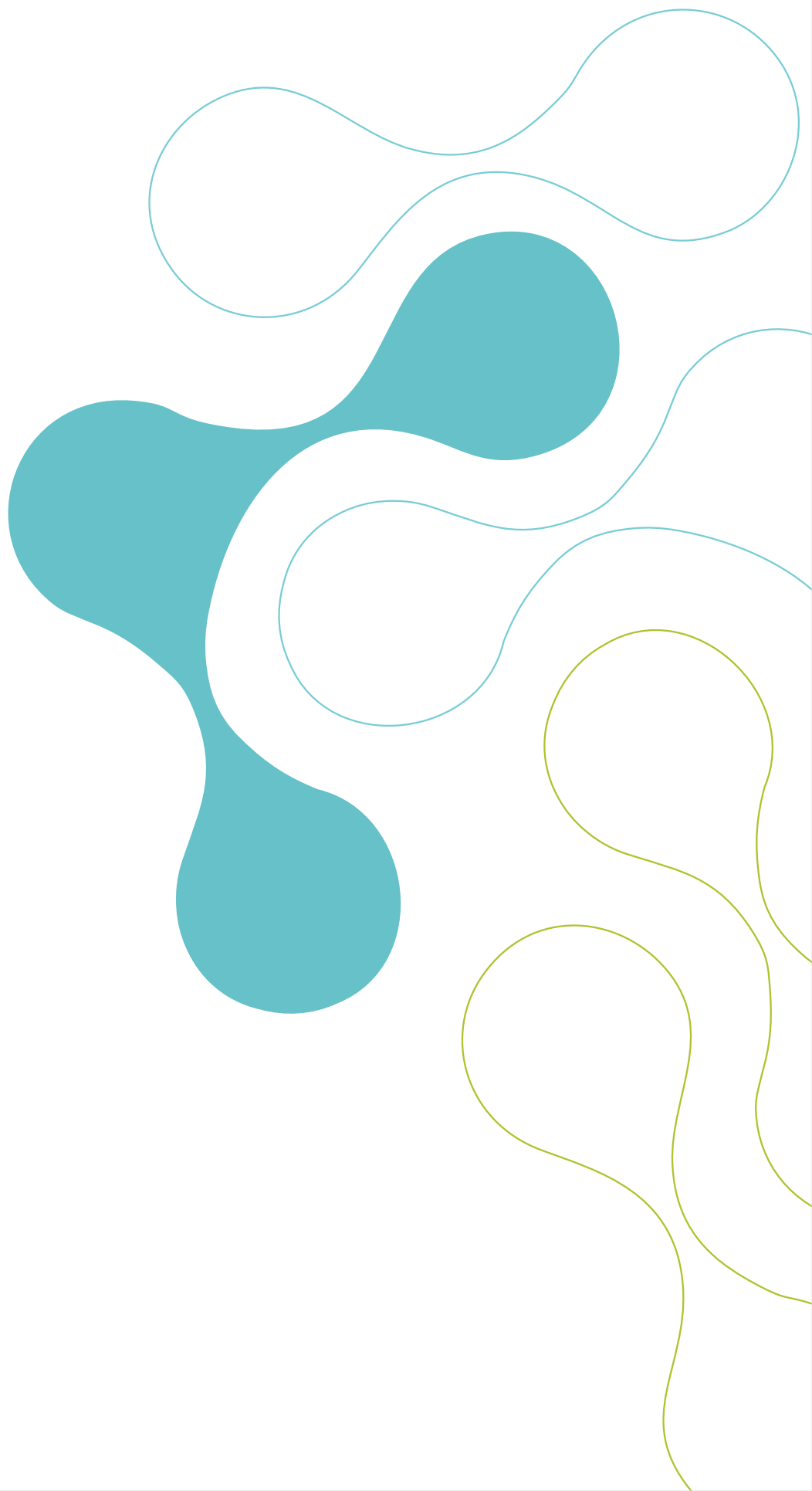


NATIONAL ROADMAP FOR RESEARCH INFRASTRUCTURE (2020-2027)

MINISTRY OF EDUCATION AND SCIENCE OF
REPUBLIC OF BULGARIA



REPUBLIC OF BULGARIA
MINISTRY OF EDUCATION
AND SCIENCE



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Republic of Bulgaria
2A Knjaz Dondukov Blvd.
BG-1000 Sofia
www.mon.bg
ISBN 978-954-8973-29-8

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▸ 2021

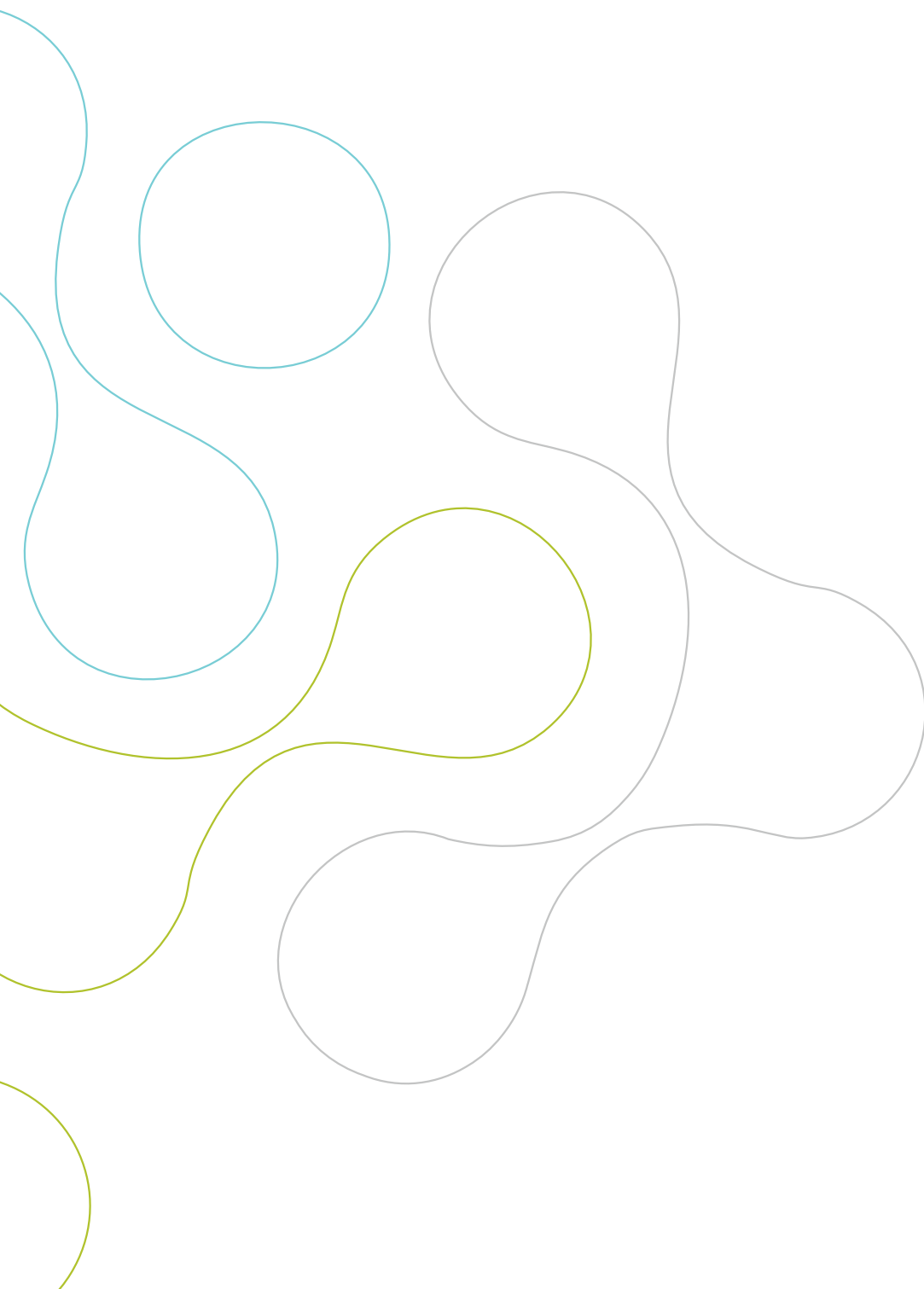


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Centre of Excellence for informatics and information and communication technologies	149
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List of abbreviations

BAS	▶▶	Bulgarian Academy of Sciences
ERA	▶▶	European Research Area
EU	▶▶	European Union
ESIF	▶▶	European Structural and Investment Funds
ESFRI	▶▶	European Strategy Forum for Research Infrastructures
ISSS	▶▶	Innovation Strategy for Smart Specialization
MES	▶▶	Ministry of Education and Science
RI	▶▶	Research and Development Infrastructure
R&D	▶▶	Research and Development
NRRI	▶▶	National Roadmap for Research Infrastructure
NSRD	▶▶	National Strategy for Research Development
OPSESG	▶▶	Operational Programme Science and Education for Smart Growth
SC	▶▶	Standing Committee
CoE	▶▶	Centre of Excellence
CoC	▶▶	Centre of Competence



Definitions

National Roadmap for Research Infrastructure

Long-term strategic document for planning the development of the research infrastructure that contains a list of new infrastructure associations of national and European importance, as well as ones that are being renewed. The infrastructures, included in the roadmap, are both physical sites and network structures, as well as consortia related to the country's membership in international organizations with research infrastructure.

European Strategy Forum for Research Infrastructure

Strategic tool for developing an integrated European approach to strengthen international achievements in science. The competitive and open access to high-quality research infrastructure supports and takes into account the quality research of European scientists and attracts the best scientists from around the world. ESFRI takes part in the formulation of European and global science policy and contributes to its development, from political objectives to specific recommendations for the development of research infrastructure in Europe.

Research infrastructure

Combines a set of tools (laboratories, facilities, equipment, resources, collections, archives, structured information), conditions, expertise, methods, materials, activities and related services used to create, transfer, exchange and retain new knowledge, gained through scientific research and technological development. The research infrastructure can be centralized (e.g. telescopes, synchrotrons, etc.) or distributed (e.g. a network of biobanks) that provides shared or virtual services, which end users – scientific community, industry, etc. – can use.

Infrastructure categories

Unique research infrastructure

Research centers and integrated complexes, which have highly specialized equipment and facilities, offer specialized scientific services, they have no analogue at national level and/or are a partnership set of infrastructures, defined by ESFRI and are included in the European Roadmap for Research Infrastructure.

Research centers

Centers with unique equipment, funded by the European Regional Development Fund, where science develops on a professional level.

Research facilities

A set of unique facilities for conducting specific research of regional and national importance on environmental monitoring and study.

Pan-European infrastructures

A consortium of organizations of the EU member states that jointly build and share scientific equipment for specific research in various fields of science and the impact on the economy and society.

Research complexes

A network of similar research infrastructures, which may be concentrated on one campus or distributed across the territory.

E-infrastructure

It includes supercomputer configurations for processing large arrays of simulation data, data warehouses, and other shared-use resources.

European Open Science Cloud

A reliable and open environment for storing, sharing and reusing scientific data and results.



Summary

Scientific infrastructure is a key pillar of the national research and innovation systems of the Member States of the European Union (EU) and the European Research Area (ERA) for the development of research and innovation in key areas of society and the economy, such as health, environment, climate, etc. At the same time, they make it possible to achieve progress and solve large-scale and difficult national and Pan-European socio-economic challenges. They form the necessary basis for conducting excellent fundamental and applied research and are a platform for the development of state-of-the-art technologies, providing access to the necessary facilities and equipment, as well as to large databases and other services. EU Member States and countries, associated to the Framework Program publish and update their research infrastructure roadmaps, following the example of the European Strategy Forum for Research Infrastructure (ESFRI), which published the first Pan-European Research Infrastructure Roadmap in 2006.

This is the third updated edition of the Roadmap for Research Infrastructure of the Republic of Bulgaria and it covers the period 2020-2027. In 2019, after a scientific evaluation of the projects according to a methodology developed on the basis of the ESFRI criteria – stable and effective management, vision for sustainable development, access rules and infrastructure-specific research, etc., 13 new RI projects were selected, which had received the highest grades and had shown high potential for development. As a result of a signed Memorandum of Understanding between the Ministry of Education and Science, Sofia University and two leading Swiss institutes, with CMD No. 56/18.02. 2021 (SG, issue 16, 23.02.2021), the Institute for Scientific Research in the Field of Computer Science at Sofia University "St. Kl. Ohridski" was created. The institute was included as a new site on the NRRI and falls into the group of

national scientific innovation complexes – projects of key importance for the development of the competitiveness of the Bulgarian economy and technological base. The plan for the institute is to work on global scale with established innovative practices and models, incl. in terms of doctoral training, career development of researchers, habilitation, etc. Thus, the current updated version of the Roadmap includes a total of 51 projects (including 15 CoCs and CoEs, approved by OPSESG and that have undergone international evaluation) in various areas of impact covering energy; environment and ecology; biotechnology, biomedicine, health and food; physics and engineering; aerospace and defense industry; social and cultural innovation, information and communication technologies, and electronic infrastructure.

The current update of the National Roadmap for Research Infrastructure in 2021 provides detailed information on each of the 51 projects, namely on the institutional partnerships within each project, description and activities of the research infrastructure, project benefits and impact. The connections with Pan-European infrastructure consortia or other major international initiatives in the field are described.

The National Roadmap for Research Infrastructure implements the policies and measures, identified in the National Strategy for Research Development (NSRD) and the Innovation Strategy for Smart Specialization (ISSS), and meets the needs of increasing the public awareness regarding the work of scientists and of public recognition of their achievements in order to encourage young people to start a career in science. At the same time, the projects included in this updated strategic document of the Republic of Bulgaria, are of key importance in terms of promoting excellence, knowledge transfer and internationalization of Bulgarian research within the priority of strengthening open science and civil sci-

ence in Europe, thus contributing to the building of a knowledge-based society

The building of the research infrastructure is a leading goal of the National Development Programme Bulgaria 2030, where priority one is aimed at strengthening the research and innovation environment through investments in infrastructure. This policy is the basis of the Partnership Agreement between Bulgaria and the EU. The development of the research infrastructure aims to provide the necessary conditions for the active participation of Bulgarian scientists and innovative companies in Horizon Europe and to increase the interest of third country scientists in order to increase the internationalization of Bulgarian science.

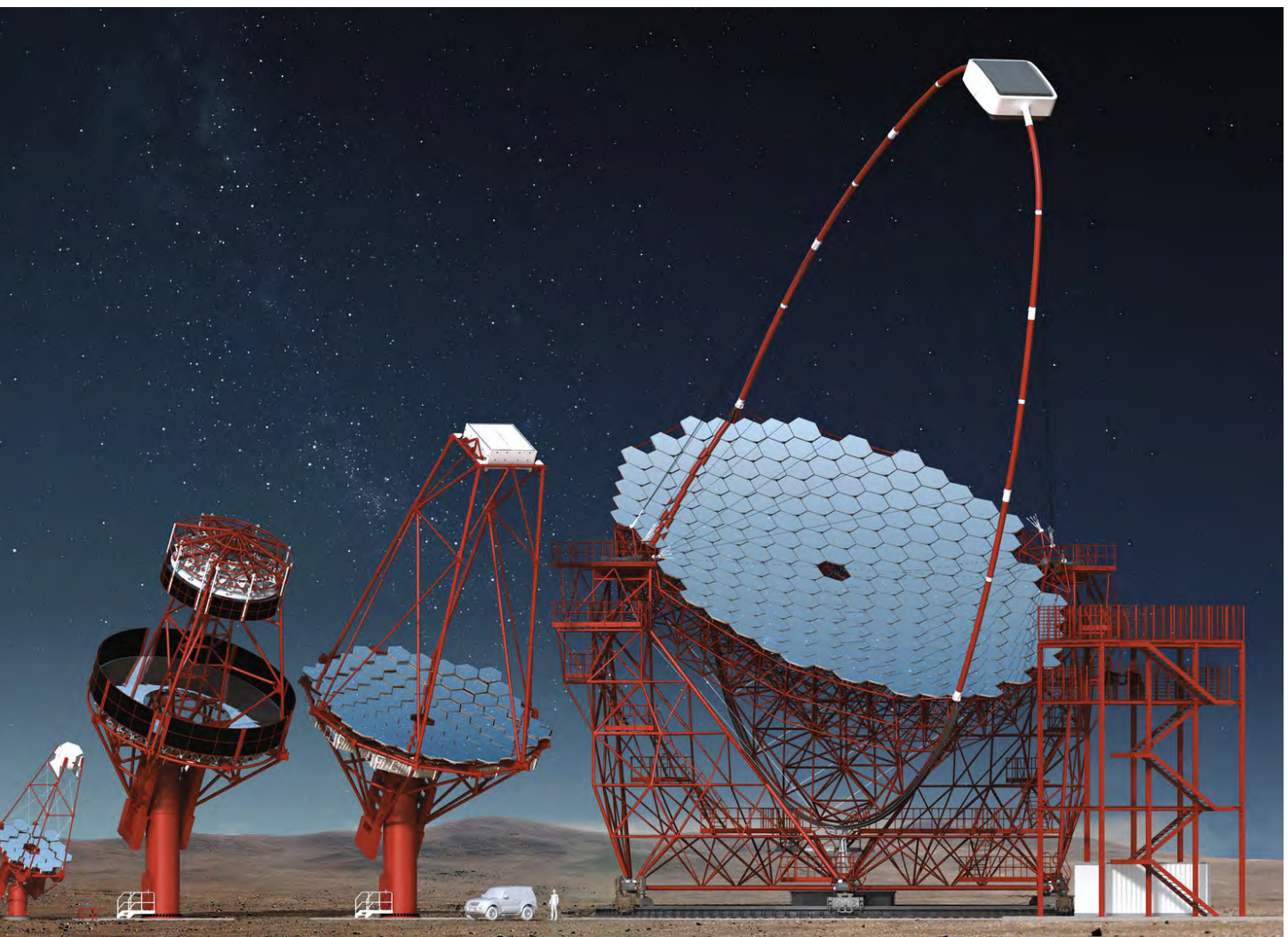


Introduction

The National Roadmap for Research Infrastructure 2020 – 2027 is elaborated by the Ministry of Education and Science in coordination with the Bulgarian research organisations and higher education institutions, representing the consortia managing the NRRI-included projects. It is structured as follows:

- Monitoring & Assessment;
- PScope of the NRRI;
- Purposes of the Document;
- Strategic Framework in the European and National Context;
- Implementation of the NRRI;
- Funding;
- Description of the projects.

CTA-MAGIC Project.





1. Scope of the NRRI

The National Roadmap for Research Infrastructure 2020 – 2027 includes the main research complexes in the country and their respective prioritization at European and national level, according to the areas of impact of the ESFRI (energy, environment, health and food, natural and engineering sciences, social and cultural innovations and e-infrastructure) and ISSS (information and communication technologies and informatics; healthy lifestyle and biotechnology industries; mechatronics and clean technologies, and new technologies in the creative and recreational industries), the infrastructures being grouped as follows:

- International research infrastructures;
- Unique research facilities;
- Bulgaria in Pan-European Research Infrastructure Consortia (ERICs);
- National research and innovation complexes – projects of key importance for the development of the competitiveness of the Bulgarian economy and technological base;
- E-infrastructure. Digital, computational and computer research (e-research).

As a result of the evaluation and selection, the updated NRRI contains 51

projects (23 after the last update in 2017, 13 new projects and 15 Centers of Excellence and Centers of Competence, which after entering the operational phase will receive support for further sustainable development), which fall into one or more of the described groups. Based on the assessment of the membership and status of the European sites in ESFRI, there was confirmation of the national commitment to 8 European consortia (CLARIN ERIC, Euro Argo ERIC, ESS ERIC, EurBioImaging ERIC, BBMRI ERIC, SHARE ERIC, EATRIS ERIC, DRIAH ERIC), and of the participation in 5 partnerships for the creation of consortia (ACTRIS, CTA, ELI, EPOS, AnaEE).

2. Purposes of the Document



- 2.1. To act as a reference strategic document of national importance, which provides guidelines and priority for the development of future and already built infrastructures of strategic importance and their international inclusion;
- 2.2. To create framework conditions for uniform standards for access and use of infrastructures;
- 2.3. To improve the efficiency of the system of research infrastructures in the country and to reduce the fragmentation in scientific research;
- 2.4. To contribute to increasing the participation of the Bulgarian scientific community and business in research and development activities in the various pillars and thematic areas of FP "Horizon Europe";
- 2.5. To contribute to the training of young talents through easy access to various infrastructures in order to encourage them to start a career in science;
- 2.6. To create favorable conditions for innovation activities and generation of added value through research at the highest level by facilitating industry access to the research infrastructure.



3. Strategic Framework in the European and National Context

3.1. European Context

The update of the Roadmap in 2020 and 2021 aims to continue the consolidation and modernization of the research infrastructure in Bulgaria, as well as to ensure sustainability of investments in leading consortia, areas and units in order to implement Bulgaria's obligations to meet the objectives of the ERA, in particular the ones under Priority 2 "Optimal transnational cooperation and competition" that includes joint actions on major societal challenges and research infrastructures, and the ones under Priority 5 "Optimal circulation and transfer of scientific knowledge", covering knowledge exchange and free access (through electronic infrastructures).

At the same time, in view of our country's participation in the ESFRI, rules for operation and access to research and technological facilities are introduced, operational and technological capacity for work with foreign users is created, and, last but not least, the fragmentation of the national research ecosystem is reduced and the international visibility of the country is increased. The ESFRI's White Paper, presented in 2020, aims to identify the role of these infrastructures and their future continuous modernization in the context of the renewed ERA. Its main messages are to strengthen the position of research infrastructure as an important pillar of the ERA, forming a healthy, sustainable and integrated ecosystem of infrastructures that strives for excellence with impact and that provides transnational services, supports the educational process and contributes to the development of skills. Emphasis is placed on the development and exploitation of the potential of research infrastructures such as hubs of knowledge and innovation, integrated at local and regional

levels and shaping European competitiveness with regional impact and global advantage. Another important policy element is to achieve coherence between European, national and regional priorities and policies for the development of research infrastructure. This will reduce duplication of efforts for efficient resource sharing and will standardize procedures. Last but not least, a key factor in achieving the above objectives is the infrastructure to provide open access to data that meet the principles of easy detection, accessibility, interoperability and reusability.

Research infrastructures are included as a priority in the EU Framework Programmes for Research and Innovation. Their key importance, benefits and impact on the development and proper functioning of the ERA are confirmed by their inclusion in the first pillar of Horizon 2020, the EU Framework Programme for Research and Innovation (2014 – 2020). Research infrastructures will also be included in Horizon Europe's Open Science pillar, the EU's ninth Framework Programme for Research and Innovation (2021 – 2027). The budgetary resources of the EU Framework Program Horizon Europe will be used to upgrade European research infrastructures in terms of technological development, new tools, means and methods¹, as well as for activities related to the creation of international consortia, especially the European Research Infrastructure Consortia (ERICs), which provide favorable conditions for the creation and development of large European infrastructure segments between several Member States and as-

sociated countries, as well as third countries. Horizon Europe will enable EU Member States to compete for investment in research infrastructures.

In order for Member States to meet major societal challenges, such as climate change or tackling pandemics of the magnitude of COVID-19, research infrastructures must be able to be integrated with neighboring ones, enhancing knowledge sharing and contributing to interdisciplinary research. Such an approach would contribute to a sustainable and efficient scientific infrastructure ecosystem and, more generally, to a more sustainable society. In this respect, the electronic research infrastructure is of paramount importance and it is therefore necessary to support the free access to research infrastructures of all researchers, as well as the facilitation of access to scientific data and results through the European Open Science Cloud (EOSC)².

EOSC is an ecosystem of standards, technologies and services that will enable and improve access to reliable reuse of data and other digital objects, including those generated or collected by other research infrastructures, supporting the whole life cycle of discovery research data, analysis, storage and management. High-speed connectivity (GÉANT) is at the heart of EOSC's development and provides fast and reliable connectivity for researchers in Europe and beyond. The overall goal is for the European Union to have sustainable world-class research infrastructures that are open and accessible to all scientists in Europe and beyond, in order to make full use of their potential for scientific progress and innovation.

¹ So far, only the preparatory phases have been funded under the Framework Programmes.

² <https://www.eoscsecretariat.eu/news-opinion/major-milestone-eosc-association-born>

3.2. National Context

The National Roadmap for Research Infrastructure implements the policies and measures, identified in the NSRD and ISSS to build a modern infrastructure that will contribute to the retention of highly qualified people in the country, attract young scientists and stimulate international scientific cooperation.

The first National Roadmap for Research Infrastructure was developed in 2010 as part of our country's efforts to fully participate in the European Research Area and provide an attractive environment for Bulgarian researchers from around the world to work and to develop scientific activity in our country. The NRRI is one of the leading strategic documents for the development of a knowledge-based economy and the building of research infrastructure and capacity to address significant societal and economic challenges. The aim is to increase the attractiveness of Bulgaria as a destination for researchers and innovators from around the world, as well as to complete the construction of a modern base for conducting high quality research and innovation by 2030 by developing investments in national and regional research and innovation infrastructure.

The Roadmap is updated regularly (every 3–4 years) to take into account any change in conditions and opportunities. The inclusion of sites in the Roadmap is not a funding decision, nor does it prioritize projects. The Roadmap serves as a starting point for subsequent funding decisions.

Updates to the strategic document were made in 2014 and 2017.

In 2018, the active construction of the roadmap research infrastructures began. The construction of the Centers of Excellence and the Centers of Competence, which received financial support under the Operational Programme "Science and Education for Smart Growth", was also

undertaken. These are joined by the successful projects for scientific infrastructure under the Horizon 2020 Framework Programme, which are implemented with additional funding from the same operational programme of the European Struc-

tural Funds. In addition to the centers in 2018, for the first time, investments were made in RI's, participating in European consortia and in unique research facilities, such as the Observatory in Rozhen.

At the same time, according to the



National Development Programme 2030, the main goal of the research infrastructure of Bulgaria is to stimulate and accelerate the process of development and implementation of innovations in various sectors of the economy, the key role being performed by educational institutions, research centers and business, and their interconnectedness. The scientific infrastructure in the country will contribute to the promotion of applied research and developments and the measures for their

commercialization and their transformation into marketable products with high added value.

Following the success of the flagship event of the Bulgarian Presidency in 2018, "Research Infrastructures beyond 2020 – sustainable and effective ecosystem for science and society", and the International Conference on Research Infrastructures, later that year in Vienna, in 2019, the Ministry of Education and Science of the Republic of Bulgaria and the Ex-

ecutive Agency Operational Programme Science and Education for Smart Growth organized an international conference on the topic of "Research infrastructures of the future – synergy, sustainability, smart growth and social impact". The conference was a discussion platform for synchronizing national and European Union (EU) efforts in the context of the long-term sustainability of European research and innovation infrastructures in the next programming period and in the context of the National Development Plan Bulgaria 2030. One of the main messages of the conference was to work towards synergy between the Research and Innovation Framework Programme "Horizon Europe" and the ESIF to unlock the scientific and economic potential of all regions in Europe.

At a national level, specific policy-making actions will be carried out, as well as advocacy actions and training / skills development for research infrastructure staff. This will increase the competitiveness of the Bulgarian economy by transforming it into an economy based on knowledge and smart growth, as research infrastructures are at the center of the so-called knowledge triangle: scientific research, education, innovation.

The RIs included in the Roadmap will work on assignments by the local and regional authorities to address public needs and to implement applied research tasks. Such cooperation with local and regional public authorities will be carried out via agreements between the coordinator of the RI and the relevant district governor or mayor and will include a justification for the necessary equipment and the specific socially substantiated scientific tasks to be performed.



National Astronomical Observatory –
Rozhen



4. Implementation of the NRRI

The implementation of the current NRRI in the context of the new programming period and "Bulgaria 2030" was planned in three stages, as follows:

Stage one: Increased participation in Horizon Europe, internationalization and national capacity building (2020-2023). The emphasis of this stage is on the construction and maintenance of existing sites. During this period, the Centers of Excellence (CoE) and Centers of Competence (CoC) were established. At European level, the ESFRI Roadmap (2021) will be updated. During this period, the new projects will prepare their business plans for participation in competitive procedures for infrastructure building under programmes of the European Regional Development Fund (ERDF), the

European Fund for Reconstruction and Development (EFRD) and other funding programmes. We are currently entering this stage of development of a modern scientific infrastructure, but at the same time, one that has elements of sustainability, reduction of fragmentation and increase in connectivity.

Stage two: Building the Connection with Innovation (2024-2025). Within this stage, the focus will be on the development of existing infrastructures and regular assessment of their effectiveness and efficiency in terms of services offered, available operational and technical staff, international and project visibility, potential to attract users from business, industry and public administration, where possible, and the potential for sustaina-

bility and autonomy. By the end of 2024, a new updated version of the NRRI should be drawn up, which will predetermine the next cycle of prioritization of important infrastructures for Bulgaria in the context of the new priorities for the development of research in the country and in the EU.

Stage three (2026-2027): The main activities during this stage will be focused on the transfer of technology, clustering and transformation into technological infrastructures, attracting foreign scientists and companies, as well as creating an attractive environment for attracting users and for career development of scientists, creating digital access to the offered services by infrastructure facilities.





5. Monitoring & Assessment

The main implementation of the Roadmap and the construction of the individual research complexes will be subject to constant national and international monitoring and assessment (M&A). It will include an overview of the implementation of NRRI policies at the national level, as well as corrective actions and opportunities for the introduction of new tools and schemes.

The efficiency of the participation of individual RI in European consortia and in large international infrastructures, the implementation of their research and technological programmes and activities will be monitored and assessed.

The assessment criteria for scientific infrastructures generally cover the following components:

- Need and benefits of infrastructure research;
- Development, maintenance and use of scientific apparatus and equipment;
- Scientific quality of the research

and main beneficiaries of the results (measured by publications, patents; citations; number of users);

- Institutional capacity (scientific staff, conducting specific research; availability of habilitated staff, number of doctoral students, age profile, etc.);
- Activity in attracting funds from various sources;
- Socio-economic benefits and relevance of the results (availability of created product, technology, methodology, etc.);
- Established partnerships - national, regional and European ones;
- Certified open data warehouses created.

A Standing Committee as an advisory body to the Minister of Education and Science performs the general monitoring of the implementation of the NRRI. The SC assists the Ministry of Education and Science in planning, monitoring and assessing the implementation of the NRRI, it analyzes the implementation of the

Roadmap and makes a proposal for prioritization of the sites, based on the methodology approved by the Minister of Education and Science. The Committee shall meet at least twice a year. The powers of the SC and the operational procedures are regulated in its Rules of Procedure. The composition of the SC consists of representatives of the scientific community, employers' organizations, ministries and departments and independent experts.

The assessment of the sites under the NRRI is carried out on the basis of a methodology for review and assessment of the effects of the construction and development of the sites in the National Roadmap in three stages: (1) self-assessment, carried out by the teams at sites under the NRRI on the basis of expert maps based on the ESFRI expert maps, (2) annual assessments on the effect of the support for the sites under the NRRI, assigned by the MES.

6. Funding



The financial support of the NRRI assumes efficient and integrated use of the available national and European funds. In this regard, it is necessary to implement a combined funding, in particular through targeted funding from the state budget; ESIF or from other financial sources that they may attract. The new projects included in the current NRRI are subject to subsequent selection by prioritization by the Standing Committee, or after reaching a high degree of maturity they can apply in competitive procedures for the construction of RIs. Achieving ma-

turity can be assisted through financial support for the development of a business plan for construction that includes the expansion of the consortium, a legal form for cooperation, rules for management and access, etc.

These 51 projects include infrastructures that are at different stages of development - construction, operational condition, independent financial condition. Depending on the degree of realization of the sites, costs for their construction, maintenance and operational activity, modernization, develop-

ment, membership fee in the respective Pan-European infrastructure, incl. provision of the necessary human resources, must be planned.

It is important that the Roadmap remains part of the Government's priority activities for the next programming period (2021-2027) and after 2027 as well, and that it is a key component in the development of areas for intervention in order to improve the competitiveness of the national economy and its gradual transformation into medium and high-tech one.

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Participation in international organizations and experimental mega-projects provides access to global scientific knowledge, international networks of scientists, research infrastructure, often times unique, databases and other research sources. International infrastructures are administered on the basis of concluded agreements, conventions, international treaties or other legal acts, giving rise to an obligation for participation and contribution on the part of Bulgaria in the construction or modernization of the technical equipment / facility of the international research infrastructure. On the basis of such agreements, Bulgaria participates in:

European Organization for Nuclear Research



The European Organization for Nuclear Research (CERN), established in 1954, is the largest and most renowned intergovernmental organization for fundamental scientific research. It was founded by 23 member countries. Bulgaria is a member state since 1999.

CERN performs research studies, upon which stable or long-lived charged particles (protons, electrons and heavy ions) are accelerated. Thereafter they collide with other particles, accelerated in an opposite direction, or with nuclei from stationary targets. Using detectors, located around the target or the collision point, the results from the interaction are registered.

In its essence CERN is a complex of a unique range of particle accelerators which work in a cascade. The Large Hadron Collider (LHC) is the last in the chain and is able to accelerate protons to energies of 7 TeV and heavy nuclei to 2.76 TeV/nuclon. There are 4 detector complexes installed on the LHC (ATLAS, CMS, ALICE, LHCb). Their main task is to register the results from the interactions at the collision points of the accelerated beams. The data processing requires a powerful computational infrastructure which avails to 17 000 processors (85 000 cores) and storage capacity of 185 PB. The LHC Grid encompasses 170 computer centers in 42 countries all over the world.

CERN's scientific program is broad and diverse. It is focused mainly on high-energy and nuclear physics research but includes also researches in atomic physics, condense matter physics, ecology, medical physics, and a variety of applied studies. The maintenance and the exploitation of the complex accelerator and detector systems inevitably leads to extensive engineering and technological studies and developments. Processing and storing the enormous amount of data generated by the experiments at CERN pushes the

boundaries of information technologies and big data research. More than 15 000 scientists from 97 countries are involved in the scientific program of CERN. CERN is also engaged in training the next generation scientists and engineers and communicating science in the society. There are several special programs devoted to training of young scientists, experts, teachers and students.

More than 100 Bulgarian scientists, engineers and technicians have been in projects at CERN. The Bulgarian research institutions which are involved in the CERN's scientific program are Sofia University "St. Kliment Ohridski" (SU), the Bulgarian Academy of Sciences (the Institute of Nuclear Research and Nuclear Energy - INRNE, the Institute of Information and Communication Technologies and the Institute of Robotics), Plovdiv University "Paisii Hilendarski" and the Technical University - Sofia. At present, Bulgarian researchers participate in several projects - CMS, NA61, NA62, ISOLDE and SHIP. CERN programs attract young people, facilitating their professional development and studies in physics, engineering and information technology. The research works are usually carried out by large international teams. Such international cooperation is a solid basis for joint participation in the Framework program of the European Union for research and innovations and contributes to the increase in the number of scientific papers published. The international cooperation at CERN benefits the development of Bulgarian science in the domains of physics, nuclear physics, informatics, electronics and medicine, and many others.

The NRRRI includes the national infrastructure developed for full-value scientific and technological participation of Bulgaria in CERN. The Ministry of Education and Science is the financial coordinator of the participation of Bulgaria in

CERN. The scientific coordinator of the national infrastructure is Sofia University "St. Kliment Ohridski".

National scientific infrastructure supporting Bulgarian participation in CERN

In cooperation with Sofia University the Institute for Nuclear Research and Nuclear Energy (Bulgarian Academy of Sciences), developed a laboratory for production and testing of ionizing radiation detectors, and a laboratory for nuclear electronics. The Research and Development department of the Institute was the main contractor for a project for the extension of the CMS experiment (2016 – 2020). The laboratory at Sofia University carries out research related to ionization radiation detectors, in particular for the development of new detectors for different experiments in CERN and detectors for medical applications. There is a CMS center hosted by the University which facilitates the control of the CMS detector in real time. Sofia University hosts a computer center, part of the thematic global Grid.

The Project features construction and operation of scientific infrastructure used for the development and testing of detectors and complex detector systems to register ionizing radiation, computer modeling of detector systems response, processing and analysis of data gathered during CERN experiments. The infrastructure has three major complexes: Center for grid and cloud technologies, Laboratory for ionizing radiation detectors with solid and liquid active medium and Laboratory for gas ionizing radiation detectors.

The Project envisages the development of **Grid and cloud technologies center** at SU that will accommodate installed computer systems, as part of the world Grid network (1 800 computation

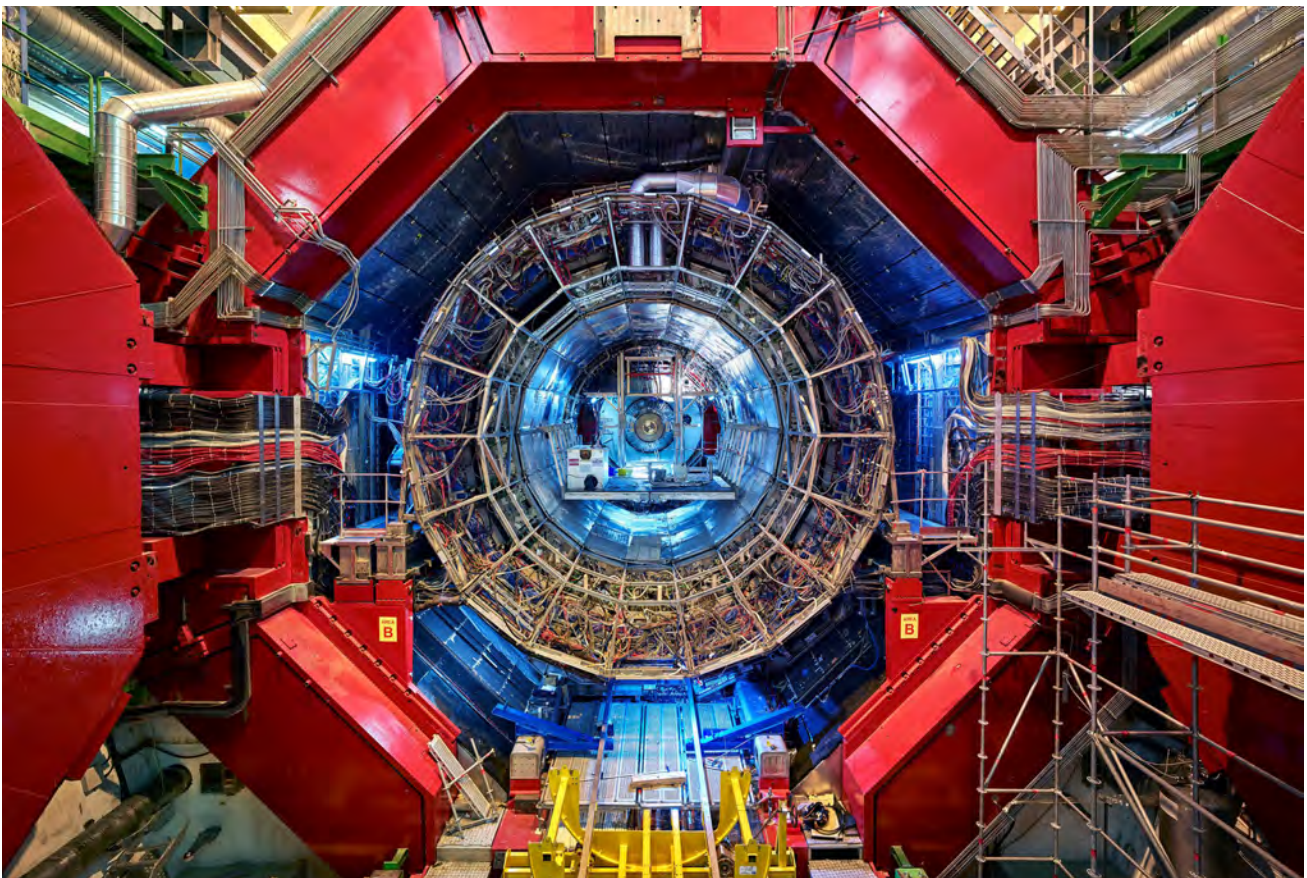
units and 800 TB data storage capacity, cluster for parallel computations, 196 computation units equipped with powerful video-cards, and interface to a large-scale international cloud infrastructure). Development plans feature the construction of another similar center at INRNE. Both centers will develop new methods and technologies for data storage and analysis, development of grid and cloud technologies, application of artificial intelligence for controlling the operation of equipment and data analysis. These activities boost integration of the Bulgarian scientific community in the European Research Area (ERA) and international scientific cooperation. In addition, the Centers will support training of students and PhD students, young researchers working in the spheres of nuclear physics and elementary particles physics, information technologies and life sciences. The existing infrastructure is built with

substantial support from CERN and will be used for storage and analysis of data obtained during CERN experiments, as well as for computer simulations on complex physical and detector systems.

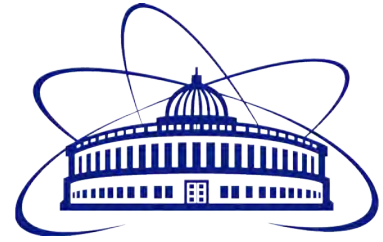
The Laboratory for ionizing radiation detectors with solid and liquid active medium has two departments - a Laboratory for development and investigation of scintillation detectors, and a Laboratory for development and characterization of detectors used in experiments with accelerated radioactive ion beams. The laboratory will be hosted at Sofia University and will represent a further upgrade of the available equipment at the Faculty of Physics. The major task of the laboratory is to provide for the full-value participation of the Bulgarian teams in the experiments NA61, NA62, SHiP on the SPS accelerator and in the experiments using radioactive nuclei beams, performed at

the ISOLDE experimental complex. New types of detectors with medical and industrial applications can also be developed.

The Laboratory for gas ionizing radiation detectors is a distributed infrastructure, constituting an upgrade of the existing laboratories for ionizing radiation detectors hosted at INRNE and SU Faculty of Physics. The major task of the laboratory is to support the participation of the Bulgarian scientists in the experiments on the LHC. R&D on characterization of new detectors will be carried out. The developed new detectors will be used for upgrading of the detector complexes operating on LHC. The laboratory at INRNE will focus on characterization of multi-detector systems by using muons. The laboratory at SU Faculty of Physics will work on the development of new detector systems for high-precision measurements.



Joint Institute for Nuclear Research (JINR, the city of Dubna)



The Joint Institute for Nuclear Research (JINR) is an international intergovernmental organization, established on March 26, 1956 by eleven founding states, amongst which the Republic of Bulgaria (<http://www.jinr.ru>). JINR is situated in the city of Dubna (Russian Federation) and is established for the purpose of uniting the efforts, scientific and resource potential of its member states for studying the fundamental properties of the matter.

JINR has seven laboratories – the Laboratory of high energy physics, the Laboratory of neutron physics, the Laboratory of theoretical physics, the Laboratory of radiation biology, the Laboratory of information technologies, the Laboratory for nuclear reactions and the Laboratory for nuclear problems.

JINR avails to unique scientific infrastructure which includes accelerators, nuclear reactors and infrastructure allowing for research at the highest global level. JINR partners with more than 800 scientific centers and universities from

64 countries. Currently, there are several large-scaled infrastructural projects under implementation at JINR involving the participation of Bulgarian scientific teams. These projects include the The Nuclotron-based Ion Collider Facility (NICA), the Superheavy Element Factory (SHEF), the Baikal-GVD Deep Underwater Neutrino Telescope and the multi-functional computation complex that hosts the modernized supercomputer "Govorun".

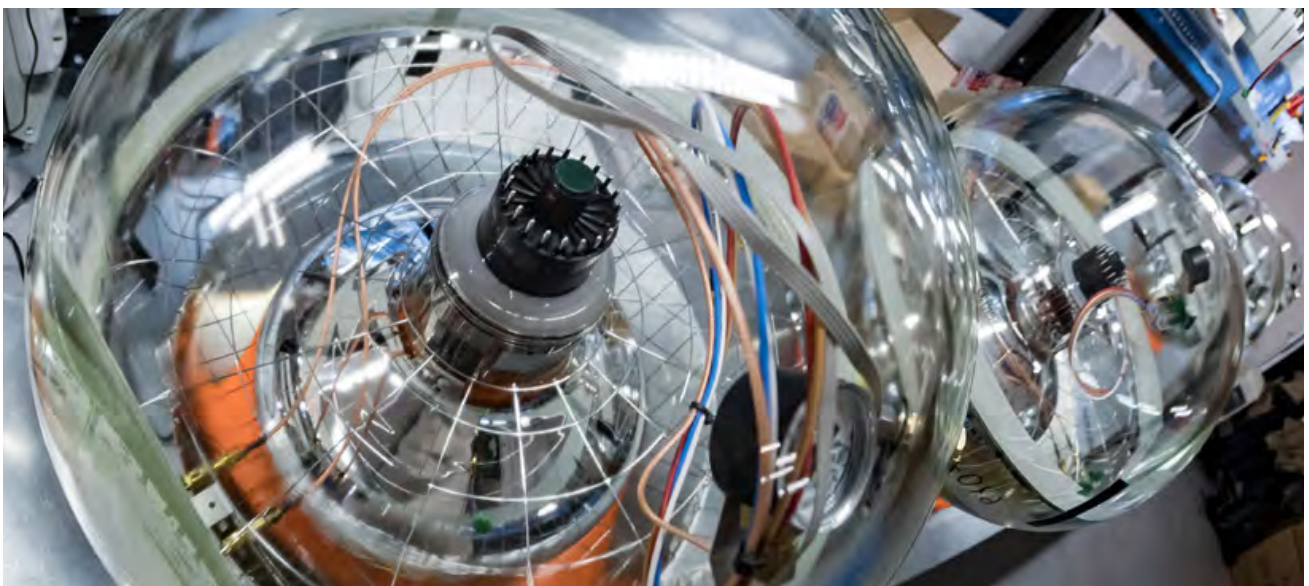
For the past 60 years more than 500 Bulgarian physicists, mathematicians, chemists, engineers and biologists have worked at JINR. On an annual basis, about 100 researchers from Bulgaria visit the laboratories of JINR, representing the Bulgarian Academy of Sciences, Sofia University "St. Kliment Ohridski", Plovdiv University "Paisii Hilendarski", the South-Western University "Neofit Rilski", the National Center for Radiobiology and Radiation Protection, etc. JINR commissions to Bulgarian institutes and companies the manufacture of apparatus and facilities for the re-

search works carried out at the Institute. Such participation also impacts positively Bulgarian economy.

The benefits for Bulgaria from its JINR membership are vast and affect positively education, science and economy.

The financial coordinator for the participation of Bulgaria in JINR, Dubna is the Ministry of Education and Science, and the scientific coordinator is the Bulgarian Nuclear Regulatory Agency (BNRA). The Chairman of BNRA is the Plenipotentiary Representative of the Government of the Republic of Bulgaria in JINR.

Baikal-GVD (Gigaton Volume Detector)



Research in the area of thermonuclear synthesis (ITER)



The International Thermonuclear Experimental Reactor ITER (<https://www.iter.org/>) operates in the domain of nuclear synthesis as a new unlimited energy source. In particular, ITER could demonstrate the scientific and technical capabilities of the thermonuclear energy sector, and that the transition from the present Tokamak experiments to the first demonstration of a thermonuclear power plant can be made. The European partnership in the activities is based on an agreement signed in 2006 between seven global partners - Euratom (representing the European Union), China, India, Japan, South Korea, Russia and the USA. The program implements scientific research from Euratom in the development of technologies, dissemination of technical information and operational activities. The main purpose of the ITER experiments is to achieve controlled thermonuclear fusion, which is one of the most perspective options for a future energy source.

The research works in the sphere of nuclear fusion should result in the development of an experimental reactor which will demonstrate the potential capabilities of controlled thermonuclear fusion, substantiating a project for the first thermonuclear power plant. The major advantages of the reactors operated on the basis of the nuclear fusion if successfully commissioned, are:

- Times more energy generated compared to common sources, such as gas, coal or oil;
- The basic fuel for nuclear fusion is widely spread and inexhaustible - deuterium (may be distilled from water);

- Nuclear fusion does not release carbon dioxide or any other gases in the atmosphere. Its basic product is helium which is an inert and non-toxic gas;
- The activity of components upon this reaction is very low and the materials can be recycled and re-used.

ITER is located in Southern France, in the Center of the Commissariat à l'Energie Atomique (CEA) Cadarash. Europe, as the host of this largest fusion experiment, finances almost half of the project. At the core of ITER is the Tokamak complex - a 400 000-ton building including the premises of Tokamak, the Diagnostics and the Tritium buildings. In December, 2017 the 50% completion of the common construction works milestone was reached. It is fundamental to the first stage of operation - the so-called "First plasma". The generation of the first plasma from ITER is planned for the year of 2026. All major components of the experimental thermonuclear reactor will be tested to prove that all magnetic systems are fully functional. The subsequent development stage will initiate the installation of components, so that the experiments with high-temperature plasma generated in ITER can begin.

The scientific program "WP 2014-2020 EUROFUSION" on controlled thermonuclear fusion has been implemented by the EUROFUSION Consortium. The consortium encompasses the EUROFUSION ASSOCIATION of the 28 EU member states and Switzerland" since 2014.

Bulgaria is a full member of Euratom and participates in the European joint undertaking on thermonuclear fusion (Fu-

sion for Energy). The annual membership fee installments of the member states are proportionate to their financial par-



ticipation in the European Atomic Energy Community (Euratom), in accordance with the Statute of the joint undertaking.

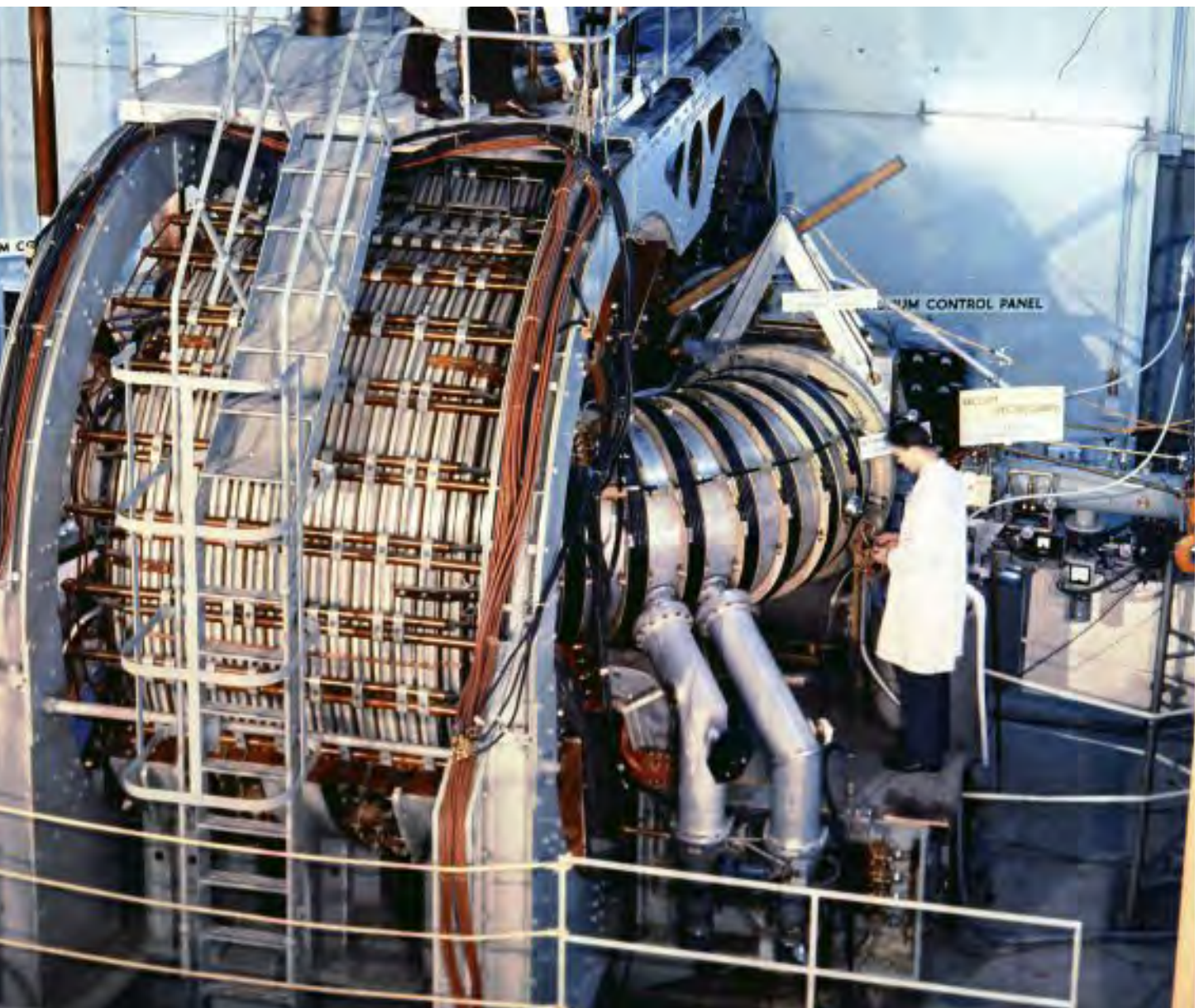
The partnership relies on the support of the best experts in the sphere of controlled thermonuclear fusion. The activities of the Bulgarian Association build up on the scientific research and the technological activities on the Project for the construction of the international thermonuclear reactor ITER, as well as on the

preparation of the „Demonstration fusion reactor – DEMO.

The “Conclusions of the Council of EU regarding the reviewed project on international thermonuclear experimental reactor” were approved in 2018, during Bulgarian Presidency of the Council of EU. The document addresses the balanced participation of all member states in the public procurement orders for the Project implementation. The Conclusions

confirm the commitment to the, feasible and timely completion of the ITER Project.

The Project implementation would allow for increased capacity for scientific achievements, contributing to increased competitiveness, new jobs and EU competitiveness. Thermonuclear fusion will play an important future role in the European energy sector, constituting an inexhaustible and climate-friendly energy source.



7.2. Unique research facilities

Regional astronomical center for research and education (RACIO)	30
Bulgarian polar base St. Kliment Ohridski	32
National Cyclotron Centre	36





The main reasons that stimulate investment in research are new scientific knowledge. The research scientific facilities, presented in this section, include unique research equipment for Bulgaria, as well as provide our country with unique advantage in certain regions. Using these tools, researchers seek answers to scientific questions through experiments they can use to explore the wonders of the universe, discover new knowledge related to cancer and human genetics, and to study the physicochemical properties of the environment that complement data on global climate change.



Regional astronomical center for research and education (RACIO)



Webpage:

http://195.96.236.171/ratio/?page_id=251

Coordinator, contact address:

Institute of Astronomy with National Astronomical Observatory (IANAO)
<http://nao-rozhen.org/>

Bulgarian consortium:

Financial coordinator:
Ministry of Education and Science

Scientific coordinator:

Institute of Astronomy and National Astronomical Observatory - BAS

Consortium member-organizations:

- » The Department of Astronomy of Sofia University "St. Kliment Ohridski";
- » Astronomical Center of Shumen University "Konstantin Preslavski".



Description and activities of the infrastructure:

RACIO is an association of research and educational institutions in the field of optical astronomy in Bulgaria. The major activity of RACIO is acquiring new scientific knowledge and training of students and PhD students in the sphere of astronomy.

The National Astronomical Observatory – Rozhen specialized resources for astronomical observations are feature four telescopes:

- 200 cm, Ritchey–Chrétien–Coudé telescope;
- 60 cm, Cassegrain telescope;
- 50/70 cm, Schmidt telescope;
- 15 cm, Lio-coronagraph.

The telescope arrays are used for obtaining data from observations in a survey of the trends in contemporary astrophysics. The main methods of investigation are photometry (measuring the parameters of radiation from cosmic objects) and spectroscopy (spectral analysis of emitted light). By applying these methods scientists receive information about the mass, volume, chemical composition, direction and speed of movement, distances to the cosmic objects, etc. As part of an international partnership, optical data from NAO-Rozhen is combined with the data received from observations with radio telescope arrays and data from space missions performing observations in the infrared and ultraviolet part of the spectrum, as well as in the roentgen and gamma-range. As a result, joint scientific papers are published, utilizing the data from NAO-Rozhen. Such data is used by space missions such as XMM-Newton, Fermi-LAT, Swift, NuSTAR, AGILE and others.

2020 marked for NAO-Rozhen the delivery and assembly of the first Bulgarian Chromospheric Telescope with diameter of the mirror of 31 cm that will be used for observation of the Sun.

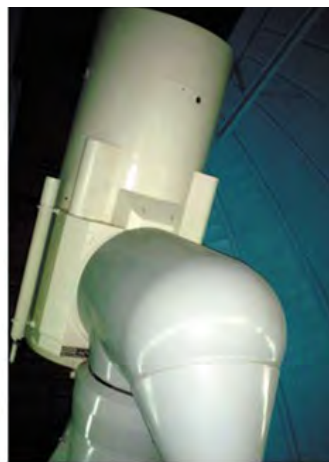
As a next step in the technological modernization NAO-Rozhen will commission the development of a new robotized telescope array with diameter of the mirror of 1.5 m. It is expected that the new telescope will be installed at NAO-Rozhen in the summer of 2022. There are new CCD cameras for the Schmidt telescope at NAO-Rozhen and a 60 cm telescope array at AO Belogradchik. Three new ANDOR CCD cameras have been put into use, which will significantly improve the quality of work with the focal reducer and the Coudé spectrograph of the 2-m telescope. The Astronomical Observatory of Shumen University operates a new automatic meteorological station. The infrastructure partners in the *ASTRONET* and *OPTICON* international organizations.

Impact/benefits:

- The infrastructure is the largest astronomical observatory in South-Eastern Europe,
- Applying new methods for observation and research of powerful gravitational and magnetic fields, enormous densities and temperatures; near-absolute vacuum and temperatures close to the absolute zero, relativistic velocities, etc;
- Studying of physical processes related to space objects whereas such study could benefit the spheres of nuclear physics, plasma

physics, neutron physics and magnetic-hydrodynamics;

- Discovering and tracking through astronomic observations of asteroids and comets passing dangerously close to Earth;
- Improving the quality of education and strengthening the links between the education and research sectors, through of the application of the STEM approach.



Area of impact:

Natural and engineering sciences

Type of infrastructure:

Concentrated, virtual



Bulgarian polar base St. Kliment Ohridski



Webpage:

<https://bab-bg.weebly.com/>

Coordinator, contact address:

Sofia University "St. Kliment Ohridski" – National Center for Polar Studies – Sofia
15 "Tzar Osvoboditel" blvd.

Bulgarian consortium:

Sofia University "St. Kliment Ohridski" – National Center for Polar Studies –
Bulgarian Antarctic Institute,
"Nikola Vaptsarov" Naval Academy

Financial coordinator:

Ministry of Education and Science

Scientific coordinator:

Sofia University "St. Kliment Ohridski" – National Center for Polar Studies



Description and activities of the infrastructure:

The Antarctic Treaty, signed in 1959 and ratified by Bulgaria in 1978, defines the Antarctic Continent as territory which shall be used only for peaceful purposes, free for research and exchange of scientific information and data. According to Article 2 of the Protocol on Environmental Protection, "... *the parties commit to the all-round protection of the Antarctic environment and its ecosystem. The Antarctic is a natural preservation area, dedicated to peace and science*". Established in 1988, the Bulgarian Antarctic Base "St. Kliment Ohridski" is situated on Livingston Island - part of the South Shetlands Archipelago. The consortium "Bulgarian Antarctic Base "St. Kliment Ohridski", established in 2018 between Sofia University "St. Kliment Ohridski" and the Bulgarian Antarctic Institute, joined by the Higher Military Marine School "Nikola Vaptsarov" Naval Academy in 2020, works towards establishing high-tech, contemporary working conditions. The Bulgarian Antarctic Base provides opportunity for research and a relevant material base to all interested researchers from Bulgaria and abroad for multi-disciplinary research of the Polar regions and the World Ocean.



Module 1. The Bulgarian Antarctic Base "St. Kliment Ohridski"

The Bulgarian Antarctic Base "St. Kliment Ohridski" facilitates a wide range of fundamental and applied research, as well as monitoring of the basic physical and chemical parameters of the unique natural environment of the Antarctic Continent. The Bulgarian Polar base is a modern research infrastructure of significant national importance. Research has been carried out there for over 30 years in the spheres of geology, seismology, biology and hydrobiology, glaciology, geodesy, climatology, medicine and many others, and since the 28th expedition – also in the humanitarian studies. The location of the base at Livingston Island provides perfect conditions to the Bulgarian scientists and their colleagues from over 35 different countries.

The planned construction of a new laboratory unit will help improve the quality of scientific research and will allow for processing of samples locally.



Consortium member-organizations:

Module 1

- » Sofia University "St. Kliment Ohridski" – National Center for Polar Studies
- » Bulgarian Antarctic Institute

Module 2

- » Sofia University "St. Kliment Ohridski" – National Center for Polar Studies
- » Bulgarian Antarctic Institute
- » "Nikola Vaptsarov" Naval Academy

Area of impact:

Environment and ecology

Type of infrastructure:

Wide range of integrated, multi-disciplinary and inter-disciplinary fundamental and applied research, as well as monitoring on the parameters of the environment in the unique nature of Antarctica and its related ocean areas, as well as studies and control of the strata condition in the national marine areas.

Participation in European infrastructures:

EUROPEAN POLAR BOARD



EU-POLAR NET



EUROFLEETS



EUROPEAN MARINE BOARD





Module 2. Field research

A multi-purpose research ship will be allocated to the Bulgarian Antarctic base, representing an additional module of the infrastructure. This research vessel will be essential to achieving the goals of the National Polar Research Program and the National Research Program in the Black Sea. Equipped with stationary laboratories and mobile research centers, the ship will ensure appropriate conditions for oceanographic research, as well as vital logistic support for implementation of the scientific projects in the Southern Ocean, the maintenance of the Bulgarian Antarctic base and the construction of the new laboratory on Livingston Island.

The equipped research ship will facilitate research of marine strata in the Southern Ocean and in the Black Sea, as well as research along the transit routes to the Antarctic base. The ship, in its capacity of shared scientific infrastructure, will benefit the whole scientific community of Bulgaria and will foster inter-disciplinary studies of the seas and oceans. Bulgaria will join the strategic European research structures European Marine Board and Eurofleet.



Impact/benefits:

The polar research of the Bulgarian scientists and their foreign colleagues is of global significance. In addition to the research carried out on annual basis in the domain of the Earth sciences of, biology and ecology, medicine and Human sciences the Bulgarian Antarctic base facilitates continuous monitoring of the physical and chemical parameters of the local environment, complementing the available data on the global climate change. on the base is part of the logistic and organizational structure encompassing members of all Antarctic programs. to the international cooperation in Antarctica improves the quality of work of the researchers across the continent, limits the carbon footprint and promotes scientific diplomacy.

National Cyclotron Centre



Webpage:

<http://www.inrne.bas.bg/>

Coordinator, contact address:

Institute for Nuclear Research and Nuclear Energy
- BAS
72 "Tsarigradsko Shosse", 1784 Sofia

Bulgarian consortium:

Financial coordinator:

Ministry of Education and Science (MES)

Scientific coordinator:

Institute for Nuclear Research and Nuclear Energy
- BAS

Consortium member-organizations:

- » Medical University, Sofia;
- » Medical University, Varna.

Area of impact:

Applied and engineering sciences

Type of infrastructure:

Distributed



Description and activities of the infrastructure:

The National Cyclotron Center (NCC) is a large-scale scientific infrastructure which includes an accelerator (cyclotron), laboratories for research in radiochemistry and radiopharmacy and a laboratory for applied research. The core facility of the Center is the cyclotron and its equipment (vacuum pumps, supplies, lines for the transfer of accelerated particle beam, etc.).

It is planned for the synthesis premises of the NCC building to feature chambers with modules for synthesis of radiopharmaceutical products and also gas systems, systems for liquid and thin-layer chromatography as part of a quality control laboratory. Features will also include equipment for measuring the purity of ready radiopharmaceutical products and equipment for microbiological control of waste products. The NCC partners in research with the Cyclotron Center of the multi-disciplinary Institute Hubert Curien in Strasbourg, France (Le cyclotron Cyrce l'IPHC), the Cyclotron Center IHCP Ispra, the National laboratory for nuclear research in Legnaro, Italy, the PET Center Dresden-Rossendorf, Germany and the Jülich Research Centre (FZJ), Germany. On 12 January 2016 the Institute for Nuclear Research and Nuclear Energy at the Bulgarian Academy of Sciences received the TR-24 type cyclotron made in Canada. The purchase of the cyclotron was financed by *NPP Kozloduy EAD* and the United States Department of Energy. Funding in amount of BGN 4 000 000 was provided by the Ministry of Education and Science and the Ministerial Council of the Republic of Bulgaria for the construction of a dedicated building and for activities related with the NCC's commissioning and safe installation.

Impact/benefits:

- Provision/ production of specific isotopes for diagnostics and treatment of a number of diseases (mainly oncologic and neurological ones);
- Availability and utilization of infrastructure for research for successful treatment of cancer;
- Conditions for high-quality research in radiochemistry, radiobiology, radiation safety and radiation protection, nuclear physics and nuclear energy;
- The scientific and applied research output of the Center will be a significant factor for the improvement of Bulgarian healthcare;
- NCC will facilitate the training and practical skill development of researchers and specialists for the nuclear industry and in the sphere of nuclear medicine;
- The new isotope-marked molecules developed under the NCC research program will be used for fundamental research in the sphere of biological sciences and pharmacy. NCC will be able to carry out pre-clinical studies of new molecules marked with radioisotopes;
- Access to the Center for researchers from the Bulgaria and abroad.



7.3. Bulgaria in Pan-European Research Infrastructures (ESFRI)

E-infrastructure (CLaDA BG) for Resources and Technologies for the Bulgarian Language and Cultural Heritage, Member of the Pan-European Research Consortia CLARIN ERIC and DARIAH ERIC	42
European Social Survey for Bulgaria (ESS)	44
Study on Health, Aging and Retirement in Europe (SHARE)	45
National University Complex for Biomedical and Applied Research	47
Center for Contemporary Microscopy for Fundamental and Applied Research in Biology, Medicine and Biotechnology (EUROBIOIMAGING)	50
Research Infrastructure for Cell Technologies in Biomedicine (INFRAACT)	52
National Geoinformation Center	55
Infrastructure for Sustainable Development of Marine Research and Participation in the European Infrastructure (EURO ARGO) – MASRI	58
National Research Infrastructure for Observing Atmospheric Aerosols, Clouds and Gas Pollutants Integrated within the Pan-European Infrastructure ACTRIS	60
CTA-MAGIC International Cooperation in the Field of Particle Astrophysics	62
Electronic Infrastructure for Research of the Bulgarian Medieval Written Heritage (ELINIZB)	64
“Extreme Light” ELI-ERIC Consortium (ELI-ERIC-BG)	66
Bulgarian Observation Station of the Pan-European Radio Telescope “Low-frequency Array” (LOFAR) – LOFAR BG	68
Distributed System of Scientific Collections - Bulgaria (DISSCo BG)	70
Distributed Research Infrastructure “Bulgarian Network for Long-Term Ecosystem Research” (LTER BG)	72





The European Research Area is a strategic document aimed at unifying the scientific system of the EU countries, which should be open to the world and should allow the free movement of scientists, scientific knowledge and technology. The ERA is evolving and is monitored in relation to six priority objectives. One of them is for the development of effective transnational cooperation and research infrastructure. The commitments of the Member States and Bulgaria are to create a modern and contemporary environment, infrastructure and access to equipment that allows for top-level research, participation in international projects, projects funded by the EU Framework Programme for Research and Innovation, as well as and global collaboration. Since joining the EU, Bulgaria has reviewed the participation of Bulgarian research groups, the best teams involved in Pan-European infrastructures are prioritized, and the country is committed to supporting the development of research infrastructure, as well as holding regular open competitions, including for participation in European consortia.

This ensures the maintenance of a high level of the research equipment at the national level, which can perform quality research in line with the European standards, training of a new generation of scientists, preparation and implementation of specific services for the business, etc. In view of this, Bulgaria has made financial commitments and participates in a number of Pan-European research infrastructures presented below.



E-infrastructure (CLaDA BG) for Resources and Technologies for the Bulgarian Language and Cultural Heritage, Member of the Pan- European Research Consortia CLARIN ERIC and DARIAH ERIC

Webpage:

<https://clada-bg.eu/>

Coordinator, contact address:

Institute of Information and Communication
Technologies – BAS
1113 Sofia, 25A "Acad. Georgi Bonchev" str., bl. 25A

Bulgarian consortium:

Financial coordinator:

Ministry of Education and Science

Scientific coordinator:

Institute of Information and Communication
Technologies – BAS

Consortium member-organizations:

- » Institute of Mathematics and Informatics – BAS
- » Sofia University "St. Kliment Ohridski"
- » New Bulgarian University
- » Shumen University
- » "Bulgariana" Association
- » South-Western University "Neofit Rilski"
- » Cyrillo-Methodian Research Center - BAS



CLaDA BG

Description and activities of the infrastructure:

CLaDA BG is an interdisciplinary research infrastructure providing resources and technologies for the preservation and development of the Bulgarian language, cultural and historical heritage. It gives an open public access to structured digital data and automatic processing tools, specially developed for the Bulgarian language. Examples of such data are the syntactically analyzed Bulgarian texts along with the correct meanings of the words within various contexts; the Bulgarian lexical database BTB-Wordnet that presents the relations among words (hypernyms, synonyms, antonyms, meronyms, etc.), and is linked to the Bulgarian Wikipedia; the Bulgarian child speech corpus, exhibiting the early stages of acquisition of the Bulgarian language, etc.); digital editions of text according to the old spelling (used prior to 1945); catalogs of 3D museum exhibitions and access to virtual museum collections. Examples of service programs include analyzers of contemporary texts; 3D processing software; knowledge extraction models; Web access to the provided services. CLaDA BG intends to establish a *Knowledge Graph* reflecting Bulgarian language, culture and history (the so-called, *Bulgaria-centric Knowledge Graph*). This Knowledge Graph and the implemented infrastructure of services will form the base for supporting the research in the area of digital humanities and social sciences in Bulgaria, applying modern technologies such as Artificial Intelligence, Big Data and Virtual Reality.

Within CLaDA BG there will be provided a framework for the creation of high-quality and adequately curated and managed data about Bulgarian cultural heritage, from Antiquity to Modern Age. Such collections of specimens, manuscripts, stone monuments, archive documents and artifacts will be described along with detailed knowledge about their sources (the so-called *metadata*). Collections developed by the partners of CLaDA BG demonstrate the potential of the services and the capacity of the infrastructure.

CLaDA BG provides a combination of linguistic knowledge (encoded in texts and vocabularies) and encyclopedic knowledge (encoded in Knowledge Graphs such as Wikidata, DBpedia, as well as in the scientific research works of the partnering institutions). This combination includes also their collections of epigraphs (stone inscriptions) in ancient languages, clerical documents; personal archives of prominent layers and public figures, ethnographic documents, etc.; and services for automatic processing of collections in Bulgarian. The language technologies developed by CLaDA BG allow for the processing of contemporary, as well as historical and specialized texts in specific areas such as law and ethnography. The purpose of these technologies is the extraction of knowledge from texts. This knowledge will be used for supporting the research in the area of Social Sciences and Humanities (which is the main aim of CLaDA BG), in the process of implementation of the Bulgarian-centric Knowledge Graph; for indexing of documents in libraries, archives, etc.

The results and achievements of CLaDA BG are directly applicable to education, social and governmental policies, e-government, tourism, etc.

Impact/benefits:

- Digital preservation of Bulgarian language, cultural and historical heritage. Popularization of the role of the Cyrillic alphabet for the formation of the national identity through the years.
- Providing access to Bulgarian language, cultural and historical heritage in a digital form within Bulgaria and all over the world utilizing contemporary best technologies (Big Data, Artificial Intelligence, Knowledge Graphs).
- Supporting research in humanities, Bulgarian language learning, Bulgarian literature, Studies via semantic technologies and introducing personalized and adaptive profiling.
- Supporting e-Government through tools for analyzing and indexing administrative documents, conceptual search, etc.
- Supporting the activity of different cultural institutions through the establishment of environment for management of collection, catalog development, digital storage and representation of data and documents.

The participation of CLaDA BG in the European infrastructures CLARIN ERIC and DARIAH ERIC facilitates the use of the already existing data repositories and the adaptation of the existing technology for open access to information applying good practices in education, training and public services. With regard to CLARIN EU, CLaDA BG is part of the Knowledge Centre for South Slavic languages (CLASSLA), located in Ljubljana, Slovenia (<http://www.clarin.si/info/k-centre/>). Through the membership of Bulgaria in CLARIN EU, Bulgarian language became the first Cyrillic-alphabet language to join this dedicated European multi-lingual community.

- » Institute of Balkan Studies with Center for Thracology - BAS
- » Institute of Ethnology and Folklore with Ethnographic Museum - BAS
- » Burgas Free University
- » National Library "Ivan Vazov" - Plovdiv
- » Regional History Museum
- » SofiaOntotext AD (Sirma AI, part of Sirma Group)
- » Sirma Media (SM)

Type of infrastructure:

Virtual, distributed

Area of impact:

Social and cultural innovations

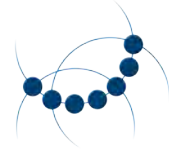
Participation in European infrastructures:

CLARIN ERIC

(since 2012 – founder state)

<https://www.clarin.eu/>

CLARIN
Common Language Resources and
Technology Infrastructure



DARIAH ERIC

(member since 2019)

<https://www.dariah.eu/>

 **DARIAH-EU**
Digital Research Infrastructure
for the Arts and Humanities

European Social Survey for Bulgaria (ESS)



Webpage:

<http://www.ess-bulgaria.org>

Coordinator, contact address:

University of National and World Economy,
Students' Campus, 1700 Sofia

Bulgarian consortium:

Financial coordinator:

Ministry of Education and Science

Scientific coordinator:

University of National and World Economy

Consortium member-organizations:

- » University of National and World Economy
- » Institute of Philosophy and Sociology - BAS
- » Bulgarian Sociology Association
- » Bulgaria Union of Economists

Type of infrastructure:

Distributed

Area of impact:

Social and cultural innovations

Participation in European infrastructures:

European Social Survey – European Research Infrastructure Consortium (ESS ERIC)

Coordinator: City University of London (UK)



Bulgaria

Description and activities of the infrastructure:

The distributed research infrastructure “European Social Survey in Bulgaria” (ESS BG) facilitates the participation of Bulgaria in the consortium of the Pan-European research infrastructure “European Social Survey – European Research Infrastructure Consortium” (ESS ERIC). Since 2002, each participating country carries out a biannual thematic survey in conformity with the highest international scientific standards on social surveys. Such an approach provides high reliability, completeness, accuracy and international comparability of obtained results. Up to date five ESS surveys have been carried out in Bulgaria (in 2006, 2008, 2010, 2012, 2018); Round 10 (2020) is at last stage of preparation.

The ESS survey provides information and assesses the attitudes of Bulgarian citizens in key areas of public and political life in Europe:

- satisfaction with the working place, career, education, quality of labor;
- attitudes towards the quality of life, poverty, social inequalities, social policies, social integration (inclusion/exclusion);
- health status, healthcare, access to healthcare services;
- national identity, attitudes towards foreigners and immigrants (multiculturalism), attitudes towards the European future of Bulgaria;
- rights and liberties (political, religious, etc.) – equal opportunities, discrimination;
- security – crime, confidence in the institutions, individual expectations and attitudes towards public authorities;
- prosperity, life and labor values, socio-demographic profiles, etc.

Impact/benefits:

ESS is focused on significant social topics, such as prosperity, trust in the institutions; political, social, religious liberties; education; healthcare; migration; security, etc. **The survey provides reliable information to social researchers, governmental institutions, mass media and the civil society** in the countries participating in ESS ERIC on social climate dynamics at national, regional and European level, revealing attitudes, values, expectations and concerns of the European citizens.

The activity of the Bulgarian research infrastructure ESS BG as part of ESS ERIC ensures thematic, accurate and internationally comparable information beneficial for researchers, public authorities, businesses, and non-governmental organizations. The results from the activity of ESS BG contributes to **raising the level of awareness and support to policies and decisions** in a number of areas – civil society, security, education, healthcare, migration, social inclusion and other socially important spheres of life in the European countries.



Description and activities of the infrastructure:

The National Scientific Infrastructure "Survey of Health, Aging and Retirement in Europe (SHARE)" is established to maintain, modernize and sustainably develop Bulgaria's participation in the Survey of Health, Aging and Retirement in Europe. (SHARE), and accession and full participation of Bulgaria in the European infrastructure SHARE ERIC.

SHARE is the largest Pan-European comparative panel Survey of social sciences, which is unique in the world and is able to support research in the field of social, health and economic development of the EU Member States and Israel.

In 2016-2018 Bulgaria participated in SHARE for the first time and collected information about the life history of people aged 50 and over through 2025 individual face-to-face interviews. The SHARE survey is representative of the population of 50+ in Bulgaria and the data is comparable with the other countries, participating in the consortium. SHARE-ERIC provides publicly available information on childhood, work history, health, retirement and social circumstances within human's life, cognitive ability and grip strength.

In 2018-2022 Bulgaria participates in the collection of data from 8th and 9th waves of SHARE, and thus a unique, longitudinal, multidisciplinary database on aging, health, employment status, unemployment and retirement for Bulgarians of 50 and more years will be collected.

In June 2020, SHARE restarted the data collection of wave 8 through telephone interviews, including a special "SHARE COVID-19" questionnaire. The data collected from this COVID-19 questionnaire will allow an in-depth study of how groups of adults at-risk cope socio-economically and healthily with the COVID-19 pandemic.

The national infrastructure site SHARE ERIC Bulgaria guarantees sustainable scientific and applied representation, and full participation in the European infrastructure SHARE ERIC, through questionnaire adaptation and data collection, promotion, analysis and use of SHARE results, including for students and PhD students, and using unique SHARE data and analysis for the purposes of public policies in the field of social, health, economic and demographic development. The Bulgarian scientific infrastructure supports and encourages the use of SHARE database, as the analysis of longitudinal, comparative panel data requires specific knowledge, qualifications and experience. It provides training opportunities for students, PhD students, scientists and experts to work and analyze with panel national and comparative data; for data processing and expert analysis; to coordinate, adapt and organize the collection of panel data within SHARE, etc.; The Bulgarian Infrastructure supports the work of public institutions through analytical materials and reports based on SHARE data; It maintains and upgrades the national scientific infrastructure according to the methodology and scientific tasks of SHARE ERIC (wave 8 and wave 9 of SHARE in Bulgaria) according to methodology, research standards and tools of SHARE ERIC, and also contribute to adaptation and application of the adopted technological innovations in the practice of empirical research in Bulgaria.

Study on Health, Aging and Retirement in Europe (SHARE)

Webpage:

<https://share-eric-bulgaria.bg/>

Coordinator, contact address:

Ekaterina Markova, PhD, senior researcher
Institute of Philosophy and Sociology - BAS
13A "Moskovska" str.
1000 Sofia, Bulgaria

Bulgarian consortium:

Financial coordinator:
Ministry of Education and Science

Scientific coordinator:

Institute of Philosophy and Sociology – BAS

Consortium member-organizations:

- » Sofia University "St. Kliment Ohridski",
Faculty of Economics and Business Administration

Area of impact:

Social and cultural innovations

Type of infrastructure:

Distributed

Participation in European infrastructures:

SHARE ERIC





EUROPE'S
POPULATION

RAPIDLY AGEING



Impact/benefits:

Addressing the common challenges of aging societies has been improved significantly by extending the scope of the SHARE survey to all EU Member States, including Bulgaria. SHARE is a longitudinal, international comparative study among people aged 50 and over in all EU Member States and Israel, and collects high-quality information on their health, family relations and social networks, socio-economic, retirement and demographic indicators. SHARE is held every two years and thus it measures the changes in 50+ people's lives:

The information from SHARE is unique, collected for the first time in Bulgaria in 2017, and it will support knowledge-based public policies in the field of retirement, employment, education and lifelong learning, health and social security. SHARE data can be used to develop fundamental and applied science, for national and comparative analyzes of aging, health care and retirement - all of a great importance for social, economic and political development of Bulgaria and the European Union.

SHARE survey is based on the highest scientific standards and innovations that can be used for scientific and policy decisions. Following the Coronavirus pandemic, the Survey of Health, Aging and Retirement in Europe (SHARE) is contributing to new knowledge gathering about social, health and economic effects of the COVID-19 pandemic. Scientists and representatives of public institutions will have the opportunity to assess the impact of the pandemic on people aged 50 and over - nationally and comparatively.

For the first time, SHARE provides for Bulgaria nationally representative survey data on life history of people aged 50 and over, on their health, work history and education, on their retirement plans, on family relationships.

SHARE is a unique international study that monitors every two years the change in lives of older people, collecting objective data on social, health, economic aspects of life. For example, SHARE provides objective measurement on body mass index, grip strength and other predictors of socially significant chronic diseases.

The dynamic situation due to Coronavirus pandemic demands that there is a growing need for specialized analytical scientific activities - aimed at public administration, educational and scientific institutions. For example: professional study of the health system (access to health care, health literacy) in relation to employees at the end of their careers - especially in crisis situations; Analysis of legislation and policies on health and safety at work in all organizations from crisis management perspective. It is necessary to work on educational and retraining measures for people at the end of their careers - especially about digital competencies, but also regarding the increase of the health literacy and healthy way of life. SHARE data allows in-depth analyzes of pension policies, employment policies, issues and challenges with long-term care and justification of an integrated long-term care system, analysis of attitudes and the state of care for elderly and sick household members.

A particularly important impact of the national infrastructure SHARE ERIC Bulgaria is the work with students, PhD students, scientists and experts to gain experience and knowledge for analysis of longitudinal data from SHARE.



Description and activities of the infrastructure:

The National University Complex for Biomedical and Translational Research (NUCBTR) is distributed infrastructure, organized as resources network (biobanks, scientific equipment and research units) of two of the largest medical universities in Bulgaria – Medical University of Sofia (Sofia MU) and Medical University of Plovdiv (Plovdiv MU).

The strategic network covers infrastructures for fundamental and translational biomedical research of Sofia MU and Plovdiv MU, as well as a number of associated partners – health care institutions and centers. In parallel, it includes some of the largest bio-banks for genetic and tissue material in the country, such as the bio-bank of the Molecule Medicine Center (MMC) and the National Genetic Laboratory (NGL). The infrastructural units are distributed on the territory of several departments of MF of Sofia MU, MF and PhF of Plovdiv MU. Core facilities are established, offering services and expert support in the field of biobanking, omics technologies, bioinformatics, cell and tissue cultures, biochemistry, molecular biology, microbiology, molecular genetics, clinical laboratory, immunology, clinical pharmacology, physiology.

The Consortium's role is to support and stimulate the development of research in the area of molecular medicine, omics technologies and translational medicine in Bulgaria in the post-genome era, providing access to the most contemporary technologies and expert support to scientists and research organizations.

The scientific infrastructure has been built in several stages. The Molecular Medicine Center is established through the support of the European Commission in 2006; its further upgrade is provided by projects, funded by the Bulgarian National Science Fund, the Ministry of Education and Science and the Science Fund of Sofia. MU. In 2009 the establishment of NUCBTR was launched through infrastructure project financed by the National Science Fund, Ministry of Education and Science. The provision of maintenance, modernization and sustainable development of NUCBTR is carried out also through its participation in the National Roadmap for Research Infrastructure 2017 - 2023. In 2018 Bulgaria joined BBMRI-ERIC. MU-Sofia through the MMC bio-bank is national coordinator of BBMRI.bg and initiates the setting of the national hub and a network of bio-banks.

During the years NUCBTR gained recognition as a leading national scientific infrastructure, providing access of scientists and organizations to the equipment and creating possibilities for multi-disciplinary research.

NUCBTR participates in the development of a modern educational program in medicine and biomedical sciences and establishes attractive environment for scientific development of young scientists and PhD students.

The scientific teams, using the infrastructure of NUCBTR, generate significant share of the scientific production of the two medical universities.

NUCBTR establishes strategic partnerships with international scientific infrastructures, academic centers and innovative biopharmaceutical enterprises.

National University Complex for Biomedical and Applied Research



Webpage:

<http://mmcbg.org/>

Coordinator, contact address:

The Medical University – Sofia, through the Molecular Medicine Center (MMC)
1431 Sofia, 2 "Zdrave" str.

Bulgarian consortium:

Financial coordinator:

Ministry of Education and Science

Scientific coordinator:

Medical University of Sofia via Molecular Medicine Center (MMC)

Consortium member-organizations:

Plovdiv Medical University:

- » Medical Faculty
- » Immunology Center
- » Molecular Medicine Center



Associated partners:

- » The National Genetics Laboratory, SBALAG "Maichin Dom"
- » UMBAL "Alexandrovska"
- » UMBALSM "Pirogov"
- » USBALE "Acad. I. Penchev"
- » UMBAL "St. Ekaterina"
- » UMBAL "St. Ivan Rilski"
- » UMBAL "Tsaritsa Yoanna – ISUL"
- » SBALDB "Prof. Ivan Mitev"
- » UMBAL "St. Georgi", Plovdiv

Potential partners:

- » MU - Varna;
- » MU - Pleven;
- » Sofia University;
- » Trakia University (TrU).

Area of impact:

Healthcare and foods

Type of infrastructure:

Distributed

Participation in European infrastructures:

Member of BBMRI-ERIC since 2018;

EATRIS – invitation in 2019, in process to join the infrastructure.



NUCBTR offers and renders services to external organizations and people in the sphere of public health. It provides to the National Genetic Laboratory, SBALAG "Maichin Dom" access to the MMC's equipment for genetic analysis. Since 2016 Laboratory of Genome Diagnostics is registered at MMC, Department of Medical Chemistry and Biochemistry, MF, Sofia MU, offering diagnostic genome tests, as well as companion diagnostics for targeted therapies and bio-marker studies.

NUCBTR in cooperation with NGOs participates actively in popularization the concept of personalized medicine.

NUCBTR provides platform for open access and dissemination of research achievements amongst scholars, the public, administrative bodies and patients' organizations.

Impact/benefits:

The long-term vision for the development of NUCBTR is to establish it as National Center of Excellence in biomedical research and translational medicine, which will accelerate the transition between fundamental research and clinical practice, aiming at improved prophylaxis, diagnostics and treatment of the most socially significant diseases.

The expected benefits from the activity of the infrastructure are:

Through establishment of the national hub BBMRI.bg and development of a network of bio-banks, capacity will be created for storage of biological materials and clinical data for scientific research, possibilities will be provided for standardization, certification and quality control in accordance with the European and the national legislation on personal data protection and the ethical norms.

Raising the level of biomedical sciences through upgrade and maintenance of modern infrastructure providing access to bio-banking, omics technologies, cell and tissue culture facilities, molecular and microbiology techniques, functional research in model systems, processing and storage of large databases. This will stimulate participation in innovative national and international projects and will guarantee high scientific achievements.

Improving the quality of training of future medical specialists at Sofia MU and Plovdiv MU through the establishment of new educational programs, provision of possibilities for additional qualification and career development for young scientists.

Establishment of collaboration partnerships for knowledge exchange and transfer of scientific achievements to practice. NUCBTR possesses a vast potential for inter-institutional and inter-disciplinary collaborations, stimulating the translational research with other research centers, institutes and associated partners in the field of public health. Solving of significant health care problems – stimulating translational biomedical research to improve diagnostics, prevention and treatment of socially significant diseases, such as oncological, cardiovascular, neuro-psychiatric, metabolic, infectious, as well as rare genetic diseases.

Development of smart technologies in the field of Health and Life Science Industries and Biotechnologies, focused on precision and personalized medicine, biomarkers and new drugs development, telemedicine and artificial intelligence.

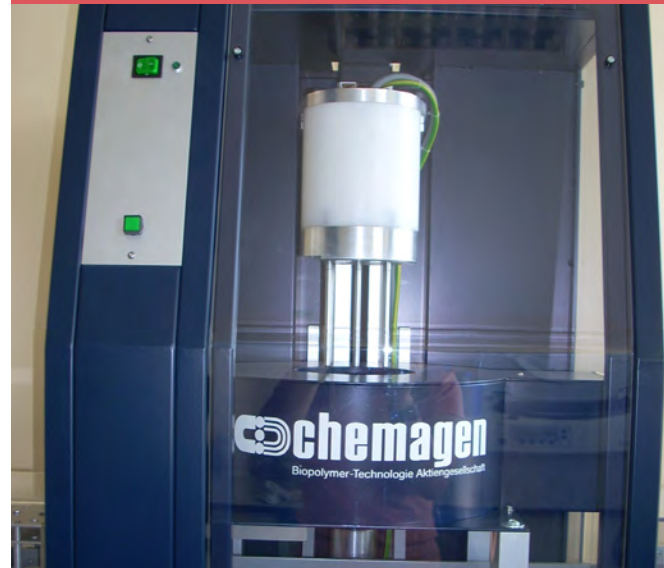
Promoting innovations and knowledge transfer to practice by establishment of public-private partnerships with business, providing services in the sphere of biomedical research and omics technologies; development of innovation based spin-off companies of undisputable social and economic impact; attracting partners and clients from regional and European research and health care organizations. Raising the competitiveness of Bulgarian science by promoting and facilitating the access to national biological materials resources, data and research infrastructure, improving the quality of scientific production and the integration of Bulgarian research teams in the European Research Area (ERA).

Integration of NUCBTR in the European biomedical research infrastructures

Bulgaria is a member of European bio-banking research infrastructure BBMRI-ERIC (Biobanking and BioMolecular Resources Research Infrastructure – European Research Infrastructure Consortium) since 2018. Sofia MU is national coordinator of BBMRI.bg.

Under the conditions of COVID-19 pandemic, BBMRI.bg joins the global research efforts with Bulgarian samples and data.

An invitation was received and steps undertaken by the RI for joining EATRIS (European Advanced Translational Research Infrastructure). The infrastructure possesses potential for joining in the future certain activities of Euro-Biolmaging - European Research Infrastructure for Imaging Technologies in Biological and Biomedical Sciences, as well as in ECRIN - European Clinical Research Infrastructure.



Center for Advanced Microscopy for Fundamental and Applied Research in Biology, Medicine and Biotechnology [EUROBIOIMAGING]

Webpage:

<http://www.bio21.bas.bg/imb/?id=164>

http://dnarepair.bas.bg/eurobioimaging.bg/site/index_BG.html

Coordinator, contact address:

The Institute of Molecular Biology "Acad. Rumen Tsanev" - BAS
Bulgaria, 1113 Sofia, bl. 21

Bulgarian consortium:

Financial coordinator:

Ministry of Education and Science

Scientific coordinator:

The Institute of Molecular Biology "Acad. Rumen Tsanev" - BAS

Consortium member-organizations:

The infrastructure is of open access and is centrally located in the Institute of Molecular Biology "Acad. Rumen Tsanev" - BAS



Description and activities of the infrastructure:

The Center for Advanced Microscopy for Fundamental and Applied Research in Biology, Medicine and Biotechnology (EuroBioImaging) is a part of the Euro-Biolmaging Consortium - a large-scale Pan-European infrastructure, one of whose founders is Bulgaria. The Euro-Biolmaging Consortium is a part of the Roadmap of the European Strategy Forum on Research Infrastructures (ESFRI) with "Landmark" status. Euro-Biolmaging builds and coordinates infrastructure for biological microscopy and biomedical image examinations, distributed across the EU member states. The infrastructure is composed of 21 centers - called Nodes, for the implementation of fundamental and applied research in the area of biology, medicine and biotechnology, located in 8 EU countries, and the European Molecular Biology Laboratory (EMBL). The Center of Advanced Microscopy is the only Node of the Euro-Biolmaging Consortium in South-Eastern Europe. As part of the Euro-Biolmaging Consortium, it provides free researchers access to state-of-the-art microscopy technologies for biomedical studies, its leading principles being that of highest quality research and functioning of infrastructure.

The Center of Advanced Microscopy towards the Euro-Biolmaging Consortium aims to build a modern microscopy infrastructure, which will provide Bulgarian and foreign researchers from the academic and business circles free access to innovative imaging technologies. The Center provides access to the following innovative microscopic techniques:

- Spinning disc confocal microscopy for real-time high-temporal resolution live cell imaging, equipped with FRAP;
- System for laser micro-irradiation of living cells;
- System for micromanipulation, microinjection and microperfusion;
- Scanning confocal microscopy with high spacial resolution;
- Processing and analysis of images generated by spinning disc confocal microscopy and scanning confocal microscopy.

In the period 2020-2023, the Center for Advanced Microscopy towards the Euro-Biolmaging Consortium will put into operation: 1) system for super-resolution microscopy; 2) high-throughput fluorescence microscopy, proving possibility for simultaneous study of the effects on normal and cancer cells of thousands of biologically active chemical compounds of potential application in medicine, and 3) multi-photon microscopy, allowing high-resolution deep tissue observation of organisms.

Impact/benefits:

The construction of the infrastructure will provide researchers with the possibility to dispose of avanguard techniques: microscopy observation of fixed and living cells for the purpose of research in the area of biology, medicine and biotechnology. The provision of free access to cutting edge microscopic technologies through the establishment of a Center for advanced biomedical microscopy as part of the international infrastructure Euro-Biolmaging will increase the capacities of Bulgarian researchers to perform fundamental scientific research, as well as R&D activity. Sharing of technologies and facilities for biological microscopy between science and business will facilitate the conceptual and technological integration of Bulgarian biomedical studies in the European Union. In the long run, the creation of biomedical products will be encouraged, upon protection of intellectual property rights, such as medicinal products, other biological active substances, tests applicable in diagnostics and criminology, etc. The possibilities for transfer of knowledge from the scientific to the production area will be extended to help the transformation of the technological concept into a real product with high added value. Such research infrastructure will raise the competitiveness of Bulgarian economy in the area of healthcare and biotechnology and will support the development of a modern economy based on knowledge and scientific achievements.

Area of impact:

Healthcare, foods, biotechnology

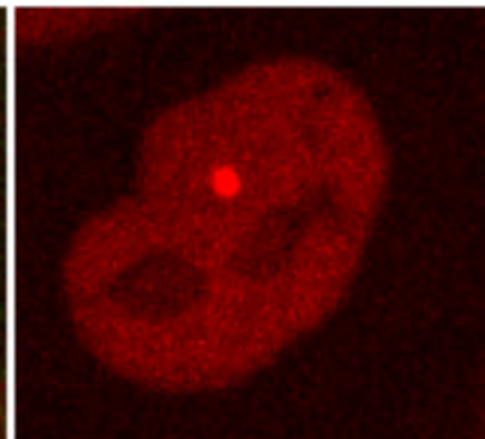
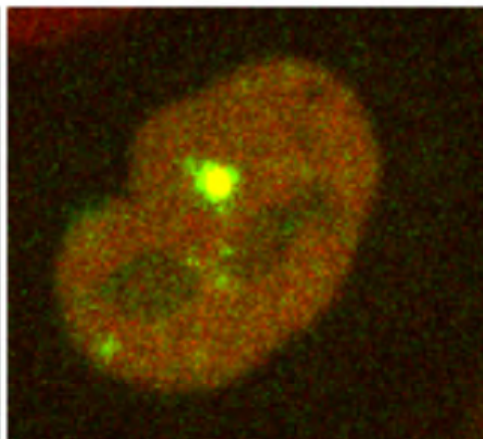
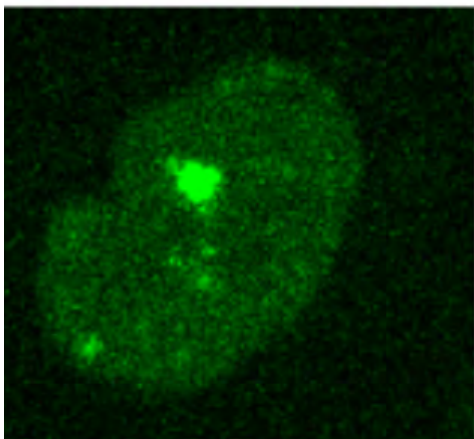
Type of infrastructure:

Distributed

Participation in European infrastructures:

Euro-Biolmaging

<http://www.eurobioimaging.eu/>



Research Infrastructure for Cell Technologies in Biomedicine (INFRAACT)



Description and activities of the infrastructure:

The RI CTB (INFRAACT) is a non-for-profit consortium of academic institutions, professional NGO's and SME from the biomedical sector devoted to joint science- and medical application – oriented research and education in the area of cell biotechnologies applicable in the humane reproductive and regenerative medicine. The research infrastructure covers the four major factors, necessary for the establishment of a dynamic economic model, aimed at sustainable development of science and its applicability in the industry, for the purpose of health prevention and improving the quality of life. In the sphere of education, INFRAACT performs dissemination of knowledge through fundamental training and life-long learning, courses and conferences, disseminating all activities related to research, teaching and new knowledge in the area of cell biomedical technologies. Its major task is the development of innovations based on high-quality research, products and services oriented to public and private sector, transfer of knowledge and skills, exchange and access to facilities from internal and external users. The infrastructure disposes of expertise, capable to ensure access to the scientific and technological achievements for a wide range of stakeholders, who may thereafter develop and apply technologies in new products, processes, materials or services in the area of reproductive and regenerative medicine. INFRAACT is socially engaged with demographic and health problems, amongst which the encouragement of voluntary and donor activity, supporting of social groups with low income and people of unequal standing, to provide their access to innovative healthcare, and cooperation aimed at achieving social sophistication, protection and prosperity.

By its translational approach INFRAACT aims providing to its users, through consolidation and maximum utilization of available and attracted resources, sustainable development of all elements of an experimental-development workflow of the latest generation for carrying out research, diagnostic and therapeutic oriented activity:

- Obtaining, in-vitro analysis and cryobanking of gender cells (gametes), re-programmed and stem cells, tissues and other biological objects;
- Analysis of single and rare specific cell populations, organelles and nanostructures, behavior of cells, cell functions and signaling mechanisms;
- Analysis of the entire genome for evaluation on a genetic base, analysis of an entire or target transcriptome for assessment of expression of all or a large group of genes, to obtain nucleotide consequential lines with big density of reading, of high precision class and possibility for tracking of small cell populations containing single mutations or new fusion genetic phenomena;
- Analysis of the metabolite profile (metabolome) aimed at non-invasive tracking and studying the development of embryos for experimental and clinical purposes, co-relation of changes in the metabolome with changes in the genome and proteome;
- Analysis of the proteome of embryos, gametes and tissues, to determine the complete profile of functional proteins, related with certain phases of the embryonic development (diagnostics application), re-programmed and stem cells;

Webpage:

<http://www.alliancecelltechnologies.eu/>

Coordinator, contact address:

Sofia University "St. Kliment Ohridski",
Faculty of Biology,
1164 Sofia, 8 "Dragan Tsankov" blvd.
https://www.uni-sofia.bg/index.php/bul/universitet_t/fakulteti/biologicheski_fakultet2

Bulgarian consortium:

Financial coordinator:

The Ministry of Education and Science

Scientific coordinator:

Sofia University "St. Kliment Ohridski"
Faculty of Biology

Consortium member-organizations:

- » Institute of Biology and Immunology of Reproduction – BAS;
- » Institute of Biophysics and Biomedical Studies – BAS;
- » Joint Genome Center OOD, Sofia;
- » Medical Center "ReproBioMed" OOD, Sofia;
- » In-vitro Medical Center "Dimitrov" EOOD;

- Analysis of lipid profile (lipidome) of biological membranes of re-programmed, embryonic stem cells and gametes, studying the behavior of specific ligands and receptor molecules;
- Generating of synthetic gene products and their incorporation in the genome of stem cells, aimed at correction of pathogenic mutation and/or therapeutic application of stem cells;
- Genome edition of cells, aimed at obtaining populations with the correct *indel* mutation (insertion of new "corrected" gene or deletion of mutated gene);
- Selection of stable genome edited cells, specifically differentiated stem cells, anti-body producing cells, etc.

Besides generated new scientific knowledge, the above mentioned activities will provide possibility for the establishment at a national level of a joint platform for identification, validation and translation of the research on biological markers and advanced cell products for personalized medicine as a key step at the pre-clinical stage of the translation process, considerably shortening the path to generating new medicines.

At the present stage, the Bulgarian party has performed planned construction, assembly and synchronization of the technological base between the consortium partners to assure initial operation of the platforms for cell technologies, *omics* technologies, bioinformatics, cryo-conservation, providing parcel functioning of research activities in the area of reproductive and regenerative medicine. INFRAACT develops its strategic partnership with EATRIS ERIC through the establishment of range of activities on "Experimental models for cell therapy" for participation in the product platforms "ATMP", "Biomarkers" and "Small molecules".

Impact/benefits:

The possibilities for development of INFRAACT are connected with:

- Synchronization of research areas with the national and European policies and strategic priorities in the sphere of healthcare and quality of life;
- Definition of priorities in the sphere of healthcare and foods in the updated National Strategy for Science and Smart Growth;
- Development of new international networks of the partnering organizations, providing access to apparatus for image and *omics* research, resulting in higher scientific-measurement indices;
- Presence of patents, high concentration of researchers with international academic and professional experience.

The expected benefits from the construction and operation of RI shall be:

- Innovations in the bio-pharmaceutical industry and healthcare;
- Participation in the global network of translational and personalized medicine along with benefits for the Bulgarian society;
- Stimulating the economic development through increasing the intensity of financing and supporting the innovative research strata by the business;
- Increasing the share of bio-tech companies as a result of expanded high quality scientific products.

- » Bulgarian Association in Reproductive Humane Embryology (BARCHE);
- » Bulgarian Society of Regenerative Medicine (BSRM);
- » Association ACT – Alliance for Cell Technologies;
- » Institute in Regenerative Medicine OOD

Area of impact:

Biomedicine, healthcare and foods

Type of infrastructure:

Unique, distributed

Participation in European infrastructures:

EATRIS-ERIC – 2018





National Geoinformation Center



Webpage:
www.ngic.bg

Coordinator, contact address:
National Institute of Geophysics, Geodesy and
Geography - BAS
Bulgaria, Sofia, "Acad. G. Bonchev" str., bl. 3

Bulgarian consortium:
Financial coordinator:
The Ministry of Education and Science

Научни координатори:

Module 1
National Institute of Geophysics, Geodesy and
Geography - BAS

Module 2
National Institute of Meteorology and Hydrology

Module 3
University of Architecture, Construction and Ge-
odesy

Description and activities of the infrastructure:

The National Geoinformation Center (NGIC) is a national scientific infrastructure, whose major purpose is the integration of primary geo-data and its interrelation in an unified, dynamic ICT based network. NGIC unifies monitoring networks, observatories, observation stations, laboratories, computation centers and other specialized equipment of the participating partners, divided in three modules:

Module 1. Monitoring and investigation of the Earth and the around-the-Earth space.

The instrumental units of this module include unique facilities, such as seismic, accelerometric, geodetic, meteorological and oceanographic stations, scientific equipment in several laboratories (geotechnical, paleo magnetic, chemical, biological) and computer systems for innovative calculations and data processing. Through them, the Consortium partners provide observation of phenomena affecting the solid Earth (earthquakes, landslides, soils), the air (pollution, UV radiation, magnetic storms) and water (river, underground and marine).



Constant monitoring on the territory of the whole country is carried out, delivering on a monthly basis more than 1 TB seismologic, geophysical, geodetic, geological and oceanographic data, which is a valuable material for the performance of research surveys related with the internal structure of the Earth and the ongoing processes in its depths, events happening in the near-Earth space, the climatic changes and the ecology.

Module 2. Hydro-meteorological monitoring.

The National Institute of Meteorology and Hydrology (NIMH), in its role of a national hydro-meteorological service of the Republic of Bulgaria, maintains the national hydro-meteorological monitoring system, consisting of a big number of meteorological, hydrological and other stations on the territory of the whole country. With its capacity and resources, it performs meteorological, climatic, hydrological and agro-meteorological analyses and forecasts for different periods, provide meteorological and hydrological expertise, make assessment for

the allocation of resources for renewable energy sources, development and maintenance of specialized early warning systems for natural disasters of hydro-meteorological origin. Satellite information is used for the elaboration of short-term forecasts, discovering of dangerous meteorological phenomena, thermal anomalies, etc.



Module 3. National Seismic Engineering Center (NSEC).

The Module plans for modernization of the constructed NSEC base, located at the campus of the University of Architecture, Construction and Geodesy, and also designing, construction and equipping of an Experimental laboratory complex on the territory of Sofia Tech Park. Its goals are:

- Improvement of the seismic security of existing buildings, facilities, infrastructure and cultural monuments;
- Development of innovative systems and solutions for earthquake sustainable designing of buildings and facilities;
- Development of regulations for sustainable designing and construction in seismic regions – BSS EN 1998.

Consortium member-organizations:

Module 1

- » National Institute of Geophysics, Geodesy and Geography
- » Institute of Oceanology
- » Geological Institute
- » Institute of Mathematics and Informatics
- » Institute in Information and Communication Technologies

Module 2

- » National Institute in Meteorology and Hydrology
- » National Institute of Geophysics, Geodesy and Geography
- » Institute of Mathematics and Informatics

Module 3

- » University of Architecture, Construction and Geodesy
- » National Institute of Geophysics, Geodesy and Geography
- » Institute of Mechanics
- » Sofia Tech Park
- » Institute of Information and Communication Technologies

Area of impact:

Environment

Type of infrastructure:

Newly built, distributed, web based scientific infrastructure with national coverage

Participation in European infrastructures:

EPOS-ERIC (European Plate Observing System)



EURO-ARGO (European infrastructure for Argo international program)





The Module's realization will contribute to:

- Development of building structures and/or their elements through experimental models;
- Improvement of the computation procedures and normative base on designing;
- Modeling of seismic impacts and control on the behavior of structures upon dynamic impact.



Impact/benefits:

The establishment of the National Geoinformation Center (NGIC) will ensure the development of multi-disciplinary, wide-spectrum geo-information products for forecasting and prevention of natural and anthropogenic risks and disasters, such as earthquakes, floods, landslides, industrial failures and eco-catastrophes. The performed research and developed applications will contribute to the better management of territories, will reveal the vulnerable areas in the relevant regions, will support the organization of modern research base for carrying out of inter-related theoretical, digital and experimental studies.

The work of the NGIC Consortium will be of use for a wide range of users- governmental structures, local authorities, business, and general public:

- For the delivery of information per protocol in case of disasters, emergencies and catastrophes, development of national programs and annual plans on the protection of population;
- Upon the introduction of the new European standards in construction, for expertise, analyses, participation in the elaboration of regulatory documents and instructions;
- For the maintenance, analysis and processing of data from the state GPS network and the elaboration and updating of the geo-magnetic model of the Republic of Bulgaria;
- For providing information on the condition of the ionosphere, aimed at optimal radio distribution;
- With data from the national hydro-meteorological monitoring

system, forecasting the levels of ground ozone and inventory of the pollutant emissions in the air above the territory of the country, etc.;

- For the development of regulatory documents, seismic security of unique buildings, engineering facilities and infrastructure;
- For joint scientific studies with the leading universities in the country, working in similar scientific areas (Sofia University "St. Kliment Ochridski", UACG, Mining and Geology University, Chemical Technological University, etc.), as well as with a number of foreign universities and institutes.

Bulgaria's joining of the European research infrastructure EPOS ERIC (European Plate Observing System) will ensure the integration of NGIC in one of the most large-scaled organizations for monitoring of the Earth, uniting hundreds of scientific and research organizations in the field. NGIC Consortium will contribute to the full-value inclusion of the country in seven of the EPOS thematic areas through data exchange, joint training and scientific cooperation.



Infrastructure for Sustainable Development of Marine Research and Participation in the European Infrastructure [EURO ARGO] - MASRI

Webpage:

<http://masri.io-bas.bg/>

Coordinator, contact address:

Institute of Oceanology, Varna
<http://www.io-bas.bg/>

Bulgarian consortium:

Financial coordinator:

Ministry of Education and Science

Scientific coordinator:

Institute of Oceanology – BAS

Consortium member-organizations:

- » Sofia University "St. Kliment Ohridski";
- » National Institute of Meteorology and Hydrology;
- » Center of Hydro- and Aero- Dynamics, Varna with the Institute of Metal Knowledge – BAS
- » Institute of Fishery Resources
- » "Nikola Vaptsarov" Naval Academy, Varna
- » Technical University, Varna
- » Medical University, Varna



Description and activities of the infrastructure:

MASRI is a large-scaled, interdisciplinary multifunctional marine research infrastructure (in physics, chemistry, biology, geology, aquacultures, medicine, energy, hydro- and aero- dynamics, submerged and oceanic technologies). It provides unique facilities, widely accessible at a national, regional and international level, for multi-disciplinary marine studies.

The infrastructure is composed of four scientific modules of an unified subject:

- Scientific-research fleet;
- National operative sea observation system;
- Highly productive computation complex;
- Research laboratory complex.

Each module is a functionally individual part of the research infrastructure, consisting of separate elements, physically distributed in individual scientific organizations in the area of the city of Varna.

Impact/benefits:

The construction of the infrastructure for sustainable development in the sphere of marine studies, interconnected with the participation of Bulgaria in the European infrastructure (Euro Argo), permits performance of research and application surveys, to support the sustainable development of major sectors of marine economy related with the *Blue Growth* initiative, such as: coastal tourism, sea transport, fishery and aquacultures, ship building and ship repair, seaport activity, oil and gas extraction of, generation of electricity from renewable energy sources.

It supports gaining of knowledge on marine strata, requested for decision making for sustainable development of the coastal area and exploitation of marine live and non-live resources, as well as for the fulfillment of the country's obligations based on the European directives. Improved will be the facilities and technologies for preservation of marine surrounding environment, safety and health of people working in the sea. The methods of scientific training and qualification of young people will be further perfected in the sphere of marine sciences and technologies, and competitive presence of the country in the European networks and programs in the area of marine studies will be ensured.



Participation in European infrastructures:

Euro-Argo is an infrastructure joining the efforts of the European states on monitoring of the Global Ocean and the European seas, which is of use upon climatic surveys and in the operative oceanography.

MASRI is the only infrastructure in the Black Sea region which maintains the regular provision of adequate information on the submerged and deep part of the Black Sea. As part of Euro-Argo ERIC, MASRI ensures efficient completing of the fleet of autonomous profiling drilling equipment in the Black Sea area and maintaining of data base for collection, archiving and dissemination of data. An important purpose of MASRI is increasing the awareness on the surveillance data and its use in contemporary oceanographic studies of the Black Sea.

Moreover, MASRI is in conformity with major European initiatives and infrastructures, such as: Copernicus; WATERBORNE; ECMAR; EURO-FLEETS; SEADATANET; EMODnet; JERICO.

Offered services:

MASRI offers scientific services for: marine research by the scientific-research ship "Akademik" and the mine submarine PC8B; collection, processing and analysis of chemical and biological samples; aero- and hydro- dynamic tests of model ships and marine facilities; development of electrodes for submerged cutting of metals; training of divers for performance of submerged welding operations; vibro- diagnostics of ship machines and mechanism, etc.

Area of impact:

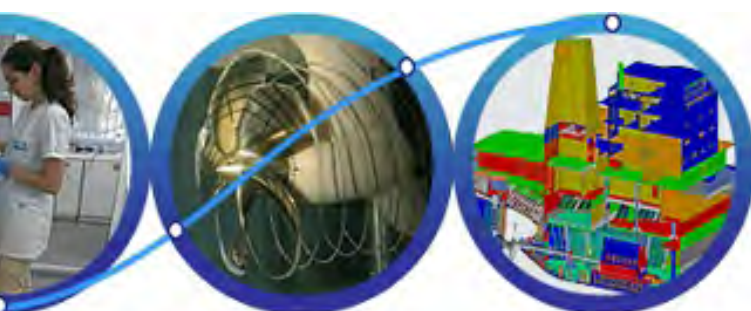
Surrounding environment

Type of infrastructure:

Distributed

Participation in European infrastructures:

Euro Argo



National Research Infrastructure for Observing Atmospheric Aerosols, Clouds and Gas Pollutants Integrated within the Pan-European Infrastructure ACTRIS

Webpage:

www.inrne.bas.bg

www.ie-bas.org

<https://www.actris.eu>

<https://www.actris-bg.eu>

Coordinator, contact address:

Institute for Nuclear Research and Nuclear
Energy – BAS and Institute of Electronics – BAS

Bulgarian consortium:

Financial coordinator:

Ministry of Education and Science

Scientific coordinator:

- » Institute for Nuclear Research and Nuclear
Energy – BAS
- » Institute of Electronics – BAS



Description and activities of the infrastructure:

ACTRIS (Aerosol, Clouds and Trace Gases Research Infrastructure) is a Pan-European research infrastructure consolidating the activities of its European partners conducting high-quality observations of aerosols, clouds and trace gases and investigating the relevant atmospheric processes. The strategic goal of ACTRIS is to further integrate the European ground-based stations and to construct a user-oriented unique European research infrastructure, to secure long-term coordinated aerosol, cloud and trace gas observations in Europe, as well as to guarantee sustainable resources and reliable management of ACTRIS activities both at national and European level.

ACTRIS is a distributed research infrastructure uniting partners from 22 countries across Europe and involving more than 100 research institutes and organizations. Since its inception, the Bulgarian ACTRIS partners have been the Institute for Nuclear Researches and Nuclear Energy (INRNE) and the Institute of Electronics (IE) of the Bulgarian Academy of Sciences (BAS). The aim of the Bulgarian participation in ACTRIS is to develop a research infrastructure for regular remote and *in situ* atmospheric aerosol and gas traces investigations, as well as to provide data from the air-quality monitoring above Bulgaria to the European data centers. Remote measurements are performed by using the laser sounding apparatus (lidars) at the IE-BAS, Sofia, whereas *in situ* measurements are conducted at the BEO Musala station of the INRNE-BAS at Musala peak.

Impact/benefits:

Various atmospheric processes are increasingly in the focus of many societal and environmental challenges, such as air quality, health, sustainability and climate change. ACTRIS aims to contribute to resolving such challenges by providing a platform for researchers to combine their efforts more effectively, and by providing observational data on aerosols, clouds and trace gases openly to anyone who might want to use them.

ACTRIS plays an important role in obtaining new knowledge and estab-



lishing a Pan-European policy about the climate changes, air-quality and long-range air-pollution transport. ACTRIS provides access to its facilities, open-access data, research support, instrument calibration and development, and training to various user groups.

ACTRIS serves a vast community of users performing observations, experiments, modelling and analysis, processing of satellite data, and development of forecasting systems. It offers access to modern technological platforms - e.g. for studying the relevant atmospheric processes in the field of climate changes and air quality. By providing data and access, ACTRIS enhances science, but it also generates and disseminates knowledge, boosts the technological development, and creates human capital and jobs for the benefit of the entire society. The participation of Bulgarian organizations in the Pan-European Research Infrastructure ACTRIS is particularly important for the national environmental monitoring and for the further development of the national research capacity in the field.

The Pan-European research infrastructure ACTRIS has gained positive feedback from the European Commission, which recognizes that the research infrastructure will enable researchers to generate substantial new knowledge, which can lead to the development of sustainable solutions to societal needs. The European Commission acknowledges ACTRIS as a major contributor to solving important environmental problems. The expected establishment of ACTRIS ERIC is planned for 2021.

The ESFRI evaluation of ACTRIS started in 2020, when the preparation for the update of the European Roadmap for Research Infrastructures - 2021 ESFRI Roadmap began. During the evaluation process, ACTRIS applied for the next level - ESFRI Landmark status. This status will additionally strengthen the role and position of ACTRIS in the European RI landscape.



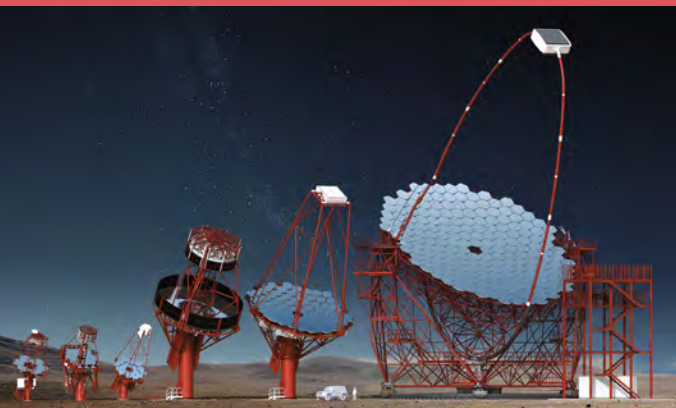
Area of impact:
Surrounding environment

Type of infrastructure:
Distributed

Participation in European infrastructures:
ACTRIS



CTA MAGIC International Cooperation in the Field of Particle Astrophysics



Webpage:

www.astroparticle-bg.org

Coordinator, contact address:

Institute for Nuclear Research and Nuclear
Energy - BAS
1784 Sofia, 72 "Tsarigradsko Shosse" blvd.
<https://www.cta-observatory.org/>

Bulgarian consortium:

Financial coordinator:

Ministry of Education and Science

Scientific coordinator:

Institute for Nuclear Research and Nuclear
Energy - BAS

Area of impact:

Energy

Participation in European infrastructures:

MAGIC, LST1/CTA



Bulgaria

Description and activities of the infrastructure:

The astroparticle physics is a globally integrated scientific area, where the experiments are carried out under and on the Earth surface, in the oceans, on the ground surface, in the atmosphere and in the outer space. This presupposes mutual influence and interaction of sciences, such as geophysics, oceanology, atmospheric sciences, cosmic explorations, etc. The Project CTA MAGIC aims the participation of Bulgarian scientists in the most advanced world scientific research teams working in the inter-disciplinary area of the high-energy astrophysics of the gamma-rays, unified around the unique installation MAGIC (Major Atmospheric Gamma Imaging Cherenkov) and the construction and operation of the future mega-complex CTA (Cherenkov Telescope Array).

CTA gained the highest status of *Landmark* in the European Forum on Research Infrastructures (ESFRI), 2018.

The MAGIC installation and the Northern part of CTA complex are situated on La Palma Island from the Canarias Archipelago (Spain). The scientific goal of the MAGIC experiment is to expand the boundaries of humane knowledge of the Universe through investigating the "mystery of the Universe" – the gamma-ray bursts in the space, and the discovery of new cosmic gamma-ray sources of super-high energies. With the active participation of Bulgarian scientists, exceptional research discoveries have been made, published in the most prestigious scientific journals in the world – "Science" and "Nature".

At the time being the activities of the research team from the Institute for Nuclear Research and Nuclear Energy (INRNE) are focused on the remote maintenance of the installation's software of the first from the four large CTA telescope arrays – LST1, the development of new artificial intelligence methods to be applied to the physical analysis of registered data and finding of new possibilities to use CTA and MAGIC research infrastructures, as well as on the generating of Monte Carlo simulated events.



Impact/benefits:

Obtaining fundamental scientific results and preparation of Master's and PhD's students in the area of nuclear astrophysics. Maintaining scientific contacts and possibilities for participation in Pan-European and world-level physics experiments.

Until now, a significant benefit from maintaining the CTA MAGIC project is the discovery of the highest energy gamma-quanta from gamma rays eruption in the Universe. The discovery breaks the boundaries of the human concepts on the essence of the cosmic processes.

The future benefits from the participation in CTA Consortium are the vast field of research and the development of new technologies, and yet unknown methods for research of the outer space, the atmosphere and the environment. An example are the developed new methods for controlling the aerosol composition of air and its impact on the cosmic radiation falling on Earth.

<https://www.cta-observatory.org/project/industry/>

Bulgaria has been accepted as a partner state in the LST Consortium (Large Size Telescope) in 2020. The Consortium LST/CTA designs, constructs and operates the prototype of the largest and fastest gamma-telescopes in the world, specially designed as a basic part of the CTA complex.

<https://www.cta-observatory.org/project/technology/lst/>

The LST-1 installation is the first from CTA having passed successfully in June, 2020 the complicated procedure of international expert critical review "Critical Design Review". Only after the successful verification through the above procedure, the new scientific facility has been allowed to operate as part of the CTA complex - <https://www.cta-observatory.org/lst1-passes-cdr/>. The INRNE scientists have been participating in the MAGIC experiment since 2005, in the CTA Consortium (Project) since 2009, and in the construction and operation of LST/CTA – since 2020.



Electronic Infrastructure for Research of the Bulgarian Medieval Written Heritage [ELINIZB]

Webpage:

<http://histdict.uni-sofia.bg>

Coordinator, contact address:

Sofia University "St. Kliment Ohridski"
1504 Sofia
15 "Tsar Osvoboditel" blvd.

Bulgarian consortium:

Financial coordinator:

Ministry of Education and Science

Scientific coordinator:

Sofia University "St. Kliment Ohridski"

Consortium member-organizations:

- » Cyril & Methodius scientific center - BAS
- » BAS central library

Area of impact:

Social and cultural innovation
Electronic infrastructure

Cyrrillomethodiana

Description and activities of the infrastructure:

Electronic resources and tools for processing medieval texts of proven Bulgarian origin have been developed for the last 10 years. The *open access Histdict system* is a complex of unique resources and tools for publication and research of medieval Slavonic texts and in a European and global context it corresponds to Thesaurus Linguae Graecae and Perseus, representing the classical written heritage. For the time being the *Histdict system* is a part of the *Cyrrillomethodiana portal* at <https://histdict.uni-sofia.bg/> and consists of the following resources and tools:

- Diachronic corpus of Bulgarian language 9th-18th c. (150 texts from different genres and in original spelling);
- Reverse Greek-Old Bulgarian Dictionary
- Historical Dictionary of Bulgarian language (a developing resource of diachronic type)
- Synchronous Historical Dictionaries: Dictionary of the Language of Patriarch Euthymius; Terminological Dictionary of John the Exarch
- Specialized software for writing and editing of dictionary entries;
- Grammar dictionary and semi-automatic morphological analyzer;
- Search engine and virtual keyboard;
- Old Bulgarian Unicode fonts and converter.

The main objective of the project is to maintain, develop and upgrade the electronic research resources and tools through the creation of new functionalities and research capabilities. The following activities are envisaged:

- Complementing the corpus with new texts in order to collect all Bulgarian written heritage in digital format
- Creating a parallel corpus with translations into Modern Bulgarian language so that the works of Old Bulgarian writers will be accessible to the general public as well
- Continuous updating of the historical dictionary
- Elaborating synchronous electronic dictionaries on medieval texts
- Maintaining and upgrading the existing software
- Research:
 - Training of doctoral and postdoctoral students and young scientists
 - Publishing: research and publications of texts and dictionaries.

Impact/benefits:

In short term RI reduces the time of research, improves the qualification and motivation of researchers and their scientific and publication activity. In this way Bulgarian Medieval Studies become more visible and competitive on an international scale.

In long term RI will contribute to the entry of Bulgarian Studies issues into the international research exchange. Particularly important in this regard is the creation of a parallel corpus of translations of Old Bulgarian writers' works into Modern Bulgarian, from which translations

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into other European languages can be easily made. The forthcoming inclusion of the infrastructure in pan-European networks, such as Resilience, is a further guarantee that the Bulgarian written heritage will enter into scientific circulation. More intensive cooperation between Bulgarian and foreign Medieval studies scholars will lead to the production of new top scientific research in the chosen field. The introduction of electronic RI in the fields of Bulgarian, Slavic and Medieval studies will enhance the prestige of humanities knowledge within R&D activities. The chosen scientific field is directly related to the national and cultural identity of the Bulgarians as part of the Orthodox and European civilization. The development of modern humanities in Bulgaria will make us equal partners of researchers from developed European countries and will enhance the transfer of knowledge between Eastern and Western Europe. This, in turn, will lead to research excellence and to the acquisition of new knowledge that can be used to develop new educational and social policies.

Type of infrastructure:
Virtual infrastructure

Participation in European infrastructures:
ReIReS
www.reires.eu



ReIReS
Research Infrastructure
on Religious Studies

Resilience
www.resilience-ri.eu



Cyrrillomethodiana

» Вход
» Текстов корпус
» Хронограф
» Стб. речник
» Ист. речник
» Словоформи
» Евт. речник
» Терм. речник
» Търсене
» Средновековен речник

Старобългарски речник

ГОСПОДЬ

господѣ -и м

1. Господар, владетел, собственик *иначѣрѣмаъ же гѣ рѣа тѣго. нусти и н дѣгъ. стѣнусти иану М Мт 18 27 3 А СК* и въ подобиѣ *уикомъ чинѣштинъ гѣ своего когда въхубратитъ са стѣ бранъ. да примѣдѣши и възвѣжѣши ани отѣрѣжѣ са иану М Лк 12 36 3 А СК* тѣ же расѣ стѣдѣти боимъ гѣ своего. и ни отѣговѣаъ ан ни стѣтѣоръ по бланъ его. бланъ еждѣтъ *много М Лк 12 47* игда оубо придѣтъ гѣ анигѣ. чѣтѣ стѣвѣритъ *дѣлатимѣ тѣмъ Л Мт 21 40 СК* и рѣи рабѣ. гѣ еждѣтъ *тѣкози повѣтъ М Лк 14 22 3 СК* а *примѣтъ единъ. шѣтъ расѣтѣи чинѣтъ. и събѣрѣ събѣрѣ гѣ своего 3 Мт 25 12А* и ни еждѣтъ *отѣ чинѣшнѣ падымѣшнѣ стѣ. тѣмѣтѣи гѣсѣдѣи своима М Мт 13 27 3 СК* сѣ *тѣко ови рабѣ. въ рабѣи гѣдѣтѣ еждѣтъ С П 122 2 Смс С 75 18* како *оборѣшенѣ члѣмъ мѣкъ. за тѣрѣи на поитѣ. узакѣненѣ* — *госѣдѣи. гѣсѣдѣи единъ же стѣ нутъ ... дѣрѣжнѣтѣ своима рѣи ... ни еждѣти ан гѣсѣдѣи аннъ како стѣ на нашии члѣи. самѣтѣ стѣ бланѣиша ... на похѣрѣшнѣ ивѣрѣи. тѣмѣтъ. ивѣрѣтъ и тѣрѣдѣдѣтъ га С 63 6—7*

2. Създѣтелъ и владетелъ на света, Господ, Бог гѣ. повѣстѣ въ *книгахъ ... тѣко еинаааааиъ са въстѣтъ. живѣи въ тѣхъ Е 27а 10* *такѣ гѣтъ. гѣ. отѣвѣрѣтъ еждѣтъ. брата тѣотъ ѳрѣанъ Е 30а 13* *въздѣнишѣу вѣстѣ аурѣи. на въстѣтъ. рѣкачѣтѣ люди еждѣ. 5 кѣратѣ гѣ бланѣиша Е 31а 5* *принѣсти гѣо самѣкъ ианнъ его С П 28 2* *дѣкогѣ гѣ похѣстѣтъ. бранъ. раздѣрѣкѣтъ. прѣтѣмѣтъ ина тѣи до кѣнѣца С П 73 10* *и прѣкѣнишнѣу. колѣна. и оуба прѣдѣтъ Гдѣиъ СЕ 61а 10* *пѣтѣи мѣнѣтъ са. бланѣи гѣ (в)сѣи блѣнѣтъ. стѣ. прѣвѣлѣиша. прѣвѣлѣиша. прѣвѣлѣиша С П 11в 18* *полѣти го ма салъ гѣ. въ цѣсарѣстѣи тѣвѣи К 11а 23* *свѣтъи же блѣгѣосѣитѣ гѣсѣдѣи. и тако прѣиастѣ ерѣшѣна С 182 15* *и тако свѣтъи прѣдѣтъ. дѣрѣжѣ гѣсѣдѣи. стѣ дѣвѣиша оубѣнѣиша своима С 217 1* *мѣнѣти са да ма въ гѣсѣдѣи. да ни еждѣти ивѣтѣи на ма С 364 6* *на свѣтъ. самѣкъ вѣстѣи чинѣшнѣ гѣсѣдѣи. гѣсѣдѣи С 350 13* *иже своего гѣсѣдѣи и цѣсарѣи. и дѣрѣ. прѣнесѣиша. и похѣшѣтъ хѣс. на похѣиша еждѣ. бранѣи тѣвѣиша С 463 20* *тѣрѣи единѣсѣрѣи. гѣ блѣи. рѣи и гѣи и стѣнъ дѣи гѣи похѣиши тѣвѣиша рѣи гѣи гѣи уубѣиши и свѣтъи ерѣшѣиша (рѣи) Д 3* *За Христо. сѣ въ ерѣжѣтѣ. и сѣ на кѣнѣцѣ. аннъ же въ стѣ. аннъ гѣ блѣиши прѣвѣлѣиша С П 19 8* *дѣмѣтъ гѣ. въ вѣдѣтъ. и отѣ еждѣ на еждѣ и свѣтъи К 10б 26* *гѣ тѣ хѣтѣ стѣ вѣстѣи. ивѣтъ. оубѣиши ианнъ и похѣиши. чѣдѣиша своѣи С 3 25* *гѣ тѣу хѣ оубѣиши гѣмѣтъ. аннъ С 22 4* *ни оубѣи са нѣдѣиши. гѣ. ко тѣ хѣ мѣнѣтѣи тѣи свѣтъиши похѣиша ма похѣиши тѣ С 3 4*

господѣ домоу
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подѣнѣитѣ са блѣнѣиши свѣтъи тѣсѣи (в)а брата. тѣко агѣиши гѣмѣ. вѣрѣжѣтъ блѣнѣиши и ни въздѣнѣтъ. стѣ. аннъ оубо въстѣнѣтъ гѣ домоу. и хѣвѣритѣ двѣи М Лк 13 25 3 СК

прѣвѣрѣжѣнѣ гѣсѣдѣи
Μεταμόρφωσις, τοῦ Κυρίου Πραξίτης Прѣображенѣ Госѣдѣи (6 августъ)
ица дѣгѣ гѣ стѣи прѣвѣрѣжѣнѣи гѣ нѣгѣ нѣтъ А 151б 7

Cyrrillomethodiana

» Вход
» Текстов корпус
» Хронограф
» Стб. речник
» Ист. речник
» Словоформи
» Евт. речник
» Терм. речник
» Търсене
» Средновековен речник

Търсене на словоформи

Търси за kbd Покажи всичко

Исторически речник: **намерени словоформи: 3, за 0.043 сек.**

Статия	Заглавна дума	Словоформа	Спрежение
d_01793	глаголь	глаголи	[Nmop] Съществително име, мъжки род, 1
d_01792	глаголати	глаголи	[Vpza2s] Пълнозначен глагол, повелителн
d_01792	глаголати	глаголи	[Vpza3s] Пълнозначен глагол, повелителн

"Extreme Light" ELI-ERIC Consortium (ELI-ERIC-BG)



Webpage:

<http://www.eli-eric-bg.ie-bas.org/indexBG.htm>

Coordinator, contact address:

Institute of Electronics - BAS

Bulgarian consortium:

Financial coordinator:

Ministry of Education and Science

Scientific coordinator:

Institute of Electronics - BAS
1784 Sofia, 72 "Tsarigradsko Shosse"

Consortium member-organizations:

- » Sofia University " St. Kliment Ohridski"
- » Institute of Solid State Physics – BAS



Description and activities of the infrastructure:

ELI "Extreme Light" is a research infrastructure with opportunities to study processes in the field of powerful femtosecond laser pulses/beams. Building powerful laser systems will allow one to perform experiments of fundamental and applied significance. In order to successfully build and operate such large facilities, it is necessary to preliminarily conduct theoretical and experimental modeling of processes with smaller laser systems, within the so-called "Small-scale projects". This is one of the directions and the main goals of the Bulgarian consortium: construction, modernization and support for powerful femtosecond laser systems and a package of mathematical models for solving problems on smaller scale. To ensure technology and knowledge transfer as well as an access of the Bulgarian scientists to the modern powerful laser systems for scientific research, it is necessary to construct modern scientific infrastructure, including completion and maintenance of femtosecond laser systems. The available infrastructure of the ELI-ERIC-BG consortium includes the Laboratory of femtosecond photonics at Sofia University, which is unique for Bulgaria and for the Balkans. Part of the experiments conducted there are unique worldwide, in particular those with femtosecond vortices. We envision three laser systems of significantly different types, for the three participants in the ELI-ERIC-BG Consortium. The system at Sofia University includes sources with extremely short laser pulses for the goals of the femtosecond photonics. The system in IE-BAS, on the other hand, will conduct research on small scale projects related to the Pan-European ELI-ERIC infrastructure such as filamentation and terahertz generation, while the system at ISSP-BAS will be used in a more technological aspect, for a research and creation of new and promising materials for opto-electronics. The services to be provided to the infrastructure users in a short term include the study of new diagnostic methods and control of extremely short laser pulses. Opportunities will be provided for measurement of linear and nonlinear susceptibilities of the second, third, and higher orders, and competing processes, including nonperturbative ones. Opportunities for research will be provided to study linear and nonlinear responses of new materials and new structures for photonics in a broad-spectrum radiation pulses (e.g. in meta-materials). A channel will be provided with adjustable femtosecond radiation for the purposes of spectroscopy of new materials.

Impact/benefits:

Since May 2018, Bulgaria is an associate member of an international consortium ELI-ERIC. In the short term, research on new methods for diagnosis and quality control of extremely short femtosecond pulses will be conducted. With such precisely controlled pulses linear and nonlinear processes of interaction of laser radiation with matter will be investigated. On the one hand, the aim is at structuring these pulses/beams in space according to the needs of specific experiments (including their coherent combination for generation of Gauss-Bessel beams). On the other hand, we will investigate the expansion of the spectral range in which such pulses/beams can be generated (incl. through nonlinear conversion of radiation, as in the generation of higher harmonics or in the THz range). Mastering these new techniques, in addition to their scientific value, will provide research groups from other laboratories to use these unique new research tools. The regional importance of infrastructure would be particularly high if the test studies conducted are subsequently transferred of the large-scale infrastructures of the international ELI-ERIC consortium. Successful implementation of the work program of the ELI-ERIC-BG consortium will provide the research groups from other laboratories (the partners in the consortium and other research units) unique research tools. Precise control of the parameters of laser pulses/beams will lead to the development of new techniques e.g. of "Optical tweezers", or in moving particle optics, with potential applications in laser technology, biology and biotechnology.

Area of impact:

Physics and engineering sciences

Type of infrastructure:

Distributed



Bulgarian Observation Station of the Pan- European Radio Telescope “Low- frequency Array” [LOFAR] – LOFAR BG

Webpage:

www.lofar.bg

Coordinator, contact address:

Institute of Astronomy and National Astronomical
Observatory – BAS
1784 Sofia, 72 “Tsarigradsko Shose” blvd.

Bulgarian consortium:

Financial coordinator:

Ministry of Education and Science

Scientific coordinator:

Institute of Astronomy and National Astronomical
Observatory – BAS

Consortium member-organizations:

- » Institute of Astronomy and National Astronomical Observatory – BAS;
- » Faculty of Telecommunications, Technical University – Sofia;
- » Astronomy Department of the Faculty of Physics of Sofia University “St. Kliment Ohridski”
- » Astronomy Observatory of Shumen University “Konstantin Preslavski”
- » Institute of Information and Communication Technologies – BAS
- » National Institute of Geophysics, Geodesy and Geography – BAS



LOFARBG

Description and activities of the infrastructure:

LOFAR is a multifunctional, highly innovative Pan-European distributed low-frequency radio telescope (10-250 MHz), developed by the Netherlands Institute for Radio Astronomy (ASTRON) for investigating the early and remote Universe, the activity of the Sun and the Earth’s atmosphere. LOFAR consists of a large number of innovative observing stations with phased-array type antennas, distributed all over the Netherlands and a part of Europe. They are linked by high-speed connections. In Southern and Eastern Europe there is no station.

The establishment of Bulgarian LOFAR station and the participation in the LOFAR network will provide an excellent opportunity for Bulgarian and foreign researchers and students for career development and supplementing of their excellent optical astronomy studies through advanced radio observations. The unique infrastructure will support international cooperation, the development of our scientific competences in the area, and the transfer of high-tech knowledge to the industry. This will be the first LOFAR station in Southeastern Europe, and it will improve the resolution and coverage of the international LOFAR telescope.

The major objectives of the construction of the first Bulgarian radio astronomical observatory are:

- construction and development of unique widely applicable scientific infrastructure – Bulgarian LOFAR station (LOFAR BG), as part of the LOFAR telescope network - a distributed Pan-European research infrastructure;

*Existing, under-construction and the proposed
LOFAR stations.*



- development of high human scientific potential for carrying out specialized astrophysical and geophysical research with the station and with the entire LOFAR telescope array;
- development of scientific and engineering potential for the maintenance of the hardware and software of the telescope, processing and maintenance of peta-byte observing data volumes, and automated analysis by artificial intelligence;
- active cooperation and exchange of know-how with the industry;
- Radio astronomical research dissemination and outreach.

Impact/benefits:

The construction and operation of the LOFAR station in Bulgaria will provide for the participation of Bulgarian researchers in research on the Epoch of Re-ionization of the early Universe, investigation of fast and remote extragalactic radio sources, the physics of the Sun, space weather and cosmic magnetism. In geophysics, it will allow scientists to study of cosmic rays, ionospheric dynamics, seismic activity and the physics of lightning. This will create the possibility for development and participation in international research collaborations and publications in these areas of science, for the defense of PhD theses and overall raising the level of our astrophysics and geophysics research. Moreover, developing radio astronomical observing capability will contribute to the development of radio engineering research activity and transfer of high technologies. Last but not least, this will contribute to increasing the popularity and improving the image of Bulgaria in the scientific community.



Area of impact:

Physics and engineering sciences

Type of infrastructure:

National *node* of Pan-European distributed research infrastructure

Participation in European infrastructures:

Pan-European distributed telescope array LOFAR (www.lofar.nl)



Distributed System of Scientific Collections - Bulgaria [DISSCo BG]

Webpage:

<https://www.dissco.eu/bg/>

Coordinator, contact address:

Institute of Biodiversity and Ecosystem Research
(IBER) – BAS
1113 Sofia, 2 "Gagarin" str.

Bulgarian consortium:

Financial coordinator:

Ministry of Education and Science

Scientific coordinator:

IBER - BAS

Consortium member-organizations:

National Museum of Natural History - BAS (NMNH
- BAS)

Area of impact:

Surrounding environment
Electronic infrastructure
Health and foods
Social and cultural innovations

Type of infrastructure:

Distributed

Participation in European infrastructures:

DISSCo <https://www.dissco.eu/>



Description and activities of the infrastructure:

Biological diversity is an international priority, both for science and for a number of practical activities of strategic significance such as adapting to the climate change, development of green economy, health care, management of biological resources, providing of clean and healthy living environment, etc.

One of the major approaches in studying biodiversity is connected with the performance of research based on natural science collections.

The research infrastructure DISSCo BG is the Bulgarian node of the Pan-European Distributed Research Infrastructure DISSCo, recognized in 2018 as research infrastructure of European importance and included in the Roadmap of the European Strategy Forum on Research Infrastructures (ESFRI).

The members of DISSCo BG Consortium are the Institute of Biodiversity and Ecosystem Research – Bulgarian Academy of Sciences (IBER-BAS) and the National Museum of Natural History, Sofia – Bulgarian Academy of Sciences (NMNH-BAS). These two units of BAS maintain research collections that have been gathered in the last 130 years. They are the major Bulgarian research centers carrying out collection-based studies and servicing the state and society with scientific products and expert opinions related to biological diversity at national, regional and international level.

The size of DISSCo BG collections is about 2 million specimens – the biggest and most representative ones in the South-Eastern Europe. The collections include collection units of the following numbers:

- NMNH-BAS: Mineralogy 14,000; Paleontology 98,000; Botany 6,000; Zoology 1,230,000;
- IBER-BAS: Botany (Herbarium SOM) 195,530; Paleobotany 16,000; Palinology 8,000; Mycology (SOMF) 29,475; Zoology 245,000.

In addition to these organized and catalogued collections, the two institutions accommodate other collections as well (estimated at about 400,000 units), which are under process of organization, registration and catalogue inventory.

The planned development during the next 4 years aims raising the level of the major natural science collections in Bulgaria in several directions – technical state of storage infrastructure, digitization of catalogues and samples, as well as better training of scientific and supporting staff working on the collections. The envisaged activities will increase the capacity for long-term and high-standard storage of a large number of samples, as well as the provision of accessibility of information on stored samples for experts as well as for the general public in conformity with the applicable international standards.

Thus, efficient support will be ensured for the Bulgarian participation in the development of the Pan-European research infrastructure DISSCo, oriented to the establishment of unified digital information source for catalogue information on major natural science collections in 21 European states.

Impact/benefits:

The most important short-term impact from the development of DiSSCo BG is the place the Bulgarian node will gain in the pan-European infrastructure DiSSCo. The Bulgarian consortium is one of the two participants in the pan-European infrastructure DiSSCo from the South-Eastern Europe. This presupposes its unique standing as a partner of the project maintaining the richest and most representative flora and fauna collections of our region. Its contribution will improve the quality of work of DiSSCo in general from the standpoint of the scope of the Pan-European databases.

The development of the Bulgarian collections' infrastructure will increase the intensity of research based on them and will contribute to their popularization amongst Bulgarian and foreign experts, which will stimulate their inclusion in the study of the biological diversity of Bulgaria and the Balkans.

In the long run, DiSSCo BG is interrelated with the upcoming development of the pan-European infrastructure DiSSCo in the following directions:

- 1) e-servicing of science;
- 2) trans-national and remote access to biological diversity resources;
- 3) support and training;
- 4) research co-programming.





Distributed Research Infrastructure “Bulgarian Network for Long-Term Ecosystem Research [LTER BG]”



Webpage:

<http://www.lter-bulgaria.net/wordpress/en>

Coordinator, contact address:

Institute for Biodiversity and Ecosystem Research,
BAS
2 Major Yuri Gagarin Str., Izgrev district, 1113 Sofia

Bulgarian consortium:

Financial coordinator:
Ministry of Education and Science

Scientific coordinator:

Institute for Biodiversity and Ecosystem Research,
BAS

Description and activities of the infrastructure:

Long-term ecosystems research is an important part of the world-wide efforts to gain better understanding of the structures of the ecosystems, their functions and the changes they undergo, caused by natural, social and economic factors. Scientific sites deployed in different types of ecosystems have been brought together in the global network of research entities ILTER (International Long-Term Ecological Research). Fundamental to the ILTER is the Whole System concept, which combines holistically all components of environment and society. Thus, the integration of natural and human scientific resources becomes possible, in order to carry out complex heterogeneous data analyses, e.g. of abiotic, biodiversity atmospheric deposition data, as well as of socioeconomic data.

ILTER is a “network of networks” wherein the European Network of Long-Term Ecosystem Research (eILTER) is a member, and so is, since 2009, also the Bulgarian LTER BG network. Within the European roadmap, ESFRI eILTER provides valuable integrated data sets on the abiotic, biotic and social environments, whereby it supports the development and validation of models and forecasts to facilitate informed management decisions.

LTER BG is a distributed scientific infrastructure consisting of nine research stations covering the main bio-geographic areas of ecosystems that are typical for Bulgaria – forest, freshwater, shore and sea ecosystems, some of these being unique for Europe and the world as well. Our network has the potential to integrate long time series of data on ecosystem components and national statistics data on socioeconomic dynamics.

In order to fully deploy the potential of the LTER BG, the following is intended:

- provide specialized equipment for the sites in order to broaden the scope of the measurements carried out, especially concerning the functional components of the ecosystems – the balance of energy, carbon, other key substances and water.
- Implementing and adapting the eILTER-developed procedures for standardization of measurements, metadata etc. as well as access for both native users of the network and external users, at several scales:
 - ▶ the ILTER-level concept for a whole system to ensure compatibility of its indicators (e.g., the land ecosystems) and the legally determined indicators for its parts (e.g., the Directives for Birds and Habitats);
 - ▶ at the eILTER network level, it is necessary to harmonize the policies for data sharing between the network members and the sharing of open data with wider circles of users in a manner compliant to EU and national data sharing requirements;
 - ▶ at the field work / observation level, it is necessary to harmonize the protocols for data collection and standardize the descriptions of the infrastructure and the respective operating methods applicable (e.g., standard for the descriptions of sensors, their location, settings, error margins, etc.) to ensure

compatibility of the data across different sites and their application for various purposes.

- Upgrading of the scientific capacity of individual sites, scientific exchange and joint research work with the European and world networks in order to make scientific products based on data from the entire network.
- Designing the national IT infrastructure to allow:
 - ▶ collecting, storing and archiving the data from the measurements carried out by the stations in all ecosystems;
 - ▶ automatic exchange of the data within the eLTER network and with external users (including other research infrastructures, administrations, local communities, businesses etc.)
 - ▶ combining these with other data and modeling for the provision of Bulgarian scientific products.
- Working with stakeholders for the purposes of in-depth fundamental science and applied socio-ecological studies, involving volunteers (citizen science) and promoting LTER BG.

Impact/benefits:

The mission of LTER BG is to provide relevant scientific information for the conservation and the sustainable management of the unique bio diversity in the Republic of Bulgaria, enhancing society's understanding of the ecosystems and their services for the benefit of people. The data collected by LTER BG have already been put into practical use for the implementation of policies, e.g., Bulgaria's commitments under the Ramsar Convention, the Marine Strategy Framework Directive, the Water Framework Directive, Directive (EU) 2016/2284 for the reduction of national emissions. These can be used also for the purposes of a future European ecosystem legislation, the implementation of the European Green Pact as well as by local communities and businesses in the implementation of regional policies for sustainable development, climate change adaptation, etc.

A significant scientific contribution of the Bulgarian LTER networks was the application of the Whole System approach to facilitate data reuse for the purposes of diverse policies, scientific and applied tasks through the Methodological Framework for assessment and mapping of ecosystem condition and ecosystem services in Bulgaria. This approach is used in the mapping and valuation of ecosystems and their services, but it can also be applied for the evaluation of the conservation status of species and habitats, ecosystem monitoring, etc. Its wider application would contribute to a more efficient management of ecosystems and their services, the development of a sustainable economy, fostering business and social innovations and the rising of a deeper public awareness of the ecosystem issues.

The activities at the network and individual site level, the following opportunities would become available:

- joint use of existing eLTER stations by research centers and the rest of the scientific infrastructures of the ESFRI, which are not represented in Bulgaria, as well as other national scientific infrastructures.

Consortium member-organizations:

- » Institute for Oceanology, BAS
- » University of Forestry, Sofia
- » Forest Research Institute, BAS
- » Geopolimorphic EOOD

Area of impact:

Environment

Type of infrastructure:

Distributed science infrastructure

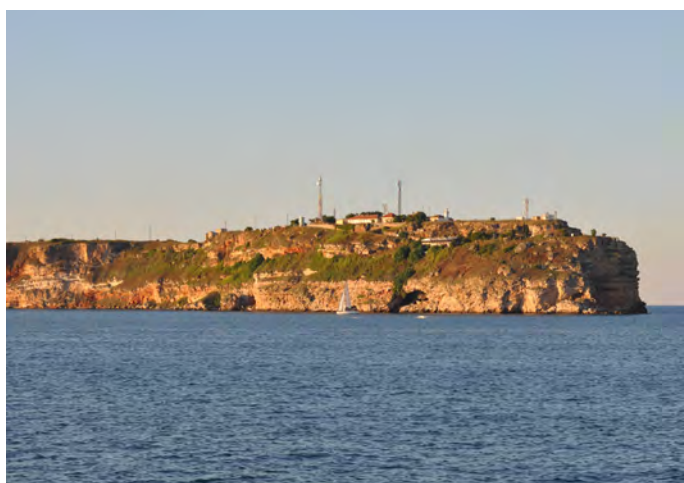
Participation in European infrastructures:

eLTER





-
- Broadening of the scope of research, scientific exchange and training in the network, and wider involvement of high-school and university students and other stakeholders in the collection and processing of ecological data.
 - Sharing of data with a larger number of users and modeling of scenarios for the needs of the stakeholders in spatial planning, evaluation of nature capital, green infrastructure etc.
 - Publishing of the scientific production according to the open science principles.
 - Put in place the preconditions to enhance ecosystems and natural habitats monitoring in this country.
 - Developing training materials for the Whole System approach and the practical application thereof.





74. National research and innovation complexes – projects of key importance for the development of the competitiveness of the Bulgarian economy and technological base



74.1.

THEMATIC AREA

Information and Communication Technologies

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74.2.

THEMATIC AREA

Mechatronics and Clean Technologies

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74.3.

THEMATIC AREA

Healthy Lifestyle and Biotechnology Industries

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74.4.

THEMATIC AREA

New Technologies in the Creative and Recreational industries

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In order to increase the quality of scientific research and the development of innovations in order for Bulgaria to achieve sustainable growth, targeted investments are needed in research directions, qualified researchers and inventors that are of first priority for the country, and an attractive scientific environment. In the period 2014–2020, the main instrument for this is the Operational Programme Science and Education for Smart Growth, Priority Axis 1, Research and technological development, aiming to support the development and modernization of two types of research centers – Centers of Excellence and Centers of Competence. The construction of the centers increases the level and market orientation of the research activities of the scientific organizations, as well as it supports the development of the capacity for scientific research (including achieving excellence) and innovations, as well as it stimulates the building of new partnerships with the business and the creation of new enterprises. Efforts are focused on the sustainable development of both the infrastructure complexes and the CoC and CoE with high quality standards and a new management model in the main priority innovative sectors of the economy. The strategic documents developed this year, such as the National Development Programme Bulgaria 2030, focus on the development of the scientific and innovation system through ongoing support for building research infrastructure, skills for transfer of technologies and deployment and adaptation of the concept behind the Centers of Excellence, the Centers of Competence, and the Regional Innovation Centers.

By 2023, all the centers listed in the section will be built and operational, with the CoC working for commercialization and the CoE concentrating critical mass, reducing fragmentation and increasing international visibility.

74.1.

THEMATIC AREA

Information and communication technologies

Center of Competence "Quantum Communication, Intelligent Security 82 Systems and Risk Management" – QUASAR 80

Institute for Scientific Research in Computed Science and Artificial Intelligence (SCAI) 82





Center of Competence "Quantum Communication, Intelligent Security Systems and Risk Management" – QUASAR

Webpage:

<http://quasar.bg>

Coordinator, contact address:

Institute of Robotics, BAS,
Academician G. Bonchev Str. Bl. 2, Complex of the
BAS, 4th km, Sofia 1113
office@quasar.bg

Bulgarian consortium:

Financial coordinator:

Operational programme "Science and Education
for Smart Growth"

Scientific coordinator:

Institute of Robotics, BAS

Consortium member-organizations:

- » Acad. Angel Balevski Institute of Metallurgy,
Equipment and Technologies, Centre for
Hydro- and Aerodynamics, BAS
- » Nikola Vaptsarov Naval Academy, Varna
- » Vassil Levski National military university,
Veliko Tarnovo
- » Technical University, Gabrovo
- » Institute of Nuclear Studies and Nuclear
Power, BAS
- » Faculty of Geology and Geography at the
St. Kliment of Ochrid Sofia University
- » Modern Flight Technologies Society



Description and activities of the infrastructure:

The QUASAR Centre of Competence is a new scientific and research infrastructure founded by a consortium of 3 institutes at the Bulgarian Academy of Sciences, 4 universities and 1 NGO, bringing together their research potential in the SSS topical section "Informatics, Information and Communication Technologies". The CoC activities focus on the arriving at innovative solutions in quantum communications, intelligent security systems and risk management in critical infrastructure.

Main goal of the QUASAR centre is the development of an advanced laboratory complex, equipped with scientists and technologies to carry out world-class research, develop and implement new products and services in the field of artificial intelligence, sensorics and robotics, in the transmission of information via quantum channels and the modeling of events, phenomena and processes allowing the neutralizing of risk for the anthropogenic environment, caused by internal and external factors.

The QUASAR centre employs leading Bulgarian scientists in the field of quantum communication, sensorics and risk management. They work together in an innovative space, well equipped with specialised instrumentation, research resources and systems allowing them to develop innovative solutions of multi-disciplinary significance. The QUASAR centre is expected to become a generator of new practicable scientific ideas, which will be transferred to businesses, following protection of property rights, in the form of specific engineering and technical products and service of distinct market impact.

The main departments of the new laboratory complex include the construction of an integrated communications network, fully protected using quantum cryptography; devising multi-sensor technologies and prognostic systems to forecast catastrophic events through emissions of nano-particles; overcoming radio communication failures in disastrous events by quantum communication of entangled photons in the space-time continuum; building up of a critical infrastructure security management system at national, regional and component level; prognosticating industrial disasters, calamities and terrorist threats using intelligent security systems and artificial intelligence (AI).



Impact/benefits:

The scientific research work underway at the QUASAR centre will result in important scientific discoveries in informatics, information and communication technologies. Specifically, systems will be developed allowing:

- Transmission of encrypted information over quantum channels at great distances, essential to the security of public and private communications, in line with the "EuroQCI" European initiative;
- Application of new models and solutions to guarantee the security of critical infrastructure through introduction of integrated security systems, based on AI;
- Broadening of the capabilities provided by added reality in virtual environment, through the integration of data from multi-sensor systems;
- Introduction of new technologies for sensor-registered significant changes in the properties of cliffs, tectonic masses and other formations that might bring about catastrophic changes in the existing infrastructure.

The results of the CoC work should have a substantial positive impact on the development of Bulgarian economy. They will make possible the introduction of innovative technologies of great efficiency, leading to increased long-term competitiveness of Bulgarian enterprises. The research to be carried out at the CoC by leading researchers, experts and attracted students and post-graduates, will allow for the accumulation in Bulgaria of a critical mass of scientists in the field of quantum communications, AI and the intelligent security and risk management systems, to meet contemporary challenges.

The main results from the CoC activities would be closely related to the protection of intellectual property and the innovatory products and based on these – their transfer for practical implementation, in order to achieve sustainability in the functioning of the infrastructure. Simultaneously, CoC shall work pro-actively with businesses for the implementation of joint scientific projects. As a part of the CoC activities, at least four new spin-off companies have been planned to commercialise the results of the scientific research.

The CoC work will have also a substantial regional impact, since leading universities in Varna, Veliko Tarnovo and Gabrovo are members of the Centre and will transfer their work experience in the scientific infrastructure locally, and thus increase the qualifications of their researchers in the thematic priority within the Innovation Strategy for Smart Specialisation.



Institute for Scientific Research in Computed Science and Artificial Intelligence (SCAI)

Webpage:

www.scai.bg

Coordinator, contact address:

Institute for Scientific Research in Computed Science and Artificial Intelligence at Sofia University "St. Kliment Ohridski"

Bulgarian consortium:

Financial coordinator:

Ministry of Education and Science

Research coordinator:

Institute for Scientific Research in Computed Science and Artificial Intelligence at Sofia University "St. Kliment Ohridski"

Area of impact:

Computer technology & artificial intelligence

Type of infrastructure:

Concentrated

Participation in European infrastructure:

No

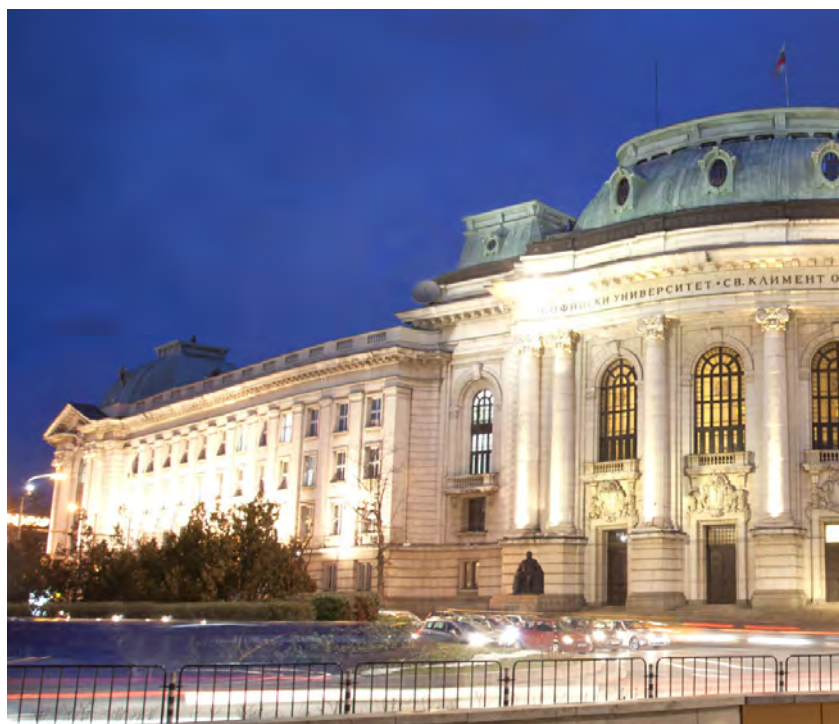
SCAI

Description and activities of the infrastructure:

The institute focuses on research and innovation in the field of computer science with a focus on artificial intelligence, digital security and adaptive software systems.

The main groups of activities are:

- Implementation of research and innovation projects in the field of computer science and artificial intelligence, aimed at the rapidly changing needs of science, business and industry.
- Attracting world-renowned scientists to lead the research projects of the Institute. Offering high-quality training (in English) to doctoral students, and in cooperation with the Faculty of Mathematics and Informatics of Sofia University "St. Kliment Ohridski" – to masters and bachelors.
- Provision of consultations to the Bulgarian government and institutions on the optimal use of computer technology and in particular: artificial intelligence, digital security, adaptive software systems, etc.
- Close cooperation with the world's leading research institutes, partnership with the Swiss Federal Institute of Technology in Zürich and the Swiss Federal Institute of Technology in Lausanne.
- Ensuring transparent and open access of Bulgarian researchers to expertise and services related to research and innovation in the field of computer technology.



Impact/benefits:

The Institute is the first of its kind in Bulgaria and Eastern Europe and represents a forefront initiative in the process of internationalization and modernization of the system of higher education, research and innovation for economic development via applied research and innovation in a high value added sector of key importance to the Bulgarian economy. The ambition of the Institute is to reverse the process of "brain drain" in this sector, making Bulgaria an attractive place for excellent research and education.

The institute will apply world-renowned and innovative practices and models, incl. the so-called Humboldt model, which combines teaching and research, complemented by a competitive development system - doctoral training, career development and habilitation. The added value is represented in the internationalization and modernization of universities and research organizations in Bulgaria, providing an impetus for start-up companies.

The institute is a pioneering initiative to reduce inequalities in science and high technology in the enlarged EU, giving Bulgaria the unique opportunity to play a leading role on the digital map of Europe.



74.2.

THEMATIC PRIORITY

Mechatronics and clean technologies

Energy Storage and Hydrogen Energetics (ESHER)	86
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Energy Storage and Hydrogen Energetics (ESHER)



Webpage:

<https://niseve.iees.bas.bg/>

Coordinator, contact address:

Institute of Electro-Chemistry and Power Systems,
BAS
Acad. G. Bonchev Str., bl.10, Sofia 1113
niseve@iees.bas.bg

Bulgarian consortium:

Financial coordinator:

Ministry of Education and Science

Scientific coordinator:

Institute of Electro-Chemistry and Power Systems,
BAS



НАУЧНА ИНФРАСТРУКТУРА

Description and activities of the infrastructure:

ESHER is a modern and unique for Bulgaria and the region thematic infrastructure planned and structured with a clearly formulated mission: to promote the development and accelerate the introduction of innovative high technologies for zero emissions in transport, industry and household, with focus on hydrogen-based technologies. While hydrogen technologies were almost unknown in Bulgaria during ESHER structuring, they were being intensively and preferentially developed in Europe. The ESHER follows the priorities of the Clean Energy for All Europeans long-term strategy of the European Commission and works in synergy with the European Green Deal updated plan to achieve climate-neutral European economy by 2050, where the Hydrogen Roadmap is one of the priority directions.

In 2020, the Module 1 of the ESHER was completed. It brings together existing and updated equipment and expertise of 11 laboratories, thus creating a national research space, integrated in two areas: "Hydrogen Energetics from Renewable Energy Sources" and "Battery Energy Warehouses".

Module 1 is unique with the multi-disciplinary character of its complex services, structured in specific research cycles, usually obtained through large project consortia in the EU the framework programs. Services are performed digitally, through the project web site, which eliminates geographical barriers, both national and international. This concern mostly developments on technology readiness level (TRL) 2-3 and includes preparation, testing and characterization of electrochemical power systems. Over the March 2019 – June 2020 period, 54 services were completed within 15 national and 2 international projects.

In 2019/2020 Module 2 was established – a modern infrastructure intended for demonstration and deployment projects performed jointly with industry. Large-scale construction and commissioning of three platforms has been planned:

- Cyber-physical platform for the development of a strategy for energy management of hybrid fuel cell/battery drive system for different types of electrical vehicles, including the two extremes – battery-powered only and fuel-cell powered only. It is expected that it will be used on national as well as on European level, due to the advancement of its application and the innovativeness of its technological orientation;
- Modular platform for the technological development of a new generation of batteries and fuel-cells. It will fill the infrastructural gap fore scaling up of advanced laboratory products (under TLR 4) created in a number of national and European projects and will generate industrial awareness;
- Modular platform for enrichment of natural gas with hydrogen. This topic entered as European priority since it facilitates the transportation of hydrogen via the existing gas transmission network and its large scale introduction into the circular economy. The platform will also support the establishment of adequate administrative and legislative framework.

Impact/benefits:

The ESHER ensures equipment, expertise and conditions for:

- Stable and efficient participation of Bulgarian scientists in the European Research Area in the field of clean energy and establishment of National Research Area;
- Participation of Bulgarian science in partnership with industry in European and national demonstration projects on clean energy, as a final pre-marketing stage;
- Implementation of the national engagements in respect to Directive 2014/94/EC defined in the "National Policy Framework for the Development of the Market as regards Alternative Fuels in the Transport Sector and the Deployment of the Relevant Infrastructure" using hydrogen as an alternative zero emissions fuel, through:
 - ▶ specialisation in hybrid battery/fuel cell transport system;
 - ▶ support in the development of innovative manufacturing structures for retrofitting;
 - ▶ assistance in the development of a new regulatory base;
 - ▶ creation of a new generation of technical potential.
- Inclusion of Bulgaria in the European hydrogen roadmap for hydrogen transportation through the gas transmission network and in the use of natural gas enriched with hydrogen;
- Industrial development of Bulgarian innovative solutions for production of batteries and fuel cells;
- Establishment of a national road-map and infrastructure for the production, targeted use and export of hydrogen produced from renewable sources.

Consortium member-organizations:

- » Joined Innovation Centre , BAS
- » Institute of Polymers, BAS
- » Institute of Chemical Engineering BAS
- » University of Chemical Technology and Metallurgy Centre for Hydrogen Technologies
- » Institute of General and Inorganic Chemistry, BAS
- » St. Ivan Rilski University of Mining and Geology
- » "Paisii Hilendarski" University of Plovdiv, Laboratory of Bio-Electrochemistry and Bio-Energetics
- » Central Laboratory of Solar Energy and New Energy Sources, BAS
- » Neofit Rilski South West University, Centre for Innovations in the Eco-Energy Technologies

Area of impact:

Energy

Type of infrastructure:

Distributed infrastructure

Participation in European infrastructures:

Communication network in the field:

- » Fuel Cells and Hydrogen Joint Undertaking (FCH JU): Hydrogen Europe research group;
- » European Energy Research Alliance (EERA);
- » Central and Eastern Europe Polymers Network (CEEPN).

European Internet Centre for Impedance Spectroscopy (EICIS).



Eco and Energy-saving Technologies – Digitalization of Technological Processes

Webpage:

<http://www.e-etech.eu/>

Coordinator, contact address:

Technical University, Gabrovo
4 Hadji Dimitar Str. Gabrovo Centre, 5300

Bulgarian consortium:

Financial coordinator:

Ministry of Education and Science

Scientific coordinator:

Technical University, Gabrovo

Consortium member-organizations:

- » Technical University, Sofia
- » Technical University, Varna
- » Angel Kantchev Russe University
- » Institute of Robotics, BAS
- » Institute of Electronics, BAS

Area of impact:

Energy, Physics and Engineering Sciences, Ecology

Type of infrastructure:

Independent



Description and activities of the infrastructure:

The Eco and Power-Saving Technologies: Digitisation of Technological Processes regional infrastructure is a consortium integrating traditions, experience and capacity of four universities and two institutes at the Bulgarian Academy of Science (Technical University, Gabrovo; Technical University, Sofia; Technical University, Varna; Angel Kantchev University, Russe; Institute of Robotics and Institute of Electronics, BAS) in the field of digitisation of the technological processes in machine-building and instrumentation.

The goal of the infrastructure is to generate a critical mass of researchers and develop scientific research, applied science and innovative activities in CAD/CAM/CAE, laser technologies, material- and environment-identifying systems, electronics and automation, intended to speed up the development of Industry 4.0, in the Machine-Building branch, which is a priority for Bulgaria.

The regional infrastructure will put in place the conditions and ensure connectedness between the partners through exchange of data of scientific and applied-scientific character, in ecology, power-saving technologies, the digitisation of technological processes, and the application of good European and world practices in the field.

Impact/benefits:

Scientific and applied-scientific results of the infrastructure in the digitisation of technological processes, would be used by the industrial plants from the processing industry. The scientific infrastructure would expand the opportunities to design, develop and produce unique high-precision elements, parts, units and systems, and would allow precise measurements and testing. The connections with businesses would reduce the need for investments in precision equipment by the small and medium businesses and will grant these the opportunity to work jointly with leading scientific institutions for the implementation of specific scientific designs, training of their staff, introduction of new products and technologies, testings and solving specific issues. The development of the regional infrastructure will provide an opportunity for further training and career advancement, retaining and attracting young people.

The main impact of the Eco and Power-Saving Technologies regional infrastructure may be summed up as follows:

- Building up the capacity of scientific research and innovations teams within the consortium, focused on the digitisation of technological processes, enlisting of leading scientists and carrying out exchange between the regional infrastructure and leading technological research organisations;
- Provide quality research-related services to tackle technological and innovation issues of small and medium enterprises from the processing industry, to facilitate the intensification of knowledge and technologies transfers in machine-building;

-
- Attract and retain science researchers and young experts by the opportunities made available by the regional infrastructure;
 - Commercialisation of the results of the scientific and applied-scientific research through the development and promoting of a portfolio of patents and useful models.



Digital Technology Systems for Clean and Secure Environment – 5D ALLIANCE



Coordinator, contact address:

University of Russe
8 Studentska Str., Russe 7017, Bulgaria

Bulgarian consortium:

Financial coordinator:
Ministry of Education and Science

Scientific coordinator:

"Angel Kantchev" University of Russe

Consortium member-organizations:

- » Agrarian University, Plovdiv;
- » G. S. Rakovski Military Academy, Sofia;
- » University of Economics, Varna;
- » Institute of Electro-Chemistry and Power Systems, BAS;
- » Institute for Information and Communication Technologies, BAS;
- » High-Tech IMS EOOD, at the Institute of Metallurgy, Equipment and Technologies, BAS;
- » Nikola Pushkarov Institute of Soils, Agro-Technologies and Plant Protection, Academy of Agriculture;
- » Technical University, Varna;
- » Technical University, Gabrovo;
- » Technical University, Sofia;
- » Thracian University, Stara Zagora.



Description and activities of the infrastructure:

5D ALLIANCE is a distributed digital infrastructure of potential impact in the Danube macro-region (DDIPDM) through the implementation of vanguard interdisciplinary studies for intelligent, secure, ecological management of interconnected systems and their business applications for a clean and safe environment. The project involves the construction of physical infrastructure allowing the Alliance to share research goals, resources, computing power and expert capacity, both among the partners and outsiders interested in the implementation of joint projects contributing to the achieving of sustainable macro-regional development.

Specific objectives:

1. Construct the DDIPDM, consisting of 7 laboratories working in the main research areas of the Alliance (see below) at the University of Russe, 1 remote laboratory of research and back-up functions at the G. S. Rakovski military academy and 17 remote access points with the Partners (7 universities and 3 institutes at the BAS);
2. Develop the conditions facilitating the integrated research solutions in support of the management of the sector policies, aiming to achieve cleaner and safer environment applying digital transformation of conventional technological systems.
3. Approbation, multiplication and internationalisation of scientific achievements in view of the shared responsibility for the sustainable macro-regional development.

The intention is to achieve these goals by building the necessary physical infrastructure and electronic connectedness between the partners, and implement a portfolio of joint projects in the key areas of the Alliance, as listed below. The investment component will address the implementation of the conditions for the functioning of the Alliance as a distributed digital infrastructure, capable of real-time sharing and/or transferring between the partners (7 universities and 3 institutes at the BAS) of computing power, expertise, and information resources, in order to carry out joint tasks and jointly tackle research problems in the areas of key significance to the Alliance, namely:

- **Precision technologies for sustainable agriculture, clean and safe environment, including:** development of intelligent systems and technologies to reduce negative impacts of the conventional and innovative agricultural equipment on the ecosystems and their unique resources, and integration of biological models into intelligent systems for the management of the Natura 2000 zones and the development of ecosystemic services, and other economic activities in them.
- **Low carbon mobility and intelligent transportation systems including:** development of intelligent integrated technological solutions for decarbonisation and improved efficiency, safety, security and connectivity of heterogeneous city transportation systems in border areas.

- **Multi-modal machine interfaces and 3D kinematics in technological systems for clean and safe environment, including:** development of intelligent solutions for the reproduction of events, physical phenomena and actual objects for a prompt preliminary ecological evaluation of complex anthropogenic impacts in case of implementation/following exploitation of inter-regional and transnational investment projects.
- **Digital energy systems for clean and safe environment, which include** development of models and technological systems for the management of shared power sources and heterogeneous associations thereof to minimize their impact on the environment.

Per plan, one of the labs will pursue horizontal goals having to do with applied science research of multi-disciplinary character on solutions developed within the main areas of interest of the Alliance.

Impact/benefits:

Science-related impact involves stimuli for the exchange of knowledge in the Danube region through the participation of the partners in the RI inter-regional networks and thus facilitate their activities on joint projects, by transfers of innovations and technologies. The Alliance will provide the conditions for the development of new and integrated scientific research solutions in support of the sector policies management, to achieve a cleaner and safer environment. Moreover, the 5D ALLIANCE distributed digital infrastructure would be the institutional environment to enhance the quality of scientific work nationally and regionally, corresponding to the specifics and intelligent specialisation of the regions in Bulgaria and the Danube macro-region. 5D ALLIANCE has been building an international network of associated partners in support of the transfer of knowledge and shared projects.



Associated partners:

Kozloduy NPP,
Clusters: Srednogorie Med, Automobiles,
Electromobiles

Associated partnership has been confirmed by:

[1] JRC - Brussel, Belgium; [2] Steinbeis Europe Centre - Karlsruhe, Germany; [3] DTC Novi Sad - Serbia; [4] DTC Zagreb, Croatia; [5] DTC Cluj-Napoca (Cluj, Craiova, Sibiu) - Romania; [6] DTC Slovak University of Agriculture in Nitra; [7] The Centre for Technological Transfer - CTT "POLITECH" from UPB, acting as a Danube Transfer Centre - Romania; [8] DTC Maribor - Slovenia.

Area of impact:

Energy, Environment, Electronic Infrastructure

Type of infrastructure:

Electronic infrastructure



Laboratory of Aerospace Mechatronics (LAM)



Webpage:

www.tu-sofia.bg/tbd

Coordinator, contact address:

Technical University, Sofia
8 Kliment of Ochrid Blvd.

Bulgarian consortium:

Financial coordinator:

Ministry of Education and Science

Scientific coordinator:

Technical University, Sofia

Consortium member-organizations:

Cluster for Aerocosmic Technologies, Studies and Applications

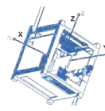
www.castra.org

Area of impact:

Aerospace and defense industry

Type of infrastructure:

Independently situated



ASMLabs

Description and activities of the infrastructure:

LAM will be a “live laboratory” of the European Union and carry out high-quality R&D, introduce technological innovations and design complex engineering systems, focused on space research and the related socio-economic development in the 21st c., in line with the new technological revolution and the transformation of human society into a society of knowledge and innovations.

The goal of the LAM is to generate new knowledge and propose innovative solutions beyond the current state of science and technologies in the EU and worldwide, in the Industry 4.0 context. Specifically, the LAM will focus on studies to implement future complex, technically robotised/ “mechatronic” systems, including autonomous ones or requiring human presence, to function in space and make possible the implementation of future multi-disciplinary top-notch applied and commercial activities out there. The LAM will allow the implementation of projects of levels of technological readiness (TLR) in the 1 – 7 range, in a creative and stimulating research environment; it will inspire, develop and supply “tools” and opportunities for practice to highly-qualified professionals from science, technologies, engineering and mathematics (STEM) – present and future researchers and talents. The LAM will combine the high academic capacity for RD of the universities and research organisations involved, and the efficiency of the private sector partners; this synergy will allow competitive and efficient generation of new knowledge, technological solutions and products to the benefit of society.

The LAM professional field is engineering science, RD and innovations, including theoretical studies and experiments, new technologies and technical systems for space application (including integrated software and AI at a future stage), components and systems thereof.

The LAM shall support also the STEM entrepreneurship through the capabilities planned for testing and prototyping of new engineering solutions of commercial potential in cosmic economy and through the creation of an ecosystem of interacting multi-disciplinary experts and organisations – academics, business persons, financiers.

LAM will comprise the following two interrelated structural components, essential to its functioning and the achievement of the intended goals:

- 1) Specialised high-tech environment, RD “tools”, innovations in engineering science, special equipment and instruments needed for space explorations, deployed on land, and a lab complex of 600 m² floor area (including 290 m² of clean premises in space, on small research satellites etc.). This specialised infrastructure will allow the development and verification of new mechatronic elements, components and systems, intended for use in space and will be there to solve key engineering RD challenges, such as support for active satellites in orbit (e.g., maintenance, steering them closer to one another, re-configuring, removal of space debris, management of space traffic etc.),

mechatronic systems supporting the implementation of active robotic operations on planet surfaces (e.g., the moon, asteroids etc.) and numerous others. All these activities are expected to be of significant importance and interest to the EU in the 21st century, as indicated by the European Space Programme.

2) Researchers and experts employed by the LAM or enlisted for programmes and projects for scientific and/or industrial cooperation, generating new knowledge and applying to this end the "tools" described above. An important element would be the attracting of researchers from the industry by the opportunity to work jointly with their colleagues from the research circles on specialised research and development projects, adding their expertise, capacity and resources, and granting them support for completing prospective Master's and Doctoral programmes within partner organisations, including international. A competitive scientific development of the LAM will also be warranted through new approaches to strategic planning and management, mainly through the planning and implementation of mid- and long-term scientific and research missions, that achieve specific and traceable results of expected powerful international impact in the LAM work areas.



Impact/benefits:

The expected short-term (up to 3 years) impact by LAM would be to provide the opportunity for the implementation of new, in Bulgaria, top multi-disciplinary research and development work and innovations at TLR 3, in the innovative, complex and difficult to access field of engineering sciences dealing with aerospace mechatronics. This will happen based on the existing activities, opportunities, experience and expertise of the consortium partners, and of the new technological capabilities, made available by the new specialised high-tech laboratory complex. At the national level, the LAM will become a strongly stimulating environment and driver of new inter-/multi-disciplinary interactions of teams of researchers working internationally in fields such as electronics and technical science, mechanics, micro-electronics, IT, communications etc. In the long-term (more than 3 years' horizon), the LAM will begin to generate research results at the TLR 4-7, including through cooperation with businesses and partners abroad, and thus will become a part of the added value chain of RD and innovations in the sector. At regional and international level, the LAM will make possible for Bulgarian researchers to join international RD efforts and innovative partner projects and initiatives in the sphere of cosmic applications – e.g., participation in the implementation process of the EU space activities as planned in Horizon Europe (Cluster 4: Digitalisation, Industry and Cosmos) and research work for the European Space Agency, addressing technologies, the development of complex systems etc.



Centre of Excellence “National Centre of Mechatronics and Clean Technologies”



Webpage:

<http://www.cemct.eu>

Coordinator, contact address:

Institute of General and Inorganic Chemistry, BAS
<http://www.igic.bas.bg>

Bulgarian consortium:

Financial coordinator:

Science and Education for Smart Growth OP

Scientific coordinator:

Institute of General and Inorganic Chemistry, BAS



Description and activities of the infrastructure:

The main goal of the Centre is to develop a modern scientific infrastructure capable to contribute to the research, technological development and innovations in virtual engineering and digital production processes; bio-mechatronics, micro/nano engineering for mechatronic technologies, elements and systems; vibration and acoustic mechatronic technologies; components of intelligent systems for mechatronic devices; technologies for clean and safe energy; green technologies; additive technologies, functional coatings and new materials; robotic systems and mechatronic technologies; modeling.

Distributed in three main campuses, the structure will concentrate the research potential of the participants while at the same time provide flexible communication with other scientific organisations and third parties interested in using the infrastructure. The three complexes shall be built and function based on the “complementarity/synergism principle”: the TU complex – specialised in mechatronics; the Lozenec complex – working on predominantly on clean technologies; the Geo Milev complex, engaged in both mechatronics and clean technologies.

The new scientific infrastructure will include laboratories, testing facilities, scientific tools and equipment, clean rooms and pilot installations, as needed for scientific research and technological innovations. It will play a key role for quality research and development of various solutions for industry and society.



Impact/benefits:

The activities included in the project will pursue top scientific achievements, innovative applied-scientific designs and speeding up of the transfer of scientific works to businesses. This will put in place a scientific foundation for the development of high-tech and resource-efficient production in this country, as well as for the transition to a low-carbon emissions economy. Of high applicability potential would be the development of nano-composite materials, hybrid materials, new materials and technologies for the micro- and nano-electronics, electro-mobility, materials for clean energy and green technologies, high-tech products for bio-mechatronics, intelligent systems and devices, the development of virtual engineering, of robotic mechatronic technologies and control systems.

Commercialisation of the results of scientific work will contribute to the competitiveness of Bulgarian economy, the increase of high-tech production share and establishment on international markets.

Availability of well-functioning infrastructure and qualified multi-disciplinary team will be instrumental to the building of collaboration with scientific organisations of leading positions in the European research area, of established experience in the implementation of European research projects and high potential in mechatronics and clean technologies.



Consortium member-organizations:

- » Institute of General and Inorganic Chemistry, BAS
- » Acad. E. Budevski Institute of Electro-Chemistry and Energy Systems, BAS
- » Institute of Catalysis, BAS
- » Acad. Angel Balevski Institute of Metallurgy, Equipment and Technologies with Centre for Hydro- and Aerodynamics, BAS
- » Institute of Mechanics, BAS
- » Acad. I. Kostov Institute of Mineralogy and Crystallography, BAS
- » Acad. J. Malinovski Institute of Optical Materials and Technologies, BAS
- » Institute of Organic Chemistry with Centre of Phytochemistry, BAS
- » Institute of Polymers, BAS
- » Institute of Solid State Physics, BAS
- » Acad. R. Kaischew Institute of Physical Chemistry, BAS
- » Sofia University
- » Technical University Sofia
- » Technical University, Varna
- » Technical University, Gabrovo
- » University of Chemical Technologies and Metallurgy
- » Central Laboratory of Applied Physics, BAS, Plovdiv

Associated partners:

- » BORIMA AD;
- » Mechatronics and Automation cluster;
- » Techno-Park Sofia, Scientific and RD association;
- » Institute of Robotics and Intelligent Systems, Federal Technical University, Zurich
- » Hebrew University, Jerusalem, Israel (HUJI);
- » Technical University, Delft, the Netherlands.

Centre of Competence “Intelligent mechatronic, eco and energy-saving systems and technologies” (IMEPSST)



Webpage:

<http://www.smeest.eu>

Coordinator, contact address:

Technical University,
4 Hadji Dimitar Str., Gabrovo 5300

Bulgarian consortium:

Financial coordinator:

Science and Education for Smart Growth operational programme

Scientific coordinator:

Technical university, Gabrovo

IMEPSST

Description and activities of the infrastructure:

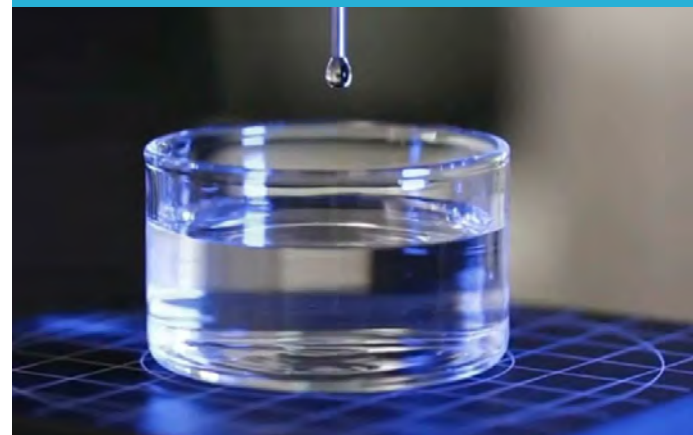
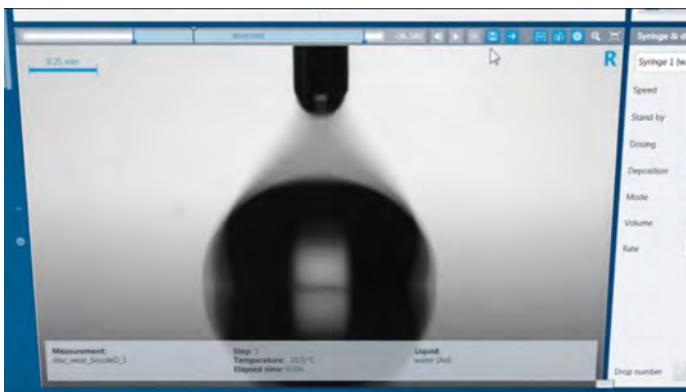
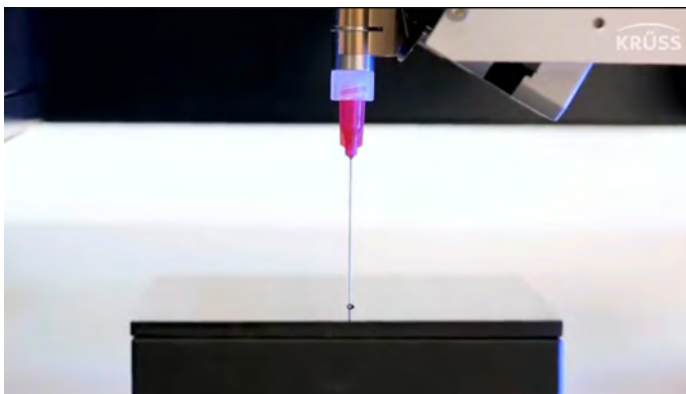
The Intelligent Mechatronic Ecological and Power-Saving Systems and Technologies (IMEPSST) scientific infrastructure is intended to facilitate leading scientists and their teams in carrying out market-oriented research in the fields of mechatronics and clean technologies.

The infrastructure is housed in a renovated and modernised buildings and has at its disposal state-of-the-art high-tech equipment. The scientific, applied-scientific and purely applied studies of the infrastructure are hosted in 8 laboratory complexes with 33 laboratories focused on the application of power-saving technologies, aiming to extend the lifespan and improve the exploitation safety of machine components, CAD/CAM systems for the design and manufacturing of high-tech products, additive and power-saving technologies and equipment, intelligent technologies, based on intensive energy streams, measuring of static and dynamic entities, studies of underwater noise, signals and vibrations of sea vessels and equipment, studies of the structure and properties of materials, development of sensors, micro-electronic and micro-processor devices and systems, studies of nano-structured materials and disperse systems in clean technologies, automation through the application of intelligent and special robots, autonomous flying devices, intelligent automated production systems and high-speed automation, inspection and interactive robotics, autonomous robots and collective work, special electric drives in robotics, methods and means to solve problems in power supply and infrastructures, related to mass electro-mobility, ecological and power-saving, contactless transmitters of electric power, electric drives and electric equipment, ecological, power-saving and electromagnetically compatible lighting equipment, LED and renewable power sources components and technologies, power-efficient systems and technologies using heat and hydraulic power and secondary renewable power sources driving positioning systems and integrated power-saving technologies.

Impact/benefits:

Research work at the competence centre will contribute to the opening of new opportunities for collaboration between science and business, through granting access for SME to specialised services, measurements performed in accredited labs, research and development of innovative technologies and products. Thus, the innovatory potential of the nation will be boosted, the number and quality of the innovatory ideas ready to be implemented in the respective enterprises will grow.

Thanks to the infrastructure available, entrepreneurship will be stimulated to initiate new start-up and spin-off companies, guaranteeing sustainability of the investments. The building of capacity of research teams for quality work innovations will allow the introduction of new training and educational methods, the drafting of applied-scientific programmes and hands-on training for young scientists, doctoral and postdoctoral researchers, students and pupils.



Consortium member-organizations:

- » Technical University, Sofia, Plovdiv branch
- » Technical University, Varna
- » St. Kliment of Ochrid University of Sofia, Physical Chemistry Dept.
- » Institute of Robotics, BAS
- » Institute of Electronics BAS;
- » Central Laboratory of Applied Physics, Plovdiv, BAS

Centre of Competence “Clean Technologies for Sustainable Environment – Water, Waste, Energy for Circular Economy” (CLEAN&CIRCLE)



Webpage:

www.clean-circle.eu

Coordinator, contact address:

Sofia University “St. Kliment Ohridski”,
Department of Biology,
8 Dragan Tsankov Blvd., Sofia

Location of infrastructure, address:

City of Sofia
The main building will be at 1 James Bourchier Blvd.,
Lozenets, Sofia

clean  circle

Description and activities of the infrastructure:

The Clean&Circle centre of competence aims to ensure investments in scientific infrastructure, professional capacity, innovation and technological business models, to create the appropriate conditions for the functioning of an ecosystem in the area of the clean technologies and circular economy, focusing on waters, energy and waste management.

The strategic goal is to turn the competence centre into a national and European innovation, scientific, RD and educational centre in the sphere of leading technologies and bio-technologies for circular economy. The centre will engage experienced experts and young innovators to generate and appropriate algorithms for eco-systems.

The CoC will host leading scientific research pursuant to the generation of products, services and clean technologies of high resource and power efficiency, and significant economic, social, educational and ecological added value, to stimulate intelligent technological and bio-technological entrepreneurship.

All activities of the CoC have been covered by a computer cloud to ensure exchange and prompt availability of information.

Three modules have been included in the CoC concept: Waters, Solid Waste, and Transfer.

The Waters and Solid Waste modules include scientific, applied scientific and development activities for circular economics power and resource efficiency in key aspects of the sustainable development:

Innovations for efficient exploitation of the installations for water purification, water supply networks and waste processing, as well as the creation of new, highly intelligent technologies of complex impact for the realisation of green, sustainable and efficient economy;

Increase of the renewable and alternative power source share in the production of bio-gas, bio-ethanol, bio-diesel, hydrogen, hydroelectric power stations, combined with technologies for bio-remediation of sewage and the resolution of critical ecological issues;

Recovering of resources such as phosphorus, precious and rare metals through bio-remediation of sludge, soils, sediments, accumulated toxic contaminants;

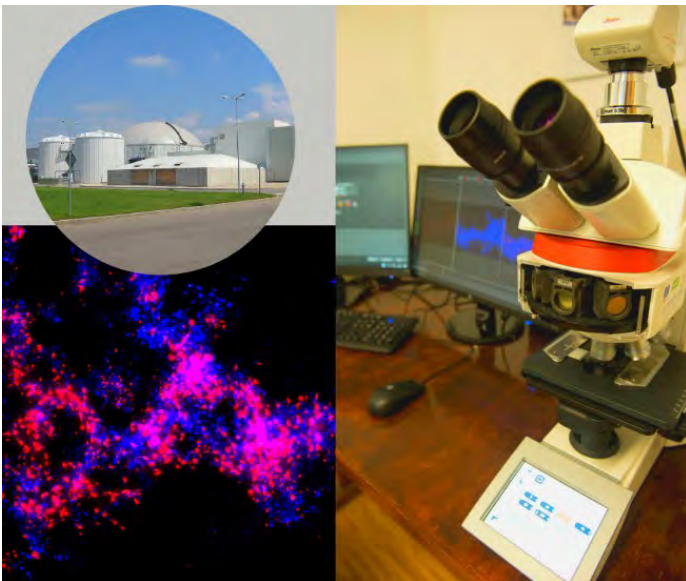
Obtaining of alternative resources – zeolites from ashes, slag, new construction and composite materials from waste, RDF fuel (from waste), quality bio-fertilisers from composting installations, microbiological preparations for detoxification etc.

The Transfer module covers activities related to education, dissemination of results, transfer of technologies and technological entrepreneurship. Multi-disciplinary doctoral and post-doctoral programmes have been planned and are now underway, linked to potential economic models of realisation through setting up of start-up and spin-off companies. The training of young talent starts at the CoC, and continues per specialised internship programmes of the associated partners in the business incubators, specially set up to that end between the Sofia Waste Treatment Enterprise, Sofia Water JSC and the Clean&Circle CoC.

Impact/benefits:

The structure and professional capacity built will have a lasting impact on various scientific areas and studies – circular use of waters, waste, energy, obtaining of precious resources from waste, bio-technologies, water cycles, management of biological and ecological risk factors, entrepreneurial and bio-entrepreneurial skills, higher education and continuing training, the transfer of technologies and bio-technologies etc. The activities of the centre correspond to the four of the main priorities included in the European Green Deal: clean energy, sustainable industry, construction and restoration, bio-diversity, eliminating of pollution, which will facilitate the scientific and technological response of this country to the challenges ensuing from the climate and environment changes. Thus, the distance between scientific achievement – real-world technologies – business will be shortened.

The results of the scientific activities of the CoC shall be made accessible for the scientific community, business and general public through information channels, events, round tables and demonstrations appropriate for each group. Thus the CoC shall be not only a part of the cultural and educational programme, but also a stimulus for pursuing environment-friendly way of life.



Bulgarian consortium:

Financial coordinator:

Science and Education for Smart Growth OP

Scientific coordinator:

Sofia University "St. Kliment Ohridski", Department of Biology

Consortium member-organizations:

- » University of Architecture, Construction and Geodesy;
- » University of Forestry, Sofia
- » Prof. Asen Zlatarev University, Burgas
- » Institute of Physical Chemistry, BAS;
- » Institute of organic chemistry with Centre of Phytochemistry, BAS;
- » Stefan Angelov Institute of Microbiology, BAS;
- » Cleantech Foundation, Bulgaria.

Centre of Competence "Technologies and Systems for Generat- ing, Storing and Consumption of Clean Energy", HITMOBIL



Webpage:

<https://www.hitmobil.eu/>

Coordinator, contact address:

Acad. Evgeni Budevski, Institute of
Electrochemistry and Energy Systems, BAS

Location of infrastructure, address:

Acad. G. Bonchev Str., bl. 10, bl. 103 and 72
Tsarigradsko Shose Blvd., and the village of
Vladaya

Bulgarian consortium:

Financial coordinator:

Science and Education for Smart Growth OP

Scientific coordinator:

Acad. Evgeni Budevski, Institute of
Electrochemistry and Energy Systems, BAS



HITMOBIL
CENTER OF COMPETENCE

Description and activities of the infrastructure:

The mission of the HITMOBIL is to promote the development and speed up the introduction of innovative high technologies for the storage of power from renewable sources and its efficient use by conversion, both by homes and industries, with emphasis on electro-mobility through efficiently meeting the three key points of the "triangle of knowledge": education, research and innovations.

The main goals of the Centre are:

- Put in place a unique, both nationally and regionally, infrastructure for the development, testing and optimisation of the industrial implementation of modern systems for mobility and accumulation of renewable energy.
- Build laboratories featuring state-of-the-art equipment to carry out industrial research and experimental development in the areas, covering the entire "green" energy cycle:
 - L1: Batteries
 - L2: Photovoltaic modules and generators
 - L3: Hydrogen and fuel cells
 - L4: Bio-energy
 - L5 Storage and electro-mobility
 - L6: Integrated power systems.
- Transfer of innovations, spreading of knowledge and training of highly-qualified experts (doctors, interns, engineering and technical staff) for the successful transition towards an economy of zero carbon emissions, especially in the light of the Green Deal of the EU.



Expected results:

By the implementation of the project, the HITMOBIL CoC will contribute to the enhancement of the efficiency and competitiveness of the energy sector of Bulgarian economy in the sphere of the innovative, highly efficient "green technologies", through the development and introduction of non-carbon technologies for the accumulation and conversion of energy (electricity and heat) from renewable power sources and its application in the transportation sector, by industries and homes.

The specific results would require setting up:

- An experimental facility to carry out applied scientific experiments, and to house innovation, research and development activities;
- Infrastructure capacity for more researchers' scientific work;
- New opportunities for the training of doctoral candidates and post-doctoral graduates, as well as for the qualification and re-qualification of interns, including from industries;
- Partnership and interaction between the centres for scientific work, research and development, higher education institutions and businesses, to strengthen the links between science/education/business;
- Conditions for joint participation of the Centre and Bulgarian companies in European demonstrative and pre-market projects, of level of technological readiness (TLR) > 6.

Through establishing the HITMOBILE CoC, private investments would be attracted, with a special focus on scientific research and innovations in the areas of competence of the Centre, which will serve as a basis for technological development and innovations guaranteeing sustainability.

Impact/benefits:

The activities intended and the results expected will ensure more efficient use of natural resources and reduction of carbon emissions due to the non-carbon technologies that would be developed and the accumulation and conversion of energy (electricity and heat) from renewable sources and its application in the transportation sector, industry and homes.

Consortium member-organizations:

- » Joint Innovation Centre, BAS
- » Institute of Catalysis, BAS
- » Institute of Engineering Chemistry, BAS
- » Institute of General and Inorganic Chemistry, BAS
- » Institute of Polymers, BAS
- » Central Laboratory for Solar Energy and Power Sources BAS
- » Scientific Institute for Clean Technologies
- » Institute of Hydrogen Technologies, through the BG H2 society,
- » Neofit Rilski Southwestern University



Center of Competence “Mechatronics and Clean Technologies MIRACle”



Webpage:

<http://imbm.bas.bg/>

Coordinator, contact address:

Institute of Mechanics, BAS
Sofia 1113, Acad. G. Bonchev Str., bl. 4

Bulgarian consortium:

Financial coordinator:

OPSESG

Scientific coordinator:

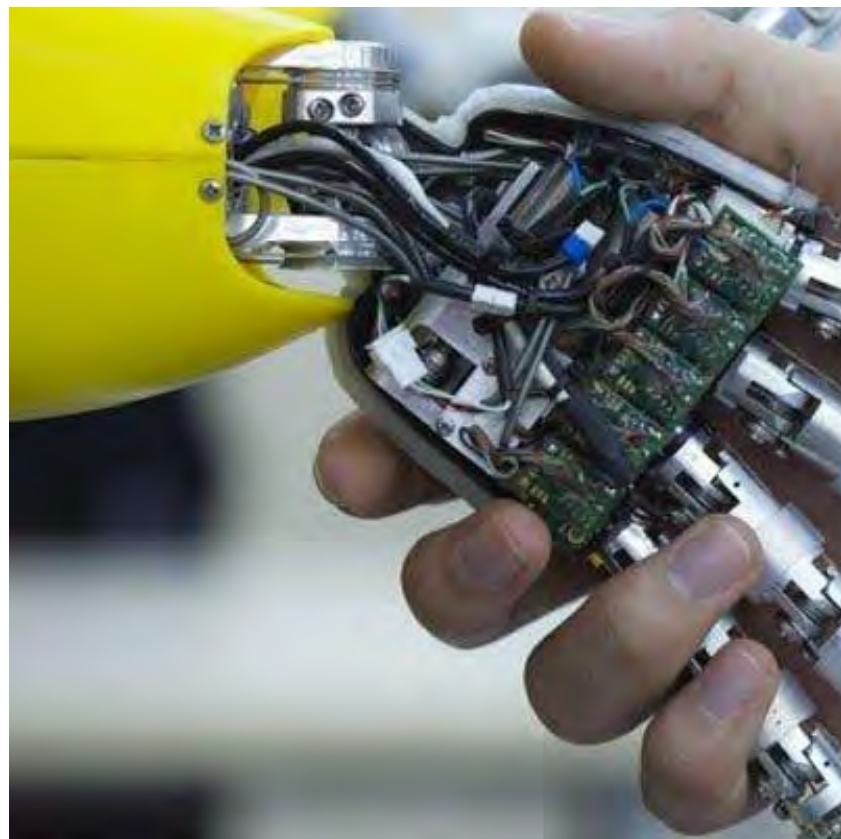
Institute of Mechanics - BAS

Description and activities of the infrastructure:

The main purpose of the Center is to unite the efforts of prominent scientists and university professors to create a organizationally comprehensive infrastructure for high-tech innovative research aimed at business in the field of mechatronics and clean technologies.

The center will have 15 laboratories in four bases, and the research activities in them are grouped in six work packages:

- Innovative solutions in robotics and automation;
- Biomechatronic systems;
- Intelligent environments, processes and technologies in mechatronics;
- New methods and means for control and testing of mechatronic elements;
- Mathematical provision and modeling of complex systems and processes;
- 3D modeling, development and introduction of pilot models of mechatronic elements, details and systems.



Impact/benefits:

- ▶ Development and introduction of new training methods and programmes, including for researchers and business representatives;
- ▶ Put in place favourable and attractive conditions for the development of highly-qualified young researchers, for the specialisation of top-level researchers and innovators;
- ▶ Establish new strategic partnerships with new technological and research organisation in Europe, initiate research projects funded by the EU framework programmes;
- ▶ Establish strategic partnerships with leading Bulgarian innovation clusters and high-tech companies to initiate innovative projects, for sponsored and contracted research works for the needs of businesses;
- ▶ Set up new start-up and spin-off firms and other related activities to provide scientific expertise to the established scientific research infrastructure.

Consortium member-organizations:

- » Institute of Information and Communication Technologies, BAS
- » Central Lab of Solar Energy and New Power Sources, BAS
- » St. Kliment of Ochrid, Sofia University
- » Technical University, Sofia
- » Prof. Assen Zlatarov University, Burgas
- » Higher School of Insurance and Finance
- » GIS-Transfer Centre foundation



74.3.

THEMATIC AREA

Healthy Living and Biotechnology Industry

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Center for Plant Systems Biology and Biotechnology (CPSBB)

Webpage:

www.cpsbb.eu

Coordinator, contact address:

Centre for Plant Systems Biology and Biotechnology,
139 Ruski Blvd., Plovdiv 4000

Bulgarian consortium:

Financial coordinator:

BG05M20P001-1.003 - "Additional support for Bulgarian research organisations working on projects within the Horizon 2020 framework programme, WIDESPREAD-Teaming, competition, phase 2"

Science and Education for Smart Growth OP, Horizon 2020

Scientific coordinator:

Centre for Plant Systems Biology and Biotechnology,
139 Ruski Blvd., Plovdiv 4000



Description and activities of the infrastructure:

The CPSBB is one of the leading European institutes in plant sciences. It utilises advanced techniques in the field of functional genomics, metabolomics and bio-informatics, to research the regulatory mechanisms and metabolic chains controlling plant development, physiology of stress, as well as the synthesis of potentially valuable metabolites of possible marketable quality. Fundamental scientific research carried out in the CPSBB departments – Plant Development, Molecular Stress Physiology, Metabolomics and Bio-informatics, have been involved in the applied-scientific research carried out by the Plant Cell Bio-technology and Vegetable Breeding departments. The CPSBB is the link between academic circles and the industry of the region and plays the leading role in the training of the new generation researchers in the field of plant systems biology and bio-technology. The Technology Transfer office facilitates the flow of knowledge to partners and end-users. The newly established CPSBB centre of excellence will significantly enhance the research potential of the nation, will broaden the capacity of the country in the field of plant genomics and will stimulate the development of the available scientific and economic potential in Plovdiv and the region.

Applied research has been structured in three main areas:

1. Plant cell bio-technology
2. Synthetic biology
3. Breeding of vegetables

Impact/benefits:

Quality scientific research is underway in molecular biology, genetics, functional genomics, metabolomics and bio-informatics. New products are being developed for Bulgarian and European markets.

Research departments and infrastructure of CPSBB:

(A) Research Departments;

(B) The building of CPSBB, Maritsa Vegetable Crops Research Institute (MVCRI);

(C) Plan for the new CPSBB research complex (23,500 m²) to be built in 2021.

References: 1. administrative building; 2. laboratories; 3. specialized premises; 4. greenhouses; 5. parking; 6. recreation area.

As a result:

- The up-to-date scientific work in plant system biology and bio-technology will enhance the research and innovatory potential of Bulgarian plant science.
- New technologies will be being introduced in vegetable breeding to improve yields.
- Decision making in farming will be facilitated and this will impact positively farm producers, end-users and environment.
- The agricultural and bio-technological sectors of Bulgarian economy would be stimulated.

The Centre is training a new generation of scientists in the fields of plant system biology and bio-technology, making available to them an attractive work environment, thus retaining quality plant science Bulgarian experts and attracting leading experts from abroad.

Associated partners:

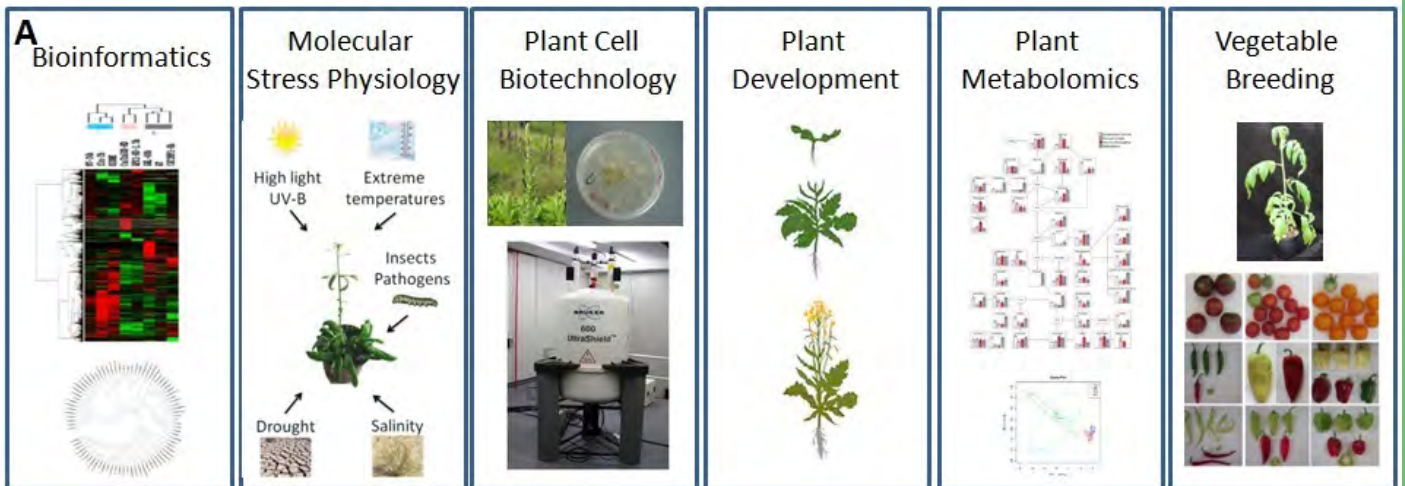
- » Maritza Institute of Vegetables
- » Stefan Angelov Institute of Microbiology, BAS
- » Potsdam University, Germany
- » Max Plank Institute of Molecular Plant Physiology, Germany
- » Institute of Molecular Biology and Bio-Technology

Type of infrastructure:

Centralized

Participation in European infrastructures:

Horizon, WIDESPREAD-01-2016-2017-Teaming Phase 2, project PlantaSYST SGA-CSA No. 739582



National Infrastructure for Research and Innovation in Agriculture and Food (RINA)



Coordinator, contact address:
Agricultural Academy

Bulgarian consortium:
Financial coordinator:
Ministry of Education and Science

Scientific coordinator:
Agricultural Academy
39 Suchodolska Str., Fakulteta distr.
Sofia 1373



Description and activities of the infrastructure:

The National Infrastructure for Research and Innovations in Agriculture and Food (RINA – Research, Innovations, Agriculture) is a consortium of scientific and auxiliary units focused on upgrading of the available scientific and applied capacity, through their inclusion in four research complexes working in the main areas of agricultural science, as follows:

1. Scientific complex for sustainable management of soils, efficient use of waters and identification of ecological risks and threats;
2. Scientific complex for genetic, metabolic and phenotype studies;
3. Scientific complex for the study of foods and drinks;
4. Scientific complex for agroinformation, agromanagement and development of agricultural areas.



Impact/benefits:

1. Sustainable and efficient management of soils and genetic resources, and improvement of eco-system services.
2. Improved sustainability of the agrarian sector and reducing the harmful impacts on the environment **by creating and introducing new Bulgarian varieties and breeds on farm animals**, well adapted to climate change.
3. Sustainable management of fresh-water and marine resources and aquaculture.
4. Innovative technologies for obtaining ecologically clean, functional foods and beverages of plant and animal origin. Increasing the range of foods for special target groups with chronic diseases - diabetes, obesity, cardiovascular disease, baby and school foods of the new generation
5. Creating new bio-based products for sustainable bio-economy.
6. Improving the quality and efficiency of services in support of agribusiness and rural areas. Facilitated access to agroinformation and its use for the development of analyses, strategies and policies.



Consortium member-organizations:

- » Bulgarian Food Safety Agency
- » National Agrarian Scientific Information Complex
- » Central Agricultural Library
- » Agrarian University, Plovdiv
- » Thracian University, Stara Zagora
- » University of Forestry Sofia

Type of infrastructure:

Distributed

Participation in European infrastructures:

There is an agreement to join the following infrastructures in 2020:

EMPHASIS (European Infrastructure for Multi-Scale Plant Phenomics and Simulation for Food Security in a changing climate); AnaEE (H&F) (Analysis and Experimentation on Ecosystems).



Research Infrastructure for Food, Nutrition and Health, Linked to Bulgaria's Participation in the Pan-European Infrastructure FNH-RI (FNH-RI BUL)

Coordinator, contact address:

Food Technologies University,
26 Maritza Blvd., Plovdiv 4000
<https://uft-plovdiv.bg/>

Bulgarian consortium:

Financial coordinator:

Ministry of Education and Science

Scientific coordinator:

Prof. Angel Angelov Food Technologies University

Consortium member-organizations:

- » Paisii Hilendarski Plovdiv University
- » Thracian University, Stara Zagora
- » Agrarian University, Plovdiv
- » Agrobioinstitute, Agrochemical Academy
- » Medical University, Plovdiv
- » AgroHub.BG, Sofia
- » Bulgarian Food Safety Agency

Type of infrastructure:

Distributed

Participation in European infrastructures:

FNH-RI BUL is a national representative at the Food, Nutrition and Health Research Infrastructure

FNH-RI BUL

Description and activities of the infrastructure:

The FNH-RI BUL is set within the scientific paradigm of the nature of nutrition. This includes continuing interaction between food supply, food-related behaviour and the consumption of food and nutritive substances that affect human health and the environment, the development of food culture locally and dealing with social challenges related to food systems.

In order to achieve these goals, the FNH-RI BUL will provide scientists with a centrally organised research environment and data services including a citizen data platform, as well as a network of available scientific structures belonging to public and private stakeholders. This will allow the stakeholders to implement the necessary food system transformations in the future decades. Through the FNH-RI BUL, studies will be conducted at the highest level in the following main areas: at the food system level, supply chains affecting the health of our planet and society as a result of the food culture developed; and at the citizen level, food habits affecting personal health and welfare. This will lead to an interaction between different scientific areas – food, agriculture, veterinary science, food chemistry, organoleptic studies, ecology, human nutrition, biomedical and social sciences.

FNH-RI BUL belongs to the thematic priority of Health and Quality of Life, Prevention, Early Diagnostics, Therapy, Green, Blue and Environmentally Friendly Technologies, Biotechnology, and Ecofoods of the National Strategy for Scientific Research Development 2017 – 2030, the Healthy Life and Biotechnology priority area of the Innovation Strategy for Smart Specialisation of the Republic of Bulgaria 2014 – 2020, and the Food and Health thematic priority of the European Strategic Forum for Research Infrastructures (ESFRI).

The FNH-RI BUL participates in the Food, Nutrition and Health Research Infrastructure (FNH-RI), which includes numerous universities and research centres from 19 European countries and is managed by the University of Wageningen, the Netherlands. The mission of this structure is to facilitate research and innovations that would support the expected changes in consumer behaviour and sustainability in the area of food and health of the population. The FNH-RI provides opportunities for undertaking interdisciplinary studies focused on the food consumption habits of European citizens, on different traditional diets and their expected impact on health and the environment.

Impact/benefits:

The FNH-RI BUL will provide opportunities for data sharing, educational and training facilities for future scientists, and will address citizens, public and private stakeholders.

The FNH-RI BUL will impact the innovations climate in Bulgaria by offering research infrastructure and quality research environment that is indispensable in the training process.

Based on top-quality research, specialised data services and information accessibility, the FNH-RI BUL will seek close cooperation with research circles and the academia, NGOs, the food industry, SMEs, agricultural producers, administration and consumers. The impact on the private sector will include innovative changes in logistics, in the social and created food environment. With regard to agriculture and food industry, the awareness of food-related behaviour will generate innovative concepts for the development of healthy and sustainable foods. Based on an approach oriented towards tackling social challenges and a wide spectrum of activities, such as entrepreneurial training and education, innovative project development, and services in support of industry, the FNH RI BUL is well prepared to work in synergism with the Horizon Europe research and innovation framework.





Center of Competence "Sustainable Utilization of Bio-resources and Waste of Medicinal and Aromatic Plants for Innovative Bioactive Products"

Webpage:

<http://subramap.orgchm.bas.bg/>

Coordinator, contact address:

Institute of Organic Chemistry with Centre of
Phytochemistry, BAS
Acad. G. Bonchev Str., bl. 9, Sofia, 1113

Bulgarian consortium:

Financial coordinator:

Science and Education for Smart Growth OP

Scientific coordinator:

Institute of Organic Chemistry with Centre of
Phytochemistry, BAS

Consortium member-organizations:

- » Agrobioinstitute, Agrochemical Academy
- » Biology Department, Sofia University
- » Chemistry and Pharmacy Department, Sofia University
- » Institute of Polymers, BAS

Description and activities of the infrastructure:

The Centre of Competence aims to efficiently utilise the available national resources of medicinal and aromatic plants and bio-waste from agriculture, and the application of green technologies, to implement and propose to the respective industries innovative products and technologies and thus put in place the conditions for sustainable growth of the bio-economy in this country and abroad.

Goals and activities:

- Set up a modern research complex covering the entire process – from plant to product, for an efficient, ecological and sustainable utilisation of the natural resources through the construction of modern scientific infrastructure;
- Renovation, modernisation and functional integration of the partner organisations scientific infrastructures, and Centres of Competence;
- Concentration of scientific expertise and highly competent research potential;
- Support for the (semi-) industrial cultivation of valuable medicinal and aromatic plants applicable in innovative bio-active products;
- Introduction and development of green chemical technologies for the extraction and utilisation of medicinal and aromatic plants;
- Introduction of innovative approaches of treatment and processing of extracts from medicinal and aromatic plants for the production of cosmetic and pharmaceutical products, nutraceuticals (dietary supplements and healthy functional foods) and similar products to enhance quality of life;
- Development of analytical methods of quality and quantity analyses, authenticity, identity and impurities content control of the extracts and products obtained; standardisation of methods and procedures for quality control of the products obtained;
- Development of innovative nutraceutical and cosmetic formulae and the processes for their production using bio-compatible polymers and natural surfactants;
- Provide a creativity stimulating work environment and the conditions for the implementation and development of the research and innovatory potential of the CoC member-organisations;
- Train and assist young researchers and innovators;
- Strengthen existing and set up new partnerships and networks with research organisations in Europe;
- Build lasting and prospective partnerships with SME and other interested companies.

Impact/benefits:

The CoC will provide the opportunity for the implementation of world-class competitive and important research works, which will lead to qualitative enhancement of the knowledge about Bulgarian medicinal and aromatic plants, the conditions favourable for their cultivation, the chemical composition and biological activity of extracts and individual natural compounds; the options for their application in innovative products, produced from Bulgarian substances of plant-origin, of high added value and potential for specific applications such as functional foods, in cosmetics and other personal hygiene products.

The long-term impact of the CoC will would depend on the building up of modern infrastructure and the opportunities to develop available human and innovations potential, to contribute to the increasing of the capacity of research institutions to carry out first-class, competitive research works and implement quality technological advancements in the future, integrating these in European scientific space.



National Center for Biomedical Photonics (NCBP)



Webpage:

<http://www.ncbp.ie-bas.org/>

Coordinator, contact address:

Institute of Electronics, BAS
72 Tsarigradsko Chaussee Blvd., Sofia 1784

Bulgarian consortium:

Financial coordinator:

Ministry of Education and Science

Scientific coordinator:

Institute of Electronics, BAS



Description and activities of the infrastructure:

Strategic goal of the NCBP is the institutionalisation and the development of the Biophotonics and Bio-nanophotonics, as a part of the European scientific infrastructure.

Its main activities:

- Create the conditions suitable for the implementation of fundamental scientific research to acquire new knowledge on the optical, biochemical and functional properties of biological matter; applied-scientific research to discover new medical and therapeutic methods and studies for the development of methodological and instrumental basis of medical theranostics and personalising of medical practice;
- Development of prototypes and demonstrations, pilot projects, testing and validation of new or improved products, processes and services in a close to the actual exploitation conditions environment.

Main tasks of the NCBP:

- Tissue optics investigations and spectroscopy of biological objects to develop diagnostic and analytical methods, laser nano- and micro-treatment of biological tissues to be applied in medical therapy. Micro/nano-lithographic structuring for the development nano-scale sensors.
- Study of the connection of the changes in the (epi) genome and (epi) transcriptome from embryonic stage to mature age with the changes in the immunity and the development of pathology in humans and animals, in order to improve quality of life.
- Study of the photo-induced processes in micro- and nano-scale layers and structures, development of high-tech materials, methods and technologies for optical applications, invent new materials and registering technologies applicable in biophotonics and sensorics.
- Development of methods for early diagnostics of tumors as well as for tracing the efficiency of therapies. Screening technology for diagnostics and monitoring of a wide range of conditions; electro-poration, electrofusion, electrotransformation, electrotransfer of macromolecules through membranes, electro-chemotherapy of tumors.
- Development of multi-modal nano-particles capable to be transported and to deliver medications to targeted tissue. Development of new optically active materials and new coatings of enhanced biocompatibility and biodegradability and new technologies for targeting drug agents to tumor cells.
- Develop new photon and nano-technological medical approaches and products to improve health and longevity of all identified by the RIS3, fields of nano-medicine: nano-diagnostics, nano-pharmacology, nano-regenerative medicine, nano-therapy, nano-surgery.
- Develop new laser-based methods, medical tools and approaches such as "optical biopsy" and develop a new medical discipline: "photodynamic/sonodynamic medicine".

- Complex development of the Theranostic Nanomedicine approach, for the "delivery of the appropriate medicine to a particular patient, at the right time, in the right place in the body", especially for cancer treatment.

Impact/benefits:

The results will impact: creation of a new generation of bio-validating models of cancer and other pathologies that mimic living human or animal tissues and allowing complex testing of the effects of various physical/chemical factors, based on methods for biological treatment at genetic material level, its functional condition, cell physiology and tissue functions. These results will impact the areas of bio-medicine, pharmacy, and clinical medicine in its most modern fields: theranostics, photodynamic medicine, nano-medicine.

Potential users would be the scientific community, the bio-pharmaceutical industry, clinical practice and related sciences – veterinary medicine, biology, and chemistry.



Consortium member-organizations:

- » Hospital "Tsaritsa Yoanna - ISUL"
- » University "Prof. Assen Zlatarov" - Burgas
- » Institute of Biology and Immunology of Reproduction, BAS
- » Institute of Optical Materials and Technologies, BAS
- » Institute of Biophysics and Bio-medical Engineering, BAS
- » Central Laboratory of Applied Physics, Plovdiv

Type of infrastructure:

Distributed



Extreme Coherent Light in the Mid-IR and X-Ray Area as a Laboratory Infrastructure (HEPHAESTUS)



Webpage:

<http://bionano-bg.eu>

Coordinator, contact address:

Sofia University St. Kliment Ochridski,
Department of Physics,
5 James Bourchier Blvd, Sofia 1164

Bulgarian consortium:

Financial coordinator:

Ministry of Education and Science

Scientific coordinator:

St. Kliment of Ochrid, Sofia University



Description and activities of the infrastructure:

Fundamental research in the interaction of laser light of extreme properties and matter is at this time in the spot-light of bio- and nano-photonics, and this has brought about a huge number of scientific and technological discoveries. So far, free electron lasers (FEL) and the synchrotrons have been the only sources of coherent light of extreme properties in the two spectrum ranges, mid-infrared (MIR FELs) and X-ray (XFEL). These sources generate very powerful photon beams and at the same time provide extreme resolutions in terms of space and time. Yet, the equipment is huge in size and is really expensive to build and maintain. It is not easily accessible for individual research groups or for the industry and small businesses. At present, the latest technological achievements in laser physics and engineering allow the construction of new laser sources, not larger than a lab workbench, as an alternative to the synchrotrons and the FELs, suitable for numerous applications in the physics of materials, biology, semi-conductor industries and nano-technologies. Despite some limitations, such as their maximum and mid-range power, and the range of their spectrum tuning, the compact alternative sources now allow the practical testing and implementation of a considerable number of technologies produced using beams from FELs and synchrotrons. The HEPHAESTUS research infrastructure, consisting of interdisciplinary laboratories of unique equipment such as the compact alternative of the MIR-FEL/ XFEL, sets the following goals:

- To serve the interdisciplinary scientific community both in academic circles and the industry, by providing access to their unique laser infrastructure;
- Set up a user network through the integration of existing FEL users, and the attracting of new ones through greater flexibility and speedier performance of specific tasks;
- Integration with other research infrastructures, which complement each other, in order to increase the research potential considerably at European level: <https://www.laserlab-europe.eu> and others;
- Maintain the critical mass of established scientists at national and international level and attract talented young researchers facilitating their career development;
- Increase human resource potential nationally and in Europe through the training of new users;
- Increase competitiveness of the national and European economies through the providing of an affordable access for small and medium-sized businesses to the development of new technologies in their respective spheres, based on the latest achievement in photonics.

Impact/benefits:

The research and development programmes of the research infrastructure will contribute to the "Industry for a healthy life and bio-technologies", and "Mechatronics and Clean Technologies" RIS3 priority areas and, specifically, to "Nano-technologies in Service of Medicine and Biophotonics". Additional impact is expected in the following areas: Medicine – minimum-invasive therapies; biology – leaser modification of biological properties of materials and photobiomodulation, biosensors; semiconductor metrology through coherent light of minimal wavelength etc.

The expected results are:

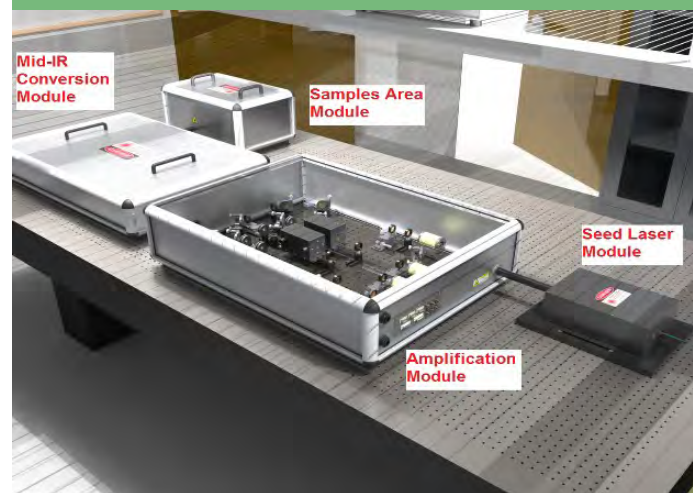
- better opportunities and partnerships in networks, spreading the existing network across the EU; access to and membership in <https://www.laserlab-europe.eu>;
- stimulate the exchange of knowledge between the national and international institutions;
- setting up of new inter-disciplinary technologies and industrial applications, including new products for high-tech companies;
- inter-disciplinary environment for young researchers and formation of a future generation of scientists and engineers;
- increase competitiveness of the national and European economies through spin-off of the achievements.

Consortium member-organizations:

- » John Atanassov Centre of Bio- and Nano-Photonics
- » Laboratory of Femtosecond Phenomena, Laser and X-Ray Physics Department E11;
- » Technical University, Munich
- » Technical University, Vienna, Institute of Photonics

Type of infrastructure:

Distributed



Diagnostics and Technology Center for Plant Health - PLANTHEALTH



Coordinator, contact address:

Agricultural University Plovdiv,
12 Mendeleev Blvd, 4003 Plovdiv /
South Central District
www.au-plovdiv.bg

Bulgarian consortium:

Financial coordinator:
Ministry of Education and Science

Scientific coordinator:

Agrarian University, Plovdiv

Consortium member-organizations:

- » Thracian University, Stara Zagora
- » Institute of Forestry, BAS

Type of infrastructure:

Distributed



Description and activities of the infrastructure:

Research Infrastructure (RI) Plant Health is a national research infrastructure, a combination of a diagnostic laboratory and linked research resources for diagnostics, prognoses and technologies related to plant health. The Plant Health will make possible to carry out state-of-the-art research on the factors that impact plant health along the soil-plant-plant product chain, by providing opportunity for technological solutions for safe bio-based plant breeding products and fodders both on this country and the EU. The main characteristics of Plant Health cover three components:

- Building up and functioning of a laboratory diagnostic complex, featuring state-of-the-art conditions and equipment for complex studies of plant health of cultivated species and trees, to tackle the three main challenges for plant health, namely, prognostication, prevention and protection.
- Functional scientific and administrative entities for research and project management.
- Functional unit for the exploitation of the results and products obtained, connection with their public users, communication, promotion and protection of intellectual property.

Plant Health will make available the results of fundamental and applied research to:

- scientific and educational communities in this country though providing of a methodological framework for complex research in plant health, taking into account climate change;
- agricultural and forestry sectors, state control agencies and public organisations, acting as a National Referential Laboratory for plant health, offering:
 - ▶ expert evaluations, prognoses and technological solutions for systemic support for plant health;
 - ▶ ecological plant protection based on the DSS: Decision Support System;
 - ▶ internationally certified (ISO) procedures for reference analysis of phytopathogens, insect/non-insect pests and microorganisms in soils and plants, mycotoxins, invasive species, qualities of xenobiotics (heavy metals, chemical plant protection agents), bio-agents;
- analyses and technologies for the utilisation of recycled waters and organic materials for soil fertility;
- verification and health passport of plants etc.

The intention is for the infrastructure to join European infrastructures (METROFOOD-RI,) and other partnership networks. Plant Health will be integrated in international networks, such as (EU EFSA and EPPO, the European Food Forum (EFF), the EUAGRI research and technological network, the Sustainable Development Infrastructure in Agrifood (SDIA).



Impact/benefits:

Plant Health will have impacts on:

- **Improved quality of research in plant health, as a substantial component of agro-food chains.**

In the short, 5-year term, Plant Health will impact the research and innovation system in this country. This will be achieved through transfer of new technologies (at least three from abroad), related to scientific products addressing ecological agriculture, analyses and proof of safety of fresh and processed plant products, or fodders for stock-breeding, the materials for the production thereof (waters, fertilisers, plant-protection preparations) etc. In the long term (up to 10 years), Plant Health will have produced innovations and research products in "green" chemistry, circular agriculture, organic production, biological plant protection.

- **Plant health protection being an essential component in the agro-food chains and addressing the EU Green Deal.**

The Plant Health methodology, applying monitoring and diagnostic tools identifying pests and diseases, prognostic models for their management, technological solutions for enhancing the resilience of



cultivated plants and forest ecosystems and their restoration following abiotic stress (climate changes), biological plant protection using bio-control agents etc., will be made available to producers of food and food-products.

- **Improved learning capacity in the area of plant health.**

Critical mass of researchers will acquire the necessary skills to develop and implement innovative research products for the entire plant-producing chain and, indirectly, for improved people and environment health through improving sustainability of economic growth in crop production and forestry. The new research equipment and the adequate compensations for the young researchers will bring about specific results and products, including 2 patents, 2 useful models, 4 technological models and solutions (strategies, approaches, methodologies, management systems, data-bases, technological platforms etc.), produced by the RI, and 2 networks with branch organisations other business- and public organisations.

- **Improved institutional interaction and collaboration with economic and public entities.**

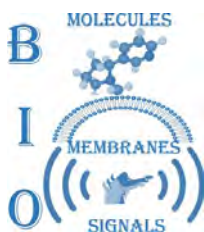
The RI Plant Health will be institutionally integrated with the Centre for Biological Testing at the Agricultural University, Plovdiv, as well as with associated partners such as the Bulgarian Food Safety Agency, the Centre for Risk Assessment in the Food Chain and the Forestry Agency at the Ministry of Agriculture, Food and Forestry, the National Agricultural Advisory Service, the Bulgarian Chamber of Commerce and Industry, the Bulgarian Industrial Association, the State-Owned Forestry Enterprises, the Bulgarian Plant Protection Agency, the Bulgarian Association of Bio-products and private companies in the agricultural sector and forestry, to identify and solve economical, ecological and social issues related to plant health.

- **Improved interaction with the business and efficient use of scientific products.**

Research products (scientific publications, laboratory analyses, useful models, technological solutions, Decision Support Systems, patents etc.) will be available to other research organisations and users provided certain transparent conditions are met, pursuant to the open access policy.

Up to 20 % of the workload of the RI Plant Health are expected to be generated through orders "for producing and providing research and innovation products" from the businesses.





Research Infrastructure for Innovative Research of Biomolecules, Biomembranes and Biosignalling

Webpage:

<http://www.biomed.bas.bg>

Coordinator, contact address:

Institute of Biophysics and Biomedical Engineering, BAS
Acad. Georgi Bonchev Str., bl. 21, Sofia

Bulgarian consortium:

Financial coordinator:

Ministry of Education and Science

Scientific coordinator:

Institute of Biophysics and Biomedical Engineering, BAS

Consortium member-organizations:

- » Acad. Roumen Tsanev Institute of Molecular Biology, BAS
- » Acad. Georgi Nadzhakov Institute of Physics of Solids, BAS

Type of infrastructure:

Distributed

Description and activities of the infrastructure:

The Research Infrastructure for Advanced Studies of Biomolecules, Biomembranes and Biosignals (BioMMS) sets the aim to bring together the best available scientific expert analyses, methods and technologies of Bulgarian research laboratories in the field of biomolecules, biomembranes and biosignals. BioMMS will combine and upgrade the existing infrastructure in the coordinating organization and the two partnering organizations, which will create a new modern infrastructure with the potential to carry out large-scale and advanced interdisciplinary scientific research in accordance with the European and global standards of research quality and to develop competitive business-oriented products and services. BioMMS will offer a closed loop of research activities – from theoretical models and computer-simulated analyses of biomolecules, through experimental characterization of biomolecules and biomembranes, and analysis of biomedical signals, to a final scientific product with an applied value.

The primary scientific objective of BioMMS is to discover the causes for molecular dysfunctions and related pathologies, leading to the development of socially-significant diseases. The defined activities will result in the discovery of new molecular mechanisms and interactions as well as the development of new treatment models, innovative diagnostic methods and appliances. The synergism between high-quality scientific expertise and modern infrastructure will allow for the implementation of innovative research, applied scientific and educational ideas and solutions, based on interdisciplinary research in the areas of Biomedicine, Biophysics, Biochemistry, Biomechanics, Bioengineering, Artificial Intelligence, Chemo- and Bioinformatics. Acquiring and promoting this knowledge will invoke a natural interaction between science and business, thus stimulating the implementation of socially significant scientific products and reducing the economic burden on society, caused by a shortage or lack of adequate treatment of severe human diseases.

In the future, BioMMS intends to join the following European infrastructures: EATRIS – ERIC, Euro Bioluminescence and Biomedical Research – ERIC.

Impact/benefits:

- **Concentration of expert knowledge and technological capacities** in the field of Biophysics and Biomedical Engineering, to result in scientific excellence related to the characterization of biomolecules, biomembranes and biosignals.
- **Training of BioMMS' scientific staff, as well as of PhD and graduate students** in new and advanced biophysical and bioengineering techniques and methods, mainly of biomedical nature, to the benefit of Bulgarian society and economics.
- **Provision of wide access to unique scientific equipment to a broad range of users** from research and business organizations in order to improve the quality of research in Bulgaria and to enhance the competitiveness and recognition of Bulgarian scientists worldwide.
- **Development and strengthening of a reliable technically equipped research potential** to assist government supervisory bodies with expert analyses and competent decisions.
- **Broadening of the competence of the scientific staff by means of exchange of experience** with leading researchers and research centers abroad.
- **Achievement of considerable social effect** with respect to the improvement of the work conditions and remuneration of the scientific staff, its recruitment and retention in Bulgaria (especially young scientists), and improvement of the country's image in the European and world scientific community.
- **Fostering the relation between science and business** by means of transfer of knowledge and technologies, and also implementation of new products and services, directed towards development of competitive Bulgarian economy based on scientific research and innovations in the field of biomedicine. This is to be achieved through proposing new approaches for improved diagnostics, prevention and therapy of socially significant diseases (oncological, cardio-vascular, neurodegenerative, reproductive, etc.); development of information technologies and smart systems for practical healthcare based on in silico drug design methods; development of new methods for rehabilitation, medical devices for electrocardiographic signals analyses, etc.



Center of Competence “Fundamental, Translational and Clinical Studies in the Field of Infections and Infectious Immunology”

Webpage:

<https://ncipd.org/index.php>

Coordinator, contact address:

National Centre for Infectious and Parasitic Diseases,
26 Yanko Sakazov Str., Sofia
Prof. Dr. Maria Nikolova, DM
mstoimenova@ncipd.org

Bulgarian consortium:

Financial coordinator:

Science and Education for Smart Growth OP

Scientific coordinator:

National Centre for Infectious and Parasitic Diseases

Consortium member-organizations:

- » Stefan Angelov Institute of Microbiology, BAS
- » National Diagnostic and Research Institute of Veterinary Medicine
- » Medical Institute, Ministry of Interior

Center of Competence “Fundamental, Translational and Clinical Studies in the Field of Infections and Infectious Immunology”

Description and activities of the infrastructure:

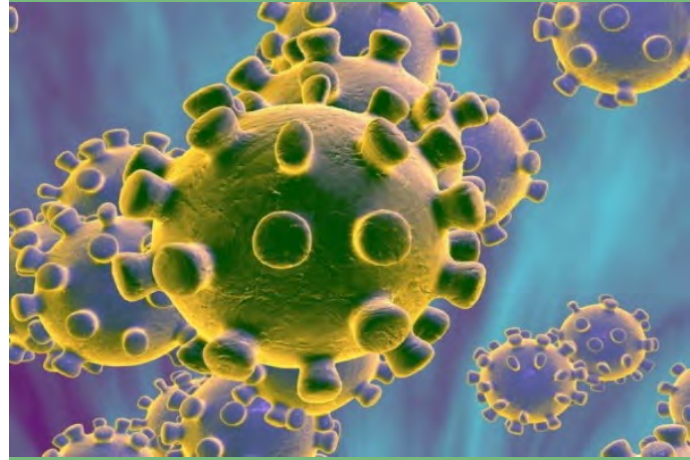
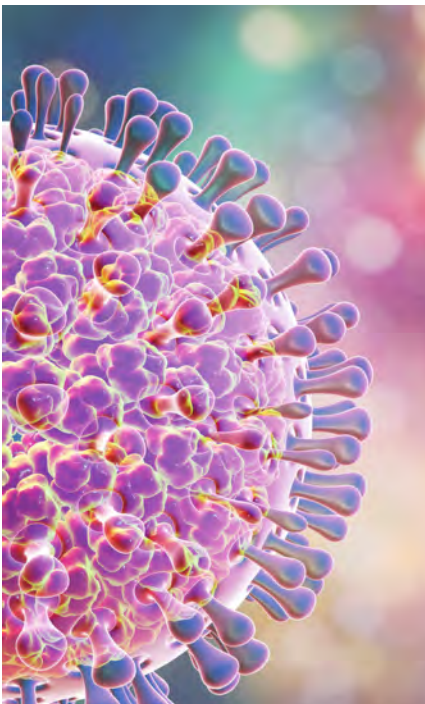
Main goal of the Centre of Competence is to increase the potential for the implementation of quality fundamental studies, acquisition of new knowledge and the translation thereof to clinical practice in the form of diagnostic algorithms, methodologies, therapeutic and prophylactic means, expertise. Building the research infrastructure will facilitate the implementation of research programmes in the following areas:

- precise and comprehensive definition of etiological agents in hosts and environment;
- molecular/epidemiological analysis of socially significant infections;
- characterisation of drug resistance of infectious agents;
- study the role of the genetic immunological “background” for the development of infectious and post-infectious pathology.

Prompt and precise identification of agents is a condition for the timely and adequate therapy of infections and the prevention of epidemic outbreaks caused by emergent and unknown pathogens. Decoding the mechanisms causing resistance to widely used anti-bacterial, anti-viral and anti-parasitic preparations will allow to work out correct strategies to their application in hospital environment during epidemics. Attention will be paid to water supply monitoring for presence of infectious agents and the analysis of waste water from hospitals, stock-breeding farms and waste-water treatment stations to characterise the circulating genes that cause anti-microbial resistance. The data about the genetic variations and the evolution of individual groups of infectious agents in Bulgaria will be the basis for epidemiological prognostication and targeted prophylaxis of socially significant infectious diseases. The outcome of any infection depends on the capability of the individuals to protect themselves by their immune response. One of the goals of the project is to find bio-markers, convenient for laboratory practice, that indicate whether the immune response was successful, predict the development and outcome of an infection and reflect the effect of the therapy applied. One of the expected results would be the development of highly-sensitive, non-traumatic methods of evaluation – the so called “local” (mucous) immune response. Third focus would be the means of correcting the pathology immune response.

Impact/benefits:

The centre will provide a quality work environment, conditions for continuing learning and qualification, for attracting and retaining new researchers. Opportunities will be offered for publishing original research results, gaining international recognition and access to projects. The setting up of a biological banks and data-base about the pathogens circulation in the region will form the basis for participation in regional and global expert networks. Valuable information will be generated for the improvement of the disease watch and managerial decisions of long-term impact for prevention of vaccine-preventable diseases. Genotyping of pathogenic strains will contribute to the adequate treatment and reduction of complications and death rate of infectious diseases. The methods for prompt detection of resistance mechanisms will contribute to the optimisation of antibiotic policies in medical institutions and the measures to control internal infections in hospitals, which will also make a long-term impact nationally. Sensitive bio-markers will be identified for the diagnostics and monitoring, and personalised algorithms for the treatment of acute and chronic infections and their possible complications.





Center of Competence "Personalized Innovative Medicine" (PERIMED)



Webpage:

<https://mu-plovdiv.bg/perimed/nachalo/>

Coordinator, contact address:

Medical University,
15A Vassil Aprilov Blvd.,
4002 Plovdiv

Bulgarian consortium:

Financial coordinator:

Science and Education for Smart Growth OP

Scientific coordinator:

Medical University, Plovdiv

Consortium member-organizations:

Partners:

- » Paisii Hilendarski, University of Plovdiv
- » Acad. Ivan Kostov Institute of Mineralogy and Crystallography, BAS

Description and activities of the infrastructure:

The Personalised Innovative Medicine project (PERIMED) has been developed in partnership between the Plovdiv Medical University, the Plovdiv University and the Institute of Mineralogy and Crystallography, at the BAS. The project aims at the building of a new structure for innovative research, focused on the integration of scientific research and the development of new and emerging technologies. Research and innovatory activities will be carried out in the area of personalised medicine, with an emphasis on oncology, onco-hematology, intensive care medicine, innovative drug carriers for targeted therapy, bio-engineering technologies and bio-sensors. The studies will be of applied character and will contribute for the competitiveness of interdisciplinary scientific products to the benefit of the economy and the people.

The project is a part of the long-term strategy of the partners for the development of inter-institutional and responsible cooperation in order to support science in Bulgaria and its becoming a factor in the development of the economy based on knowledge and innovations in line with the best world standards and practices. The project involves the founding of a Centre of Competence, renovation of existing and construction of new facilities, procurement of specialised lab equipment. Twelve large-scale research programmes will be carried out, involving leading national and international researchers of highest qualifications and experience in applied science in this country and in the EU, as well as young scientists, of up to 34 years of age.

The project involves RD in one of the priority areas of scientific research, nationally and in the EU – of the healthcare-related technologies. In this context, the activities planned will contribute to the building and sustainable development of an infrastructural scientific complex of national importance that will successfully integrate in the pan-European infrastructural networks in the field of personalised medicine. The results of the activities of the centre will prompt the making and application of innovatory, personalised approach to the development of therapeutic strategies for oncological and critically ill patients. As a result of the personalisation of therapies, the effi-



ciency and safety of therapeutic methodologies and pharmaceutical products will increase, despite their application to be larger number of patients.

The centre will achieve economic stability through research carried out per orders from businesses and collaboration between the main and the associated partners, by structuring units with market realisation and income of their own.

Implementing the activities planned will create the conditions to generate new experience in scientific research and innovations, aiming to provide technological solutions and research products in priority areas, as per the Innovation Strategy for Smart Specialisation. Experience will be gained in the commercialisation of the results from the RD activities and that would ensure efficient and applicable research work to the benefit of economic growth and enhanced quality of life in the country.

Impact/benefits:

The founding of the Personalised and Innovative Medicine Centre will directly impact Bulgarian medical practice and pharmaceutical industry and will provide individual therapy to a large number of patients in this country.

The interdisciplinary research programme encompasses the entire cycle of research and implementation of innovations in bio-technologies, medicine and pharmacy: diagnostics, identification of specialised bio-markers, application of personal treatment and innovative pharmaceutical technologies.

The expected overall result would be reduced medical costs and optimised pharmacological/economic effect.

Associated partners:

- » Neopharm, Bulgaria (Sofia)
- » Saint Georgi University Multi-Profile Hospital for Active Treatment, Plovdiv
- » Agencia estatal consejo superior de investigaciones científicas (CSIC) - Instituto de química y tecnología de alimentos (IATA)
- » CoEBio3 - University of Manchester, Manchester, UK



Center of Competence "Personalised Medicine, 3D and Telemedicine, Robot-Assisted and Minimally Invasive Surgery"



Webpage:

<http://competence.mu-pleven.bg/>

Coordinator, contact address:

Medical University - Pleven 5800 Pleven
1 Sv. Kliment Ohridski Str.

Bulgarian consortium:

Financial coordinator:
OPSESG

Scientific coordinator:

Medical University - Pleven



Description and activities of the infrastructure:

The purpose of the Center of Competence is to create an innovative, high-tech and modern Center of Competence in the field of personalized medicine, telemedicine and 3D medicine, robotic and minimally invasive surgery, to achieve excellence in research and training of specialists who will increase the competitiveness of existing institutions and stimulate entrepreneurship in the region and in the country. Over the next 10 years, the center will operate on the basis of high-tech proinnovative infrastructure, including equipment and specialized software. This will create opportunities for research and development, transfer of new knowledge and technologies, training of students, postgraduates, doctoral students and other Clinical specialists in the target areas: general surgery, gynecology, urology, ENT, orthopedics, pathology, medical genetics, etc. The Center of Competence is planned to include the following departments with the respective laboratories: Personalized medicine, 3D medicine, Minimally invasive surgery (MIS) and robotic surgery. The main activities for the implementation of the project are: construction of new and modernization of existing infra-



structure; conducting research, development and innovation activities; dissemination of research results, protection of intellectual property, transfer of knowledge and technology, and development of human resources; publicity and visualization and audit of the project.

Impact/benefits:

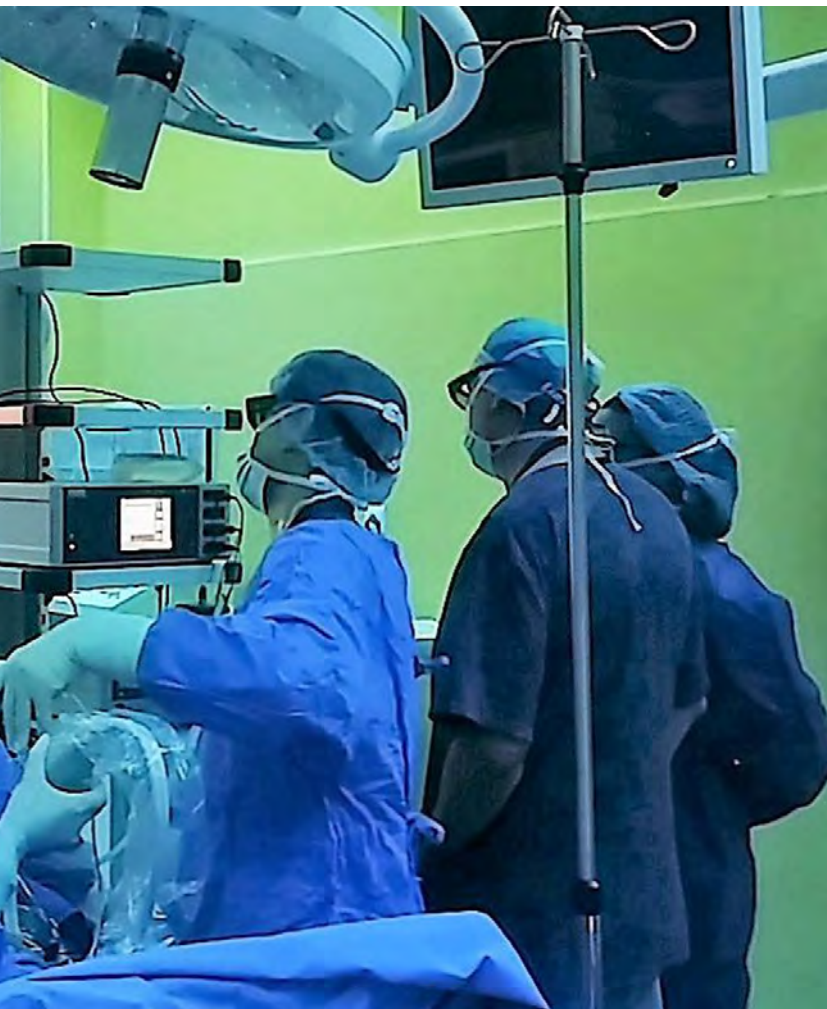
- Put in place diagnostic panels for breast cancer, ovary carcinoma, lung and colon cancer, the most frequent hereditary conditions among Bulgarian populations and genetic susceptibilities;
- Improved opportunity for prevention of hereditary conditions;
- Performance of minimally invasive operative interventions in otolaryngological, oncological and gynecological practice, and carry out additional surveys of applied and clinical importance;
- Using 3D printing, to produce individual orthotic devices, 3D models of organs and tissue transplants;
- Clinical and experimental scientific projects of applied nature, in support of robotic surgery in gynecology, general surgery and urology.

Consortium member-organizations:

- » Medical University - Varna
- » Institute of Systems Engineering and Robotics - BAS

Associated partners:

- » UMHAT Sveta Marina Varna city
- » UMHAT Dr. Georgi Stranski EAD, Pleven
- » Innovation Solutions Company "5th Degree"
- » Florida Hospital Cancer Institute, USA



74.4.

THEMATIC AREA

New Technologies in the Creative and Recreational Industries

Center of Excellence "Heritage BG"	132
Distributed Infrastructure from Centers for the Production and Research of New Materials and Their Applications, As Well As for the Preservation, Access and e-Storage of Artefacts (Archaeological and Folklore) – INFRAMAT	134
Laboratory complex in the science and technology park "Sofia Tech Park"	136





Center of Excellence "Heritage BG"

Webpage:

<http://www.nasledstvo.bg/>

Coordinator, contact address:

Sofia University St. Kliment Ochriski,
7A Gen. Gurko Str., Sofia 1000

Bulgarian consortium:

Financial coordinator:

Science and Education for Smart Growth OP

Scientific coordinator:

Sofia University

Consortium member-organizations:

- » University for Architecture, Construction and Geodesy
- » Technical University
- » Vassil Levski National Sports Academy
- » National Institute of Geophysics, Geodesy and Geography, BAS
- » Institute of Ethnology and Folklore with Ethnographic Museum, BAS
- » Institute for Art Studies, BAS
- » Institute of Literature, BAS
- » Institute of Balkan Studies with Centre of Tracology, Prof. Alexander Fol, BAS
- » Centre for Cyril and Methodius Studies, BAS
- » St. St. Cyril and Methodius National Library
- » Regional Museum of History, Sofia



Description and activities of the infrastructure:

Finding and promoting of new and deeper knowledge about the cultural and natural riches of Bulgaria using new technologies for selection, processing, description and ensuring free access to Bulgarian artifacts (in the form of text, audio, video, virtual reality products etc.). Develop methodologies and standards for the evaluation of cultural heritage objects.

Implement the new vision for transforming Bulgarian cultural heritage into a material resource for the creative and re-creative industries at European level, including through the development of marketing strategies for the creative industries and tourism.

The new infrastructure, based on the "triangle of knowledge": education-research-innovations, will provide access to new scientific equipment and scientific capacity, as well as the conditions for the acquisition of new competencies and skills.

Support computer infrastructure for shared remote access to researchers (working at their organisations, for national or international scientific initiatives) and specialised research equipment, data, scientific products and additional targeted services.

Alternative capabilities for public access to knowledge, information and services using cloud technologies, the specialised data centre "Nasledstvo BG" ("Наследство БГ"), integrative web portal, plus traditional, yet efficient technologies for public communication (educational TV, Internet).

National network of scientific and educational institutions for shared work and knowledge as an integral part of the pan-European scientific complex, providing similar services and carrying out scientific research at comparable levels and quality, specialised in serving a specific region.

International access infrastructure for researchers from other countries to available research data and initiatives of various institutions.

New material and intellectual assets to considerably improve and broaden the systems for scientific, research, development and innovative activities at European level.



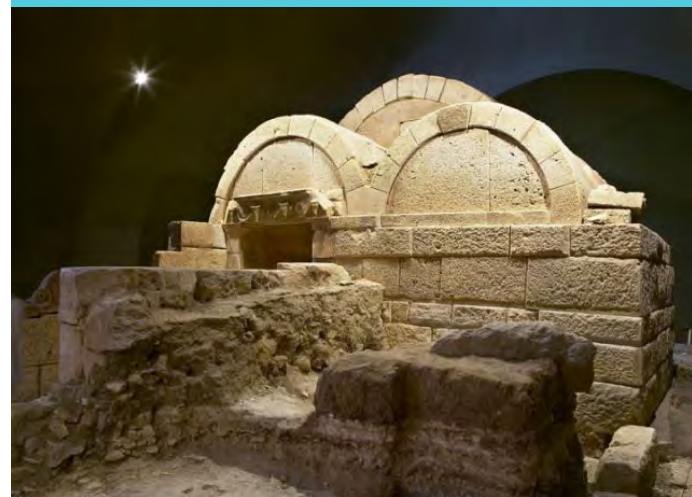
Impact/benefits:

Contributes to: research and technological development; lifetime learning; education environment and social inclusion.

Key effect: provide an attractive research environment; quality of research works; development of innovations; qualification of inventors and researchers; motivation for obtaining higher educational degree; quality school education etc.

Additional effect: regional development; international cooperation.

Works through: innovations based on cultural heritage products; VR-design and VR-demo centres; educational games; protection, conservation and restoration using new technologies; development of marketing strategies for the creative industries and tourism; new educational products; additional horizontal activities through cloud infrastructure for access to resources and services, including for the creative industries, tourism etc.



Distributed Infrastructure from Centers for the Production and Research of new Materials and their Applications, as well as for the Preservation, Access and e-Storage of Artefacts (Archaeological and Folklore) – INFRAMAT ¹

Webpage:

<https://inframmat.bg/en>

Coordinator, contact address:

Institute of Physical Chemistry, BAS
Acad. G. Bonchev Str., bl. 11, Sofia 1113

Bulgarian consortium:

Financial coordinator:

Ministry of Education and Science

Scientific coordinator:

Module 1

Institute of Physical Chemistry, BAS

Module 2

National Archaeological Institute and Museum, BAS

Consortium member-organizations:

Module 1

- » Institute of Physical Chemistry, BAS
- » Sofia University (Department of Chemistry and Pharmacy, Department of Physics)
- » Institute of Organic Chemistry with Centre of Phytochemistry, BAS
- » Institute of General and Organic Chemistry, BAS
- » Institute of Electro-Chemistry and Energy Systems, BAS



Description and activities of the infrastructure:

INFRAMAT is a unique interdisciplinary distributed research infrastructure that brings together laboratories, equipment and experts working in materials science. Its activity is focused on the complete physical and chemical description of new materials, developed to be applied in various technological areas (renewable energy, mechatronics and clean technologies, environment protection, healthy life) and in the conservation and restoration of archaeological and ethnographic artifacts (i.e., ancient and old materials).

INFRAMAT integrates research equipment and experts from 16 educational, research and museum institutions, and consists of a network, divided into two modules:

Module 1: Synthesis and study of new materials

The instrumental units of this module cover basic methods in contemporary materials science, include numerous new, state-of-the-art instruments, difficult to access in Bulgaria: electronic microscopes, X-ray diffractometers, equipment for NMR, EPR, XPS, XRF, Raman, Mössbauer and infrared spectroscopies, equipment for thermal and electrochemical analyses, coating application equipment etc. The INFRAMAT laboratories offer expert assistance to a large number of Bulgarian industrial firms in the quality control of their products and in support of their innovational and development activities.

Module 2: Analysis, restoration, conservation of archaeological and ethnographic artifacts

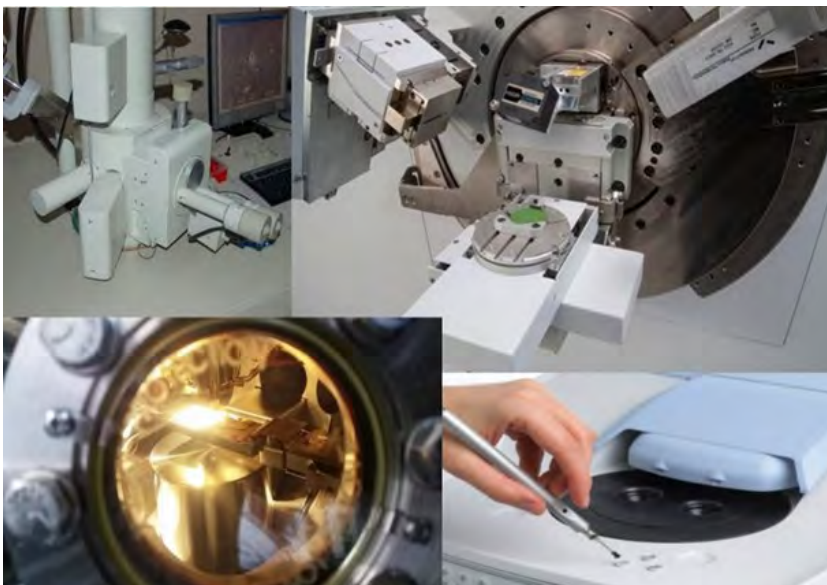
includes important scientific and educational institutions working in archaeometric studies, diagnostics and conservation of movable cultural heritage of archaeological and ethnographic value. The Module 2 laboratories carry out diagnostics, restoration and conservation of artifacts in order to prevent their destruction and protect them from environmental influences. The interaction between the two modules of INFRAMAT allows for the application of additional techniques in the studies of archaeological and ethnographic artifacts.

Activities:

- Building up and maintenance of research infrastructural environment, adequate to the needs of contemporary science.
- Joint scientific work of the partners in the synthesis and characterisation of new materials and the diagnostics/conservation of mobile cultural heritage.
- Services in the characterisation of materials for the needs of the private and the public sector in energy, machine-building, electronics, pharmacy and other industrial fields.
- Expert analyses for government entities and organisations in environment protection and identification of cultural valuables.
- Specialised training for students, experts and doctoral candidates in instrumental methods in materials science and the study of cultural valuables.

Impact/benefits:

- Better quality and competitiveness of the research in materials science and nano-technologies, green, purification and waste-free technologies, utilisation of raw materials and bio-resources.
- Providing broad access to a joint infrastructure of unique complexity and technical capabilities to all interested users from the research, public and private sectors in Bulgaria.
- Providing conditions for sustainable development of the research and innovation activities in the country in sectors that are structure-defining for the industrial development.
- Providing capacity for conservation, restoration, and studying of the available museum collections and cultural valuables. Link between conservation and restoration works and the investigation of the artifacts.
- Ensuring a critical mass of young researchers and professionals to ensure sustainable development of the conservation, restoration and research of national cultural heritage over the next at least two decades.



¹This infrastructure falls into more than one thematic area of the Smart Specialisation Strategy.

- » Institute of Optical Materials and Technologies, BAS
- » Institute of Polymers, BAS
- » Institute of Catalysis, BAS
- » University of Chemical Technologies and Metallurgy, Sofia
- » Central Laboratory of Applied Physics, BAS, Plovdiv

Module 2

- » National Institute of Archaeology and Museum, BAS
- » National Museum of History, Sofia
- » National Academy of Arts, Sofia
- » Sofia University (Centre of Archeometry, Department of Chemistry of Pharmacy)
- » Institute of Balkan Studies with Centre of Tracology, BAS
- » Institute of Ethology and Folklore with Ethnographic Museum, BAS.
- » Institute of Organic Chemistry with Centre of Phytochemistry, BAS
- » New Bulgarian University, Sofia

Type of infrastructure:

Distributed infrastructure of high resource concentration





In order to further the competitiveness of Bulgarian science and entrepreneurship, the first scientific and technological “park” was founded in the country in 2015 – Sofia Tech Park. Main goal of the Park has been to support the development of the research, innovation and technological capacity of Bulgaria. To achieve that, it entered partnerships with private and public organisations to help the development of innovative environment, develop and implement educational programmes, while at



the same time provide support services in the commercialisation of new technologies, products and services. The priority areas for development and activities of Sofia Tech Park are the information and communication technologies, life sciences, green energy, education, entrepreneurship, innovations, support for starting businesses. The park consists of several separate units, connected among each other, pursuing development of innovations, technologies, science and entrepreneurship.

Laboratory complex in the science and technology park "Sofia Tech Park"

Webpage:

<https://sofiatech.bg/laboratory-complex/?lang=bg>

Coordinator, contact address:

Research and Development and Innovation
Consortium
Sofia, Mladost Distr., 111 Tsarigradsko Shose blvd.,
Sofia Tech Park

Bulgarian consortium:

Financial coordinator:

Sofia Tech Park AD
Ministry of Education and Science (to support
scientific organization and educational institutions
that are members of the RDIC)

Consortium member-organizations:

- » Sofia University "St. Kliment Ohridski"
- » Technical University - Sofia
- » Joint Genomic Center Ltd.
- » Regional History Museum – Sofia

Area of impact:

Health and foods
Physics and engineering
Electronic infrastructure

Type of infrastructure:

Independently structured
Lab complex consisting of 11 laboratory units

Participation in European infrastructures:

Associated member of IASP (International Association of Science Parks)



Description and activities of the infrastructure:

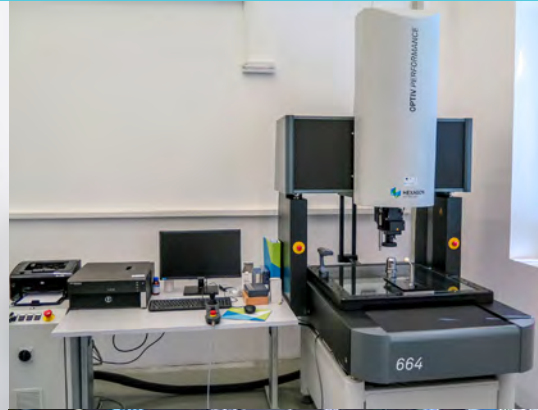
The mission of the Park is to become a prestigious location for global, regional and national researchers and innovative companies in Bulgaria and on the Balkans. To complete the system for supporting innovations and new technologies through the support of enterprises that will strengthen the knowledge economy in our country. To unite the efforts of business and science, focusing mainly on the development and implementation of projects in the three focal areas of the science and technology park - ICT, life sciences and clean energy.

The laboratory complex is one of the main elements of the science and technology park. It consists of 11 high-tech laboratories created with the support of leading experts from academic institutions. The laboratories within the complex carry out independent and joint research activities, the results of which will be widely disseminated. Research units also offer the opportunity of project development to private companies for goods or services in order to commercialize them.

- BioInfoTech Bioinformatics Laboratory;
- "3D Creativity and Rapid Prototyping of New Products" Laboratory;
- Artificial Intelligence and CAD Systems Lab;
- Micro Nano Lab - MINOLab;
- Cybersecurity Lab;
- Virtual and Augmented Reality Lab;
- High Performance Computing Lab;
- Intelligent Communication Infrastructures Lab;
- "In Vitro" Laboratory for Evaluation of Biological Activity and Toxicity;
- Development and Characterization of Pharmaceutical Forms and In Silico Design Laboratory;
- Laboratory for Extraction of Natural Products and Synthesis of Bioactive Compounds.

Impact/benefits:

The laboratories enable the academic community and the business to develop their own research projects, as well as goods and services with the help of the teams of the individual laboratory units, so that they can be successfully marketed. The complex provides an opportunity to increase and support the research capacity of the Republic of Bulgaria; to promote the innovation culture and competitiveness of knowledge-based enterprises and organizations, as well as to promote the creation of an effective working environment for research and innovation activities.



7.5. E-infrastructures. Digital, computational and computer research (E-research)

National Center for High Performance and Distributed Calculations	142
Big Data for Smart Society (GATE)	144
Centre of Excellence "Universities for Science, Informatics and Technologies in the e-Society" (UNITE)	146
Centre of Competence "Digitalization of the Economy in an Environment of Big Data" – CoC – DEBD	148
Centre of Excellence for informatics and information and communication technologies	149



Contemporary ICT are among the most important drivers of innovations and growth of economies. Their expansion into all spheres of life has brought about significant social innovations both in public and private sectors, but also in people's private lives. Over the last decade, Bulgaria was established as one of the preferred outsourcing destinations globally, including in respect to the ICT sector. One of the main reasons for that was that, in this country, the ICT sector established itself as a successful model not just for the production of software and hardware components at low costs, but also for its capacity for research and innovatory works meeting the highest standards of world ICT companies.



National Center for High Performance and Distributed Calculations



Webpage:
www.nchdc.acad.bg

Coordinator, contact address:
Institute of Information and Communication Technologies, BAS
Acad. G. Bonchev Str., Bl. 25A, Sofia 1113

Bulgarian consortium:
Financial coordinator:
Ministry of Education and Science

Scientific coordinator:
Institute of Information and Communication Technologies, BAS



Description and activities of the infrastructure:

The National Centre for High-performance and Distributed Computing (NCHDC) is an electronic infrastructure which provides stable and reliable HPC services to solve big problems in a sustainable way, in a long term, with maximum flexibility, cooperativeness and understanding and support for users across various disciplines. The NCHDC features a highly qualified team, capable of managing and operating various high-performance (HPC) resources - supercomputers and clusters with different hardware architectures, grid sites, virtual machines (VMs) for services and distributed computing, data storage resources with short and long term storage capabilities.

The main groups of activities of the NCHDC are:

- Ensuring transparent and open access for Bulgarian researchers to computing infrastructure and software with a central role for research and innovation.
- Providing sustainable and interoperable computing infrastructure services of the latest kind, promoting a flexible and open approach whereby user communities have the right to choose services that meet their requirements.
- Implementing innovative activities aimed at the continuous development of the computing infrastructure in order to meet the rapidly changing needs of user communities and the opportunity to take advantage of appropriate new technologies when they are mature enough.

Training courses are organised and consulting is offered for the optimal use of the unique capabilities of the system. Digital certificates recognized at European and worldwide level are being issued by BG.ACAD.CA thanks to the membership in EUGRID PMA. Access to the infrastructure is provided using multiple open protocols.

More than 250 scientists and 300 students have been using the resources and services provided by the NCHDC. Most numerous are the users of the Avitohol supercomputer - besides individual users, Avitohol has been used by various National Scientific Programmes (Information and Communication Technologies for Unified Digital Market in Science, Education and Security; Environment protection; BioActivMed; e-Health etc.), other Research Infrastructures from the National Roadmap for Research Infrastructure (ClaDA BG, National Geoinformation Centre etc.), numerous European projects, as well as Centres of Excellence and Centres of Competence being built up under the Science and Education for Smart Growth Operational Programme.

Impact/benefits:

The NCHDC integrates computing and data storage systems, software, middleware and services, and offers to Bulgarian researchers transparent and open access to these in order to develop and implement computationally intensive scientific applications, enabling them to achieve new scientific results with great impact.

The expertise of the NCHDC team and the great resource capacity allows tackling both complex scientific problems and practical problems of great social impact.

The use of state-of-the-art computing infrastructures has become a quality standard at national, regional and European level, and has been recognized as a European-level priority in a number of EC documents prompting Member States to maximize the impact of information technology developments in the field of advanced computing so as to overcome the digital divide. Combining the resources of the three largest resource centers (IICT-BAS, Sofia University and Technical University-Sofia) and the access and management model used provide significantly more adequate support and save resources due to the larger scale compared to the fragmented approach to local resource provisioning. Thus NCHDC creates an attractive working environment for young and experienced scientists, comparable to that available in competitive European research centers and superior to that in the countries of the region.

Especially important are the benefits of the infrastructure for staff training in operating the latest generation technologies, which ensures a great competitive advantage to the researchers using or developing information technologies.

Consortium member-organizations:

- » Sofia University
- » TU, Sofia
- » Institute of Mathematics and Informatics, BAS
- » Institute of Mechanics, BAS
- » National Institute of Geophysics, Geodesy and Geography, BAS
- » Medical University, Sofia
- » Plovdiv University
- » UniBIT

Area of impact:

Applied research and innovations

Type of infrastructure:

Horizontal

Participation in European infrastructures:

EOSC, EGI.eu, PRACE, NI4OS-Europe



Big Data for Smart Society (GATE)



Webpage:

<https://www.gate-ai.eu>

Coordinator, contact address:

St. Kliment Ohridski, Sofia University,
15 Tzar Osvoboditel Blvd., Sofia

Bulgarian consortium:

Financial coordinator:

Science and Education for Smart Growth OP

Scientific coordinator:

Sofia University

Associated partners:

- » Chalmers University of Technology, Sweden
- » Chalmers Industry Technique, Sweden

Area of impact:

Informatics, ICT



Description and activities of the infrastructure:

The goal of Big Data for Smart Society Centre of Excellence (CoE) is to carry out state-of-the-art research and achieve sustainable growth in scientific work in the area of big data and artificial intelligence, offering attractive research environment, modern infrastructure, supportive of open innovations and viable ecosystem to result in innovative solutions to the best interest of society. The research carried out at GATE focus on issues of great social significance: future cities, smart government, smart industry and digital healthcare. Within the framework of the projected activities, the construction and finalising of a new, efficient in terms of ecology, economy and power consumption building has been planned, to contribute to the establishing of a Science Park at the University of Sofia, and hosting state-of-the-art technological laboratories and equipment:

- Specialised equipment for big data (Big Data Appliance) includes both open code technologies plus integration in public cloud platforms, and industrial platforms and big data technologies from specialised suppliers, maintained locally and/or in cloud environment;
- Laboratory for interdisciplinary cooperation with the industry (Digital Twin Lab). A unique environment will be created within the laboratory, utilising state-of-the-art technologies for simulation and demonstration of the industrial applications of big data and AI. Data analysis and the creation of 3D simulation models will facilitate the overall optimisation of the production processes and will increase the efficiency and quality of the products designed;
- Laboratory in city environment (City Living Lab). To the big data and AI technologies, this lab will add up research works in the area of the Internet of Things. The use of numerous and varied sensors and watching devices will allow to collect data in real time, and this will in turn allow to analyse and visualise the processes and phenomena occurring in the city, which will facilitate data-based decision making;
- Laboratory for virtual reality and big data visualisation (Visualisation Lab). This laboratory will be structured as open space for collaboration, demonstrations and work with topological (2D), spatial (3D) and interactive (VR) data using specialised equipment for virtual and augmented reality. This lab will be used for the development and visual presentation of digital models, including the digital model of the city, based on data collected by the City Living Lab. It will allow to study the sensual perceptions when perceiving data. Thus, the labs of the complex will mutually complement each other;
- Training laboratory. This laboratory will provide modern environment for interactive and personalised training of future scientists and experts in the field. Young researchers will have the opportunity to learn and acquire practical experience for the application of big data and AI, by experimenting with the latest technologies.

- The GATE platform. Integrated with European structures, expandable technological environment, facilitating scientific research through the integrated space for big data and AI, offering a wide range of components and tools for control, analysis and visualisation of data. The platform is founded on open standards and this makes it widely accessible and operatively compatible, the objective being to provide symbiosis between the established state-of-the-art hardware and software technologies, independently of their supplier. The open applied programme interfaces and open data, provided as a service, will facilitate the conception and development of the GATE ecosystem. This will speed up the process of application of the big data and AI technologies in scientific research, and will facilitate the development of innovative solutions and their commercialisation.

Impact/benefits:

The GATE Centre of Excellence will contribute to the construction of a sustainable ecosystem university/government/industry/society and will establish itself as a national, regional and European hub for important scientific achievement, education and innovations in the area of big data and AI. Accumulating significant research capacity will allow excelling scientific work as well as the development, the application and commercialisation of innovations of impact to both the general public and the business circles. As a single Centre of Excellence in the area of Big Data and AI in Eastern Europe, the GATE institute will be playing a strategic role for the spreading of the best practices and innovative models in the countries included in the Widening Countries list, included in the Horizon 2020.





Centre of Excellence “Universities for Science, Informatics and Technologies in the e-Society” (UNITE)

Webpage:

<https://unite-bg.eu/>

Coordinator, contact address:

St. Kliment Ohridski, Sofia University, Department of Mathematics and Informatics, 5 James Bouchier Blvd., Sofia

Bulgarian consortium:

Financial coordinator:

Science and Education for Smart Growth OP

Scientific coordinator:

Sofia university, Department of Mathematics and Informatics

Consortium member-organizations:

- » Konstantin Preslavsky University of Shumen
- » Angel Kantchev University of Russe
- » Prof. Assen Zlatarov University of Burgas
- » Technical University, Sofia

Area of impact:

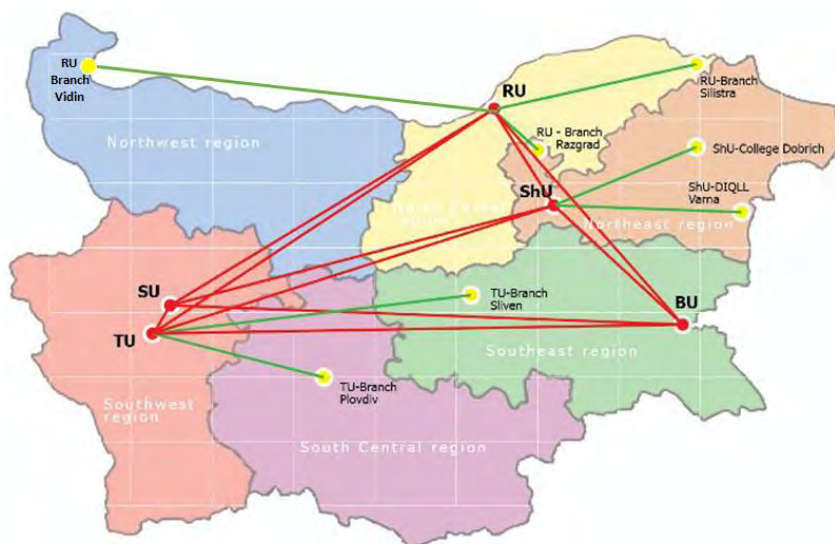
Electronic infrastructure
Informatics and ICT

Description and activities of the infrastructure:

Setting up an internationally recognised research complex, meeting the standards for state-of-the-art infrastructure and quality research in the RIS3 priority area Informatics and information and communication technologies. The UNITE centre of excellence is of the distributed research infrastructure type to further the opportunities of researchers from different geographic areas in Bulgaria (Burgas, Russe, Sofia, Shumen) to cooperate with each other and with partners from all over Europe and the world. Thus, the communications and information streams among the participating organisations will be enhanced, using computer information systems as an approach to the introduction of a new work organisation, which will predominate during the 2020 – 2030 decade.

Main goals of the project:

- Increased intensity of quality scientific research;
- Increased intensity of market-oriented scientific research;
- Improved territorial and topical distribution of research infrastructures.



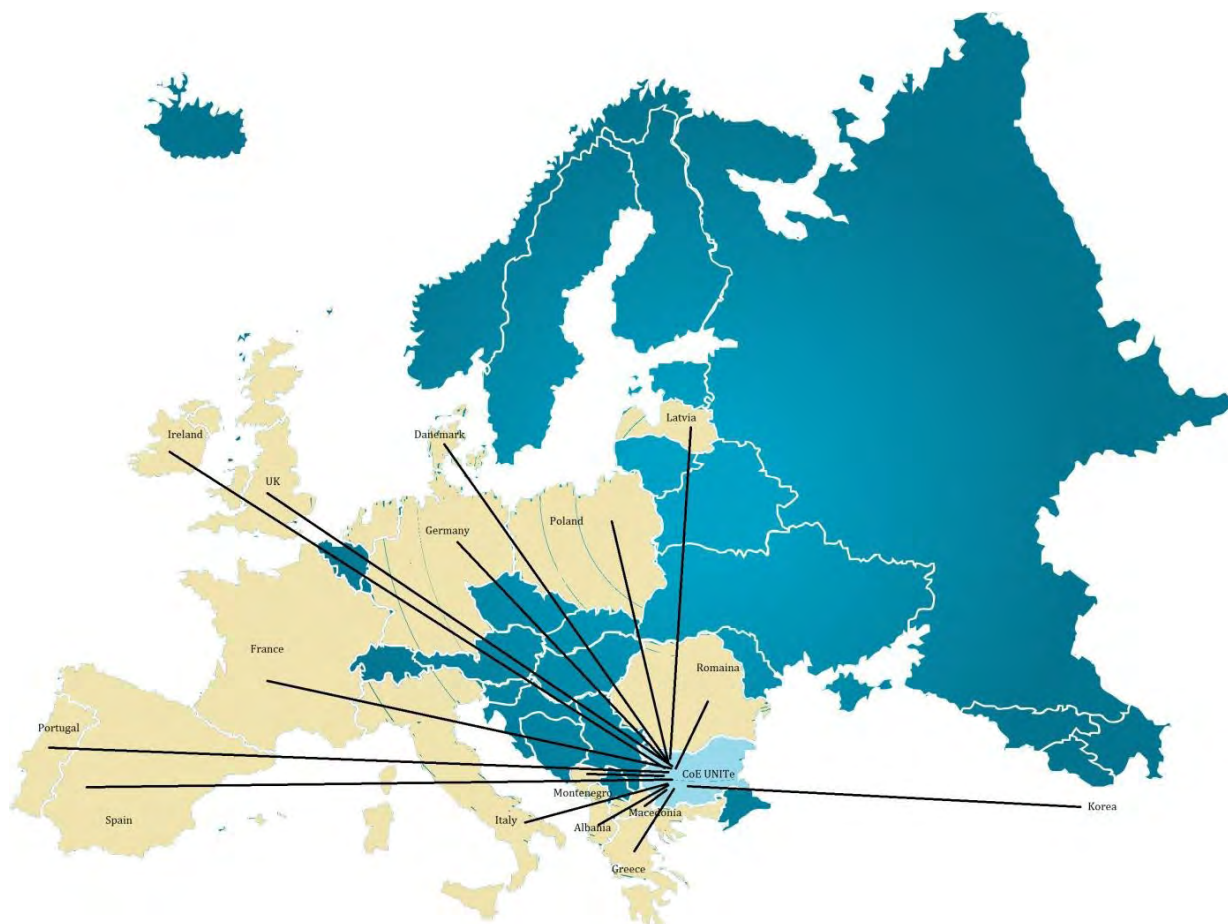
Impact/benefits:

UNITE will be contributing to all topical lines in the ICT area: manufacturing, especially Fables, and new design and/or assembly approaches; 3D digitisation, visualisation and prototyping; big data, grid and cloud technologies; wireless sensor networks and wireless communication/control.

The big data research in natural sciences have both short- and long-term impact on computational chemistry and nano-materials, nano-sciences, quantum informatics and quantum technologies; modeling of the earth/atmosphere system by high-output computer platform; bio-informatics; bio-medical processes.

UNITE will impact the ICT approaches in machine-building and the creative industries.

New approaches of modeling and simulation of systems in real time. Optimisation algorithms.



Centre of Competence “Digitalization of the Economy in an Environment of Big Data” – CoC – DEBD

Webpage:

<http://bigdataacc.bg/>

Coordinator, contact address:

University of National and World Economy (UNWE)
8 December Str., Sofia, Studentski Grad 1700

Bulgarian consortium:

Financial coordinator:

Science and Education for Smart Growth OP

Scientific coordinator:

UNWE

Consortium member-organizations:

- » University of Economics, Varna
- » Institute of ICT, BAS
- » University of Plovdiv
- » Angel Kantchev University of Russe
- » Technical University, Gabrovo

Area of impact:

Electronic infrastructure
Informatics and ICT

DEBDE

Description and activities of the infrastructure:

The Centre is a complex ICT infrastructure of integrated research organisational structures and special focus on the application of scientific results in different business areas. The research complex will utilise state-of-the-art scientific and technological achievements in the digitisation of the economy in big data environment with the application of international and industrial standards and best business practices. Research services will be offered in the following areas: accounting and asset management; financial management; human resources; marketing; sales and order management; transportation and logistics with supply chains management; production management; economics of construction and real estate management; management and organisation of the IoT, warehouse management etc.

DEBDE would be unique both in Bulgaria and across Europe. The research work offered to scientific community would be categorised in 52 services in the following groups:

- Research services (services generating digitisation strategies; processes digitisation services; services to assist ICT services selection; and research services related to the use of the Centre of Competence resources by other research organisations).
- Applied-science services (design of hardware systems for managing big data processing; design of methods, models and algorithms for big data processing; integration of big data into digitised business processes; design of computer components for big data processing).

The research infrastructure of DEBDE Centre of Competence will provide opportunities for the research and application of 3 types of corporate computer digitisation approaches:

- Development approach: based on the existing computer systems in a company/organisation, upgrading and adding new functions in the digitisation of economic activity would be offered;
- Differentiation approaches: design of new ICT components and systems for digitisation, including also non-structured data processing;
- Innovative approaches: design of new ICT digitisation solutions, based entirely on big data.

Impact/benefits:

The applied research will address analysis of adaptability: processes of adaptation of contemporary enterprises to the changes in business and market environment by the application of new technologies; customer and staff satisfaction: main goal of any digital transformation; pro-active innovations: one of the best ways to maintain competitiveness, demanding that the introduction of new technologies be performed more efficiently and promptly than ever. The Centre of Competence will offer new products: scientific, training and applied services, unique for Bulgarian scientific community and Bulgarian economic entities. New technologies will also be developed in the ICT sector addressing the digitisation of business processes and big data technologies. The use of such new products and technologies will result in the implementation of innovations and considerable upgrading of competitive advantages of the respective companies.



Description and activities of the infrastructure:

The Centre will integrate state-of-the-art research infrastructure and teams of qualified scientists and experts to carry out fundamental and applied science research in Informatics and ICT within the Smart Specialisation Strategy of Bulgaria.

The research programme includes the following scientific projects (SP) of high social and scientific impact:

- **SP1.** Innovative computing and Big Data: algorithms, tools, services;
- **SP2.** Network algorithms and software tools for large-scale simulations of high-tech materials and processes;
- **SP3.** Efficient methods and algorithms for Monte Carlo simulations and analysis of stochastic optimisations;
- **SP4.** Linguistic technologies and content based technologies for application over big data;
- **SP5.** Variation and statistical methods in information sciences and technologies;
- **SP6.** ICT approaches to the modeling and simulation of dynamic processes in industry and web-based applications, new products and services;
- **SP7.** Mathematical models and numerical methods for processes in mechatronics and bio-medical applications;
- **SP8.** Innovative computing for analysis of climate changes impacts;
- **SP9.** Mathematical modeling in drug design and bio-informatics;
- **SP10.** Web and wireless technologies of the future, searching in data-bases and modeling of applications;
- **SP11.** Conceptual modeling and simulation of smart ecosystems.

Impact/benefits:

The direct impact of the research complex of the Informatics and ICT Centre of Excellence would be determined by the high-significance scientific and applied scientific value of the research and applied projects included in the programme. The CE will put in place the conditions to stimulate the building up of research capacity in line with the top European and World Standards and incentives for interdisciplinary research and approaches.

The CE will put in place an infrastructure meeting the standards of the European technological platforms as well as of the EC conception of electronic infrastructures being the main building block of the European research space. The open access policies to the CE infrastructure will be in line with the open science principles.

Much broader and all-encompassing would be the impact of the building up of state-of-the-art electronic infrastructure to the development of science, education and innovations in Bulgaria. The synergism of quality scientific approaches and innovative computer technologies will directly facilitate the increasing of the capacity for transfer of the research results and the generation of innovations.

Centre of Excellence for informatics and information and communication technologies

Webpage:

<http://ict.acad.bg/>

Coordinator, contact address:

Institute of ICT, BAS
Acad. G. Bonchev Str., Bl. 25A, Sofia 1113

Bulgarian consortium:

Financial coordinator:

Science and Education for Smart Growth OP

Scientific coordinator:

Institute of ICT, BAS

Consortium member-organizations:

- » Institute of Mathematics and Informatics, BAS
- » Institute of Mechanics, BAS
- » National Institute of Geophysics, Geodesy and geography, BAS
- » University of Plovdiv
- » Medical University, Sofia
- » University of Librarian Studies and Information Technologies

Area of impact:

Electronic infrastructure
Informatics and ICT

**NATIONAL ROADMAP
FOR RESEARCH INFRASTRUCTURE
(2020-2027)**

