SERBIA RESEARCH, INNOVATION AND TECHNOLOGY TRANSFER PROJECT

Ministry of Education, Science and Technological Development

WORLD BANK GROUP

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Research Infrastructure Roadmap

Republic of Serbia

Ministry of Education, Science and Technological Development

GOVERNMENT OF THE REPUBLIC OF SERBIA

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Introductory Statement

Research Infrastructures – the building blocks of the knowledge economy

The adoption of the Research Infrastructure Roadmap comes at an exciting time for research and innovation in Serbia. Based on the principles of the "Research for Innovation" Strategy adopted in 2016, we are at a turning point. The ongoing reforms of research financing in Serbia will enhance scientific excellence and ensure its relevance for Serbia's economic development. The new model of financing moves away from completely project-based financing of R&D activities to a mix of performance-based core funding for research institutions with highly competitive calls for projects that support the best research teams.

In light of these reforms, the Research Infrastructure Roadmap represents our dedication to ensuring transparent, merit-based support to the long-term investments needed to develop top-notch research infrastructure which will not only have national, but also regional and EU relevance. Research Infrastructures represent the basic tools for conducting excellent research. Taking into account that in today's world, these infrastructures are becoming increasingly complex, and therefore increasingly expensive, we need to do more to ensure that our investments in research infrastructure are as effective and efficient as possible.

The Research Infrastructure Roadmap is a dynamic document, which will set the principles for future development of Research Infrastructures in Serbia and will showcase the existing capacities in the country. Significant investments in this field have led to development of excellent facilities in many research institutions in Serbia over the past ten years. This document will propose how to better leverage these investments to ensure their national and international relevance, as well as to ensure their availability to the entire research and business community in the country.

The Roadmap also launches an open and transparent communication with the research community that will help us regularly update the Roadmap with new projects and help us prepare to invest budgetary, international, IPA, and one-day EU structural funds, in the most effective and optimal manner.

Representative of Ministry of Education, Science and Technological Development

1. Introduction

The Republic of Serbia has, since 2007, been an associated country to EU framework programmes for research and innovation. As part of the European Research Area, Serbia is dedicated to advancing research and innovation and policies in support of their development to ensure our position as relevant partners and to enable our researchers to perform excellent and relevant research. A key element of these policies is improved planning for the development of Research Infrastructures. This document represents the first step towards a coordinated, transparent and merit-based approach to investing in Research Infrastructures. It is also highly relevant for our alignment with EU process in this area as noted by the EU Progress Report for Serbia[1].

1.1. What are Research Infrastructures?

A clear definition of RIs is needed for the Roadmap and it is very important that all stakeholders are clearly informed about the definition used. In Serbia there has been no single consistent definition of RIs in the past ten years. The Law on Research Activities, which recognizes the importance of investing in research infrastructure as a program of national importance, does not clearly define what an RI is and there are no by-laws which make this clarification. In addition, there have been several different usages of the term in different calls, investment opportunities and policy discussions adding to the confusion. The term "research infrastructure" has, in the past, been used to describe everything from science and technology parks, research centers to educational facilities and all the way down to individual pieces of very small equipment.

A 2015 survey of 318 researchers in Serbia[2] showcased how far the common understanding of the term "research infrastructure" in Serbia is compared to the widely accepted EU definition. Less than half of the respondents (47%) respondents yes to their lab having adequate equipment for their research. An overwhelming 92% of respondents believe that larger research infrastructure facilities can increase output of Serbian scientists. However, when asked which three research infrastructures could significantly increase their research performance, a large majority of the researchers listed individual pieces of equipment, from HPLCs and NMRs to the level of individual computers, printers, pipettes. Only a few researchers listed larger scale facilities such as clean rooms as their priorities. This further confirms the need to clearly define research infrastructure and communicate this definition to the research community.

The EU uses the following definition of Research Infrastructures as defined by Article 2 (6) of the Regulation (EU) No 1291/2013 of 11 December 2013 - "Establishing Horizon 2020 – the Framework Programme for Research and Innovation 2014-2020":

DEFINITION

Research Infrastructures are facilities, resources and services that are used by the research communities to conduct research and foster innovation in their fields. They include: major scientific equipment (or sets of instruments), knowledge-based resources such as collections, archives and scientific data, e-infrastructures, such as data and computing systems and communication networks an any other tools that are essential to achieve excellence in research and innovation.

[1] https://ec.europa.eu/neighbourhood-enlargement/sites/near/files/pdf/key_documents/2016/20161109_report_serbia.pdf

[2] Conducted by the World Bank in preparation of the national Research for Innovation Strategy.

RIs may be **'single-sited'** (a single resource at a single location), **'distributed'** (a network of distributed resources), or **'virtual'** (the service is provided electronically). RIs offer **unique research services** to users from different countries, attract young people to science, and help to shape scientific communities.

For the purpose of the Research Infrastructure Roadmap of the Republic of Serbia the abovementioned EU definition will be followed. The Roadmap will distinguish between the development of national RIs and the participation of Serbian researchers in international RIs. **A national research infrastructure is an RI that has at least national relevance, with a strong potential for regional or international relevance.**

1.2. Importance of Research Infrastructures

Research infrastructures are a key tool in modern science and technological development. A 2011 study[3] examined the role and added value of "large-scale research facilities" (by current ESFRI definition these are equivalent to Research Infrastructures). The study, which included a survey of 32 RI's, identified scientific, societal and economic benefits of large-scale research facilities.

From the scientific perspective, the key benefits were linked to the fact that pioneering research could not be performed without large-scale facilities, such facilities provide for more efficient scientific explorations, they help further integrate research and are a focal point for multidisciplinary research.

RIs were also found to have strong effects on networking and human capital development in the sense that they catalyze learning processes and knowledge-sharing, help create formal and informal social networks, they are a strong factor in determining researcher mobility and support capacity building.

The report also identified added value for the economy: through procurement of goods and services (as a customer for innovative products and services) and temporary employment, through generating long-term employment and contributing to innovation (more so in spin-offs and startups than in large industry).

Finally, the social added value of RIs can be particularly strong for those RIs that serve research fields that are geared towards solving societal challenges. However, all RIs can benefit society through social innovation, scientific communication and education.

1.3. The Importance of RI Roadmaps

Research Infrastructure Roadmaps represent the key policy instrument and planning tool for developing RIs and have become the standard in EU member states and at the EU level as well. For the OECD, the roadmap reflects a wish to advance the policy-making process, beyond past practices in which proposals for large RIs were considered separately based on lobbying by strongly motivated individuals or communities of scientists[4]. Roadmaps usually reflect consensus intentions of the policy makers and scientific community and are rarely treated as a list of projects to actually receive funding.

Roadmaps aim to prepare and support strategic research policy decisions at national level and to secure funding and financial transparency for planned projects. Another importance aspect of roadmaps is to increase general acceptance for the selected projects due to **a transparent and merit based evaluation**

[3] http://www.technopolis-group.com/wp-content/uploads/2011/02/1379_Report_Large-scale_Research_Facilities_EN1.pdf

[4] http://www.oecd.org/sti/sci-tech/47057832.pdf

process. Experiences of OECD member countries shows that even Roadmaps that offer no prospects of additional funding, still solicit high interest in the scientific community[5].

Most EU member states quote **improving effectiveness of investments, strategic long-term planning, and linkages with EU and ESFRI projects** amongst their objectives for developing an RI Roadmap. The process of developing a roadmap can be very beneficial as it can motivate the scientific community to mobilise themselves, develop high quality proposals and think strategically about their projects (as well as take into account the financial implications of their ideas).

1.4. The Serbian RI Roadmap Approach

The process for developing the first Serbian Research Infrastructure Roadmap was launched by the Ministry of Education, Science and Technological Development following the adoption of the "Research for Innovation" Strategy in 2016 when the strategic basis for policy developments in this area were set for the upcoming period. The process was supported through the technical assistance of the World Bank and funded by the European Union IPA funds (under the "Serbian Research, Innovation and Technology Transfer Project").

The approach included the following steps:

Steps	The Serbian RI Roadmap Approach
1.	Background analysis – current situation for RI development in Serbia (including interviews with analysts, researchers and policy makers)
2.	Best practice review – review of all EU member state RI Roadmaps (including interviews with European RI experts and policy makers)
3.	Establishment of advisory working group for RI Roadmap
4.	Drafting of RI Roadmap
5.	Consultation process
6.	Adoption by Ministry of Education, Science and Technological Development

[5] https://www.oecd.org/sti/sci-tech/41929340.pdf

2. The Current Policy Context

The development of Research Infrastructures has to be done in the broader context of R&D sector development as a whole. A lot depends on the existing policy setting for research and innovation in the country. For this reason, the ongoing reforms of the R&D sector in Serbia were carefully considered during the development of this Roadmap. Additionally, the EU policy framework for RI development was considered as many countries leveraged EU IPA and structural funds for the development of their RIs and benefited from participation in the EU Strategic Forum for Research Infrastructures (ESFRI) as explained below.

2.1. The National "Research for Innovation" Strategy, 2016-2020

The national Strategy on Scientific and Technological Development of the Republic of Serbia for the period 2016-2020 – "Research for Innovation" (hereinafter: the Strategy) was adopted in 2016 and represents the key policy document for R&D and innovation reforms in Serbia. The vision of the Strategy is that within five years science in Serbia will be based on a competitive system that supports excellence in science and its relevance to economic development, competitiveness of the Serbian economy and development of society as a whole. The mission of the Strategy is the establishment of an effective national research system integrated into the European Research Area which leans on the partnerships in the country and abroad and which contributes to economic growth, social and cultural progress, raising the standard of living and quality of life.

The Strategy recognizes that the development of scientific research infrastructure is a precondition for good quality research and technological and innovative development. It emphasizes the need to plan investments in RIs in a clear and transparent mechanism to ensure the implementation of strategic objectives and prevent further fragmentation of research infrastructure. The Strategy proposes to gear future investments into centers of excellence which can be an integral part of the European network of centres of excellence.

The need to establish a register of research equipment is highlighted as well as to define conditions of use, operational support and maintenance of equipment. Finally, the Strategy states that research equipment will be made available to SMEs and other users, such as start-ups, which are involved in innovative activities.

Ensuring access to international research infrastructures is also highlighted, especially in the context of European consortia of research infrastructures (ERICs). The Strategy recognizes the Research Infrastructure Roadmap as a key planning document that will be in line with the ESFRI roadmap and that should define the principles of developing RIs in Serbia.

Besides highlighting the relevance of RIs, the Strategy also puts forth a series of highly relevant reforms in the R&D sector which are relevant to be taken into consideration for future development of RIs. Serbia is currently in the process of defining and establishing a new model of financing of research activities in the country which will represent a mix of performance based institutional financing for RDIs and highly competitive project based financing. Development of RIs must closely align to this new model of financing to ensure sustainability.

The Action Plan for the implementation of the Strategy lists a number of activities related to the development of research infrastructures. Besides activities related to the adoption of the Roadmap

itself, the Action Plan also includes the development of an online database of existing research infrastructures and available equipment and implementation of activities defined under this Roadmap.

2.2. The Smart Specialization Strategy

The Republic of Serbia is currently in the process of developing the its first ever Smart Specialization Strategy (S3). This process is being led by the Ministry of Education, Science and Technological Development and the Ministry of Economy, with the support of the Public Policy Secretariat and the technical assistance of the EU Joint Research Center (JRC). The completion of this process is expected in 2019.

S3 envisages focusing of development investments in areas where the state has a critical mass of knowledge, capacity and competencies, and in which it has innovation potential for positioning in global markets. The key smart specialization document is the Research and Innovation Strategy for Smart Specialization (RIS3). A key element in successful designing and implementing a strategy is the entrepreneurial discovery process (EDP), which in turn represents a continuous public-private dialogue between the four spheres of a modern, innovative society (the so-called quadruple helix) - academia, government, private sector and civil society.

The annual progress report on Serbia's accession to the EU, published in May 2018, underlines the significance of RIS3. Namely, one of the conditions for closing Chapter 20 "Entrepreneurship and industrial policy" is the development of a comprehensive industrial policy based on EU principles and RIS3 findings. The consequence of such an association of industrial policy and RIS3 is the expansion of a range of key political, intermediary and financial stakeholders who are interested in participating in the planning and implementation of the smart specialization process. Therefore, RIS3 is gaining importance, which requires additional efforts to align the interests of a larger number of stakeholders.

The result of this process should and will be reflected in futures calls for proposals for Research Infrastructures so that investments are focused in those areas that have been identified as having the critical mass and greatest scientific, economic and societal relevance.

2.2. The legal framework for Research Infrastructures

Until 2018, the one key law governing scientific and research activities in Serbia has been the Law on scientific and research activities. As abovementioned, ongoing reforms in the existing legal framework have the primary goal of establishing a new model of financing science and research activities in Serbia which includes a mix of performance-based institutional financing and competitive project-based funding. To this end, the new Law on the Science Fund has been adopted in November 2018. This Law envisages the establishment of the first Science Fund in Serbia as an independent and expert funding agency which will implement competitive calls for proposals for scientific and research activities in Serbia. To reflect these changes, the Law on scientific and research activities is being amended at the moment of the adoption of this Roadmap.

Both laws define the program of financing the development of research infrastructures as a priority national program, the details of which are to be further developed through relevant by-laws.

2.3. EU support for Research Infrastructures

The European Strategy Forum on Research Infrastructures (ESFRI) is a strategic instrument aiming to develop the scientific integration of Europe and to strengthen its international outreach. It was set up by

the EU Council of Research Ministers in 2002 and it brings together representatives of Ministers of the 28 Member States, 12 Associated States, and of the European Commission. The comprehensive and open access to high quality Research Infrastructures, supports and benchmarks the quality of the activities of European scientists, and attracts the best researchers from around the world. The mission of ESFRI is **to support a coherent and strategy-led approach to policy-making on research infrastructures in Europe**, and to facilitate multilateral initiatives leading to the better use and development of research infrastructures, at EU and international level. ESFRI does not itself fund Research Infrastructure or indicate priorities on specific funding sources.

ESFRI has developed its own Roadmap in 2006 and it has updated in 2008, 2010, 2016 and 2018. The next update of the Roadmap is planned for 2020. The ESFRI roadmap identifies new pan-European Research Infrastructures or major up-grades to existing ones, corresponding to the future needs of European research communities, in all fields of Sciences and Technologies, regardless of possible location. The 2018 Roadmap consists of 18 ESFRI Projects with a high degree of maturity - including 6 new Projects - and 37 ESFRI Landmarks - RIs that reached the implementation phase by the end of 2017.

3. Research Infrastructure Development in Serbia so far

Research Infrastructures, as well as general conditions for performing R&D and innovative activities, in Serbia need to be further improved. Following the nineties and almost two decades of no investments into R&D institutions (RDIs) several initiatives to improve conditions for R&D have been launched starting in 2006. These initiatives have had different sources of funding, different selection criteria and have been implemented with varying degrees of success. We will discuss in more detail the key initiatives in this time period, including lessons learned from their implementation.

3.1. National Investment Plan

The National Investment Plan (NIP) was launched in 2006 with the idea of redirecting revenues from privatizations into the most relevant infrastructure projects in the country. The projects were meant to improve education, healthcare and support economic development. Each ministry sent their priorities to a centralized unit (later Ministry for NIP) and was approved an annual budget for infrastructure projects. The Ministry of science received funding in 2006, 2007 and 2008 and used it to purchase scientific equipment. Researchers were invited to propose equipment to be procured and a working group established by the Ministry approved these requests based on the budget available. A total of 28 million EUR was invested into scientific equipment in these three years. The average value of equipment purchased was 68,000 EUR with individual pieces ranging from 680,000 EUR to 300 EUR. A majority of the investments were into basic research in natural sciences: 22% into physics, 22% into ICT and engineering, 21% into biology and 18% into chemistry.

3.2. The Serbian Research Infrastructure Investment Initiative

The largest investment initiative in recent years is the Serbian Research Infrastructure Investment Initiative, which was launched in 2010. It was based on the Strategy for Scientific and Technological Development 2010-2015, and was meant to provide infrastructural support for the cycle of financing of scientific research 2010-2014. The initiative was supported through three international financial agreements: a 200 million EUR loan from the European Investment Bank and two loans from the Council of Europe Development Bank (35 million and 70 million EUR). Together with government co-investment, the total investment value was planned at 400 million EUR.

The initiative included projects such as the Petnica Science Center, centres of excellence in priority research fields, science and technology parks in the four largest university centers in Serbia, the natural history center in Svilajnac, housing for researchers and scientific equipment for existing RDIs.

For the purchase of scientific equipment, 50 million EUR was allocated from the EIB loan. The equipment was distributed to research institutions and researchers applied to receive this new equipment within their proposals for research projects. About 35 million EUR was implemented out of the allocated funds and a range of equipment (varying in cost from hundreds of euros to over a million euros) was procured and delivered to RDIs.

Research equipment was requested through research project proposals, so the successful project leaders were invited to a separate peer interview process, to justify their equipment financing request. A peer review committee, tasked to execute the equipment selection process, was appointed by the Ministry, and was assembled of 19 researchers from different fields. The objective of this group was to ensure that there is no duplication of approved requests. The group established a set of criteria, interviewed the project leaders and established a final list of equipment, to be procured.

3.3. EU - Framework Programs and IPA

HETIP is a joint initiative of the MoESTD and the EC, funded through IPA I and launched in 2010. With a total budget of 23 million EUR, the project aimed to build a modern education system in Serbia which will contribute more efficiently to the economic recovery and will be in line with EU policies as exposed in the Lisbon Strategy. Projects supported through HETIP range from 1.4 million EUR to 100,000 EUR in size with an average value of 300,000 EUR[6]. As the focus of HETIP is on improving teaching conditions, very few of these projects enhance the R&D capacities of High Education institutions in Serbia. They mostly deal with reconstructing damaged buildings, improving library or IT resources and teaching labs.

Serbia has been participating in EU Framework Programs as an associate country since June 2007. The Seventh Framework Program (FP7) included funding for building research capacity in associated countries and these calls were highly beneficial for Serbian researchers, especially in terms of purchasing scientific equipment. A total of 22 projects were approved within these FP7 RegPot calls with a total financing of 25 million EUR (average project size 1.1 million EUR).

Serbian researchers were also able to benefit from FP7 INFRASTRUCTURES, a specific funding line within FP7 for RIs. Through these projects, Serbia's participation in a few ESFRI priority RIs was supported, as well as several other projects. Serbian researchers participated in 17 such projects while receiving 3.6 million EUR of funding (average amount of funding for Serbian project participant was 224,000 EUR). Three of these projects were support towards Serbia as a permanent member of the pan-European High Performance Computing service (PRACE), which is part of the ESFRI Roadmap (745,000 EUR invested in the Institute of Physics in Belgrade as the Serbian representative in PRACE). The Serbian Medical Society received 52,715 EUR as Serbia's representative in ECRIN, a distributed ESFRI-roadmap pan-European infrastructure designed to support multinational clinical research. The Mathematical Institute of the Serbian Academy of Sciences and Arts received 321,000 EUR for their role in the Collaborative EuropeaN Digital/Archival Infrastructure (CENDARI).

Support for RIs continues within Horizon 2020 but there are no longer opportunities for capacity building in associated countries and targeted calls for the Western Balkan region. These means that the only funding opportunities require Serbian institutions to compete on equal footing with EU member states. Still, even within such tough competition, several projects to support RI have already been approved for Serbian RDIs within Horizon 2020. So far 16 projects have been awarded to institutions in the country with a total financing of 2.2 million EUR. For example, the Republic Hydrometeorological Service of Serbia has received 92,000 EUR for their participation in the ECOMS2 project which coordinates and integrates European climate modelling, climate observations and climate service infrastructure initiatives.

[6] Source: MoESTD

4. Roadmap Objectives and Principles

This document represents the first ever Research Infrastructure Roadmap adopted in Serbia. Just like in other countries, it is important that the RI Roadmap is a flexible document that is regularly updated and follows closely ongoing reforms in the country as well as EU and international trends in this area. Taking into account the experiences of EU member states in adopting their first RI Roadmaps, these three objectives of the document have been defined:

OBJECTIVES OF THE SERBIAN RESEARCH INFRASTRUCTURE ROADMAP

Objective 1. To define policies in support of efficient and effective usage of Research Infrastructures and research equipment

This objective will be accomplished through defining a set of policy measures that will address the future usage of existing RIs and research equipment in Serbia. As noted above, significant investments have been made in research equipment in the past ten years in Serbia but more can be done to facilitate the effective usage of these investments.

Objective 2. To define the principles for future development of Research Infrastructures in Serbia

To achieve this objective, the RI Roadmap will define the principles on which decisions for future investments in RIs will be made. Previous investment cycles have all relied on varied mechanisms to choose which research equipment will be purchased and the RI Roadmap will aim to improve future planning by ensuring a transparent and merit-based approach.

Objective 3. To showcase existing RIs in Serbia, as well as participation of Serbian researchers in international RIs

The RI Roadmap includes examples of national Research Infrastructures in Serbia based on a set of criteria (discussed in Chapter 5). The Roadmap also showcases the status of Serbia's involvement in different international research infrastructures.

The following five horizontal principles are to be built into the objectives and into the policy recommendations set forth by this RI Roadmap and implemented for future planning of Research Infrastructure development in Serbia:

1. **Transparency:** this principle ensures that future investment decisions are made in a transparent manner. Decision making processes will be clear and communicated with the research community in advance to ensure that the procedures are fair and decision are not made based on lobbying.
2. **Merit-based:** this principle will be built into future decision-making processes and implies that whenever possible, mechanisms will be built into these processes to ensure that investment decisions are made based on merit. Merit is to be defined through pre-defined evaluation criteria, and the evaluation process itself should whenever possible heavily rely on international peer-review.
3. **Excellence and relevance:** this principle refers to the fact that research infrastructure development should be aligned with the national strategy and that investments need to be

geared towards improving scientific excellence while at the same time ensuring its relevance for the private sector and for society.

4. **Collaboration:** research infrastructures need to develop beyond national relevance, securing regional and international relevance and therefore fostering international research collaboration. At the same time, at the national level, research infrastructures represent a great potential in fostering business-academia collaborations.
5. **Long-term commitment:** successful development of RIs depends on a long-term commitment of all actors involved and the timeframe for RI development and usage can span over several decades. Better planning is needed to ensure that all elements of RI development are taken into account – from construction and procurement, to maintenance and operational issues.

5. Policy Implications for the Future

The Research Infrastructure Roadmap aims to define measures that will improve future planning for Research Infrastructure Development and that will secure efficient and effective usage of investments.

Inefficient use of existing investments in research infrastructures and research equipment has been quoted in many discussions are a key issue in Serbia. Therefore, before undertaking new investments into RIs, some of the barriers and challenges related to equipment sharing need to be addressed first.

Challenges for sharing scientific equipment

The problem of sharing scientific equipment is not unique to Serbia. Besides cultural issues or a simple unwillingness of researchers to share their equipment, there are real challenges and limitations that are found across the global scientific community. Examples of such challenges that have been identified across the global scientific community are[7]:

1. **Operating costs:** Running scientific equipment is expensive and even though, in theory, sharing could potentially alleviate some of the costs it is not always clear how to make this happen in practice. Teams will usually allow other teams to use their equipment either in exchange for a fee or as part of a scientific collaboration (practically, in exchange for publications). In either case, the original team needs to recover the costs related to sharing. It is not easy to determine the right pricing for such services and sometimes, researchers do not have mechanisms (within their research grants) to pay other institutions for using their equipment. The eligibility of such costs should be clearly established in grant instruments.
2. **Geographic distance:** There are real challenges related to using equipment that is not physically located in your lab. Some samples may be difficult (or impossible) to transfer. Using distant equipment requires planning and time and there are instances in which you quickly need to perform a test to continue your research.
3. **Technical constraints:** The same equipment may be calibrated for very different uses, or different types of materials. Samples need to be prepared a certain way and in case something different should be performed, full re-calibration may be necessary. A technical support team would be needed to conduct this, a booking system and a mechanism for recovering costs as a result of the changes.
4. **Lack of information:** Sometimes, researchers are unaware of the existence of relevant equipment elsewhere. For them to find out where it exists, how they can use it and whether it can perform the analysis they need, would take time. In such instances, a database and online scheduling system could alleviate some of these issues.
5. **Human resources:** Perhaps one of the greatest limiting factors in sharing equipment is the lack of human resources. Usually, only one or few PhD or Masters students or technicians are trained to operate a piece of complex scientific equipment. Which is why, to use the equipment, an external researcher would need to engage the staff of the host institutions. This could be difficult either for financial reasons or even in the case in which highly sensitive IP could be shared to a competing group.

[7] A good overview of challenges (which was used and modified for the purpose of this review) can be found at: https://www.iop.org/policy/consultations/research/file_51047.pdf

6. **Damage and contamination:** There is always a risk in damaging equipment while using it or contamination. This is even more likely if equipment is being transported. Labs need to have the technical knowledge and financial means to deal with such situations.

5.1. Incentivizing Efficient and Effective Use of RIs

Some of these challenges can be addressed through different policies. There is a recent trend, especially in the EU and the USA, to support and incentivize equipment sharing. Countries have implemented different instruments to this regard but with the same objective: to optimize public investments into scientific equipment. In some cases, researchers themselves have organized to share information and facilitate sharing as to improve their access to quality research infrastructure and equipment. To this end, the RI Roadmap proposes in the following paragraphs describe policies to be implemented at national level.

5.1.1. Legal definition of Research Infrastructures

In Serbia, there is still no single common definition of Research Infrastructures. As mentioned in the introduction, this term has been differently used through various initiatives. This RI Roadmap presents the first clear definition of RIs within a national strategic planning document. However, further confusion can be avoided by introducing a definition of RIs within the Law on Research Activities. Such a clear legal definition would allow for clarity in future planning and investments.

5.1.2. Database of Research Infrastructures and Research equipment

Often researchers do not have the right information to be able to easily access equipment hosted by a different institution. To overcome this, online portals have been created in many countries which contain information on which equipment is available, what type of service it can provide, who is the relevant contact person and similar. Sometimes, this portal also acts as an online booking system in which users can chose timeslots for accessing the equipment.

In Serbia, an attempt to create such an online database and portal for booking equipment access was initiated and launched by the Project Implementation Unit (PIU) but due to inactivity it was not kept up to date and its booking services were never utilized.

Serbia is committed to creating a functional database of RIs and research equipment. Besides improving information on Ri availability, this database can also inform the policy making process by tracking data on equipment sharing, percent of usage and other relevant data.

5.1.3. Principles for Equipment Sharing Built into Legislative Framework and Monitored

In theory, the principles of sharing equipment have been built into contracts which researchers have signed when obtaining new equipment through various sources. However, these clauses have never been monitored and researchers still face some challenges with regards to the terms and conditions and costs related to sharing equipment. These same principles will be built into the highest level of legislation to ensure their implementation and compliance will be better monitored. The MoESTD will develop standardized solutions to assist researchers in the many administrative aspects of equipment sharing (such as charging and pricing or liability and insurance). These standardized guidelines will present answers to the many questions that still face Serbian researchers today.

5.1.4. Incentives for Sharing Incorporated into the Research Financing Model

As mentioned under the existing policy context in Serbia, a new model of financing research in Serbia is in the process of being defined and then translated into amendments to the Law on Research Activities and relevant by-laws. This new model will, primarily through competitive calls for research grants, aim to incentivize the usage and sharing of existing RIs and research equipment in the country. Some countries (such as the UK) have even gone so far as to dedicated special financial resources for the purpose of sharing equipment (for using another laboratories equipment or for making your own equipment readily available to the wider community). Such options will also be considered and barriers to sharing – such as the inability to pay a different RDI for their services – will be addressed under this new framework.

5.2. Developing Future RIs for Excellence and Relevance

Besides applying the already defined horizontal principles to planning of future RIs in Serbia, the following policy measures will bring policy making in this area to the next level:

5.2.1. Standing Committee for Research Infrastructures

A permanent body will be established by the MoESTD that will provide analytical support to the decision-making process with regards to developing future RIs in Serbia. This Standing Committee for RIs (the national equivalent of ESFRI) will bring together researchers, government and private sector representatives. This body, will among other things, monitor the implementation of the RI Roadmap and will support the MoESTD in future revisions of this document, as well as preparation of calls for developing new RIs and other decisions with regards to RI development. The detailed roles and responsibilities of this body will be further developed by the MoESTD and this body will be defined within the Serbian R&D legislative framework.

5.2.2. Active Participation in ESFRI

Serbia will be committed to actively participating in the work of ESFRI through permanent representatives (who will also be members of the abovementioned Standing Committee). Participation in ESFRI is relevant for Serbia in many aspects – to ensure access to EU RIs for Serbian researchers, to participate and influence EU level decision-making with regards to RIs, to raise the profile and ensure the relevance of national RIs and to inform future planning of EU IPA and structural funds. The Serbian representative in ESFRI will be committed to dissemination information on the work of ESFRI to the MoESTD, the Standing Committee and the wider scientific community.

5.2.3. Calls for Proposals for RIs (national and international)

In almost all EU economies, the selection of priority RIs was conducted through a bottom-up process. This process, usually in the form of a Call for proposals or Call for expression of interest, allows the research community to nominate potential RIs and ensures that the final list of priority RIs is based on a transparent and merit-based selection process. Researchers are usually invited to nominate either national RIs or participation in ESFRI RIs, both types of proposals being evaluated against pre-determined evaluation criteria in a peer-review based process. Eligibility criteria, timeline, evaluation criteria and procedure should all be clearly communicated to the research community to ensure the success of such Calls.

Similarly, Serbia will be committed to conducting such a clear and transparent Call for proposals two years following the adoption of this first RI Roadmap and the results of this Call will serve as input for

the revision of the RI Roadmap. Draft application forms for such a Call have been included as Annexes C and D of this document to serve as a basis for discussion with the research community in the upcoming period as to provide enough time to develop this Call for proposals based on both the upcoming reforms of financing research activities and based on lessons learned from previous investment cycles, in close cooperation with the research community.

5.2.4. A Coordinated and Transparent Approach towards EU Teaming

As an associated country to the EU Framework Programme for Research and Innovation, Serbian researchers can apply to all Horizon 2020 instruments that support development of Research Infrastructures, and as noted in Chapter 3 they have already done so with a high degree of success.

However, some programs, notably the EU Teaming programme which supports institution building (new or updated centres of excellences) in Widening countries through a coupling process with a leading EU scientific institution, requires that project proposals are supported by the Government. So far, there has been no official mechanism for obtaining such support. The importance of this support lies in the fact that significant levels of co-financing are expected and the governments shows its commitment to securing these funds. As the number of applicants from Serbia increases it is clear that the Government will not be able to commit to co-financing all potential applicants. Therefore, a more transparent process of supporting EU Teaming applicants will be needed in the future.

For this purpose, the MoESTD will develop clear guidelines for all potential applicants which will explain the decision-making process behind providing government support to applicants. The MoESTD will include the Standing Committee in developing these guidelines and into the decision-making process itself, ensuring at the same time the application of all horizontal principles as defined by this RI Roadmap. All researchers will have to submit an application to the MoESTD which will then be reviewed by the Standing Committee. Based on the recommendation of the Standing Committee the MoESTD will further consult with relevant ministries (Ministry of Finance, Ministry of Economy and relevant line ministries as needed per project basis) to make the final decisions. All decisions (both positive and negative) will be made public.

6. Research Infrastructures in Serbia Today

One of the objectives of this RI Roadmap is to present existing national RIs in Serbia, as well as, Serbia's participation in international RIs. To do so, the following criteria were used:

1. Centres of excellence (as defined by the Law on Research Activities and registered by the MoESTD);
2. RDIs and research centers which have obtained EU funding for infrastructure within FP7 or Horizon 2020;
3. Serbian existing participation in ESFRI RIs or ERICs;
4. RIs which have already been approved for developed as per Government decision.

The following table summarizes all RIs presented in this Roadmap. Descriptions of all showcased research infrastructures can be found in Annex A.

No.	Name of Research Infrastructure	Institution	Center of excellence	Has obtained EU funding for RIs	ESFRI/ ERIC	Approved for dev. by Gov. decision
1.	Center for molecular food sciences	Faculty of Chemistry, University of Belgrade	yes	yes		
2.	Center of research excellence in nutrition and metabolism (CENM)	Institute for Medical Research	yes			
3.	Center of excellence for food and vector borne zoonoses (CEFVZ)	Institute for Medical Research	yes			
4.	Center for mathematical research of nonlinear phenomena (CMRNP)	Department of Mathematics and Informatics, Faculty of Natural Sciences, University of Novi Sad	yes			
5.	Nanotechnology and functional materials center (NFMC)	Faculty of Technology and Metallurgy, University of Belgrade)	yes	yes		
6.	Center for solid state physics and new materials (CSSPNM)	Institute of Physics, University of Belgrade	yes			
7.	Center for microelectronic technologies (CMT)	Institute of Chemistry, Technology and Metallurgy, University of Belgrade	yes			
8.	Photonics Center	Institute of Physics, University of Belgrade	yes			
9.	Center for Complex systems (Scientific Computing Laboratory – SCL)	Institute of Physics, University of Belgrade	yes	yes	yes	
10.	Center for non-equilibrium processes (CNEP)	Institute of Physics, University of Belgrade	yes	yes		
11.	Center for vibro-acoustic systems and signal processing (CEVAS)	Faculty of Technical Science, University of Novi Sad	yes			

12.	Center for synthesis, processing and characterization of materials for use in extreme conditions (CEXTREME LAB)	Institute of Nuclear Sciences Vinca, University of Belgrade	yes			
13.	Laboratory for Bioarcheology	Department of Archaeology, Faculty of Philosophy, University of Belgrade	yes			
14.	CESSDA-SaW	Institute of Economic Sciences		yes		
15.	DARIAH ERIC Sustainability Refined (DESIR)	Center for Digital Humanities		yes	yes	
16.	European Long-Term Ecosystem and socio-ecological Research Infrastructure (eLTER)	University of Novi Sad		yes		
17.	EUDAT2020	University of Novi Sad		yes		
18.	GÉANT Research and Education Networking	University of Belgrade		yes		
19.	Open Access Infrastructure for Research in Europe 2020 (OpenAIRE2020)	University of Belgrade		yes		
20.	VI-SEEM	Institute of Physics, University of Belgrade		yes		
21.	agINFRA	Institute of Physics, University of Belgrade		yes		
22.	Collaborative EuropeaN Digital/Archival Infrastructure (CENDARI)	Mathematical Institute, Serbian Academy of Sciences and Arts		yes		
23.	Distributed Research Infrastructure for Hydro-Meteorology (DRIHM)	Republic Hydrometeorological Service of Serbia		yes		
24.	European Clinical Research Infrastructures Network (ECRIN)	Serbian Medical Society		yes	yes	
25.	Distributed Infrastructure for EXPErimentation in Ecosystem Research (EXPEER)	University of Novi Sad		yes		
26.	Virtual Atomic and Molecular Data Center (VAMDC)	Astronomical Observatory of Belgrade		yes		
27.	Advanced Research in Agricultural and Food Sciences (AREA)	Faculty of Agriculture, University of Belgrade		yes		
28.	SERBORDISinn	Institute for Molecular Genetics and Genetic Engineering (IMGGE)		yes		
29.	CERN	National Committee for Collaboration with CERN			yes	
30.	CERIC-ERIC	Vinca Institute for Nuclear		yes	yes	

		Sciences, University of Belgrade				
31.	PRACE	Institute of Physics, University of Belgrade		yes	yes	
32.	DARIAH-ERIC	Center for Digital Humanities			yes	
33.	European Social Survey (ESS)	Faculty of Philosophy, University of Belgrade			yes	
34.	Center for Molecular Medicine and Stem Cell Research	Faculty of Medical Sciences, University of Kragujevac				Yes
35.	Biosense Institute	University of Novi Sad		yes		yes
36.	Verrocchio	Institute of Physics, University of Belgrade				yes
37.	Astronomical Station Vidojevica	Astronomical Observatory of Belgrade		yes		yes

7. RI Roadmap Action Plan

The following Action Plan summarizes key steps that need to be taken to implement the actions defined in the RI Roadmap and reach the objectives of the Roadmap.

OBJECTIVE	ACTIVITY	TIMELINE	RESPONSIBLE INSTITUTION	PARTNER INSTITUTIONS	LEGISLATIVE/POLICY/ REGULATORY CHANGES	ESTIMATED RESOURCES (RSD million)
1. Promote efficient and effective usage of RIs in Serbia	1.1. Introduce legal definition of Research Infrastructures	2018	MoESTD	/	Amendments to the Law on Research Activities adopted	/
	1.2. Develop database of RIs and research equipment	2019	MoESTD	/	/	To be determined after scope of work is defined
	1.3. Develop standardized guidelines for equipment sharing	2019	MoESTD	RI Standing Committee, research community	Guidelines adopted by MoESTD	/
	1.4. Introduce incentives for equipment sharing in new financing model	2019	MoESTD	National Council, RI Standing Committee	Amendments to the Law on Research Activities and related by-laws	/
2. Adopt policies for future development of RIs	2.1. Establish Standing Committee on Research Infrastructures	2018	MoESTD	/	Adopt MoESTD decision on establishment of RI Standing Committee	/
	2.2. Ensure active participation in ESFRI – nominate delegates and set up system for information sharing	2018	MoESTD	RI Standing Committee	/	/
	2.3. Adopt guidelines for EU teaming applications	2020	MoESTD	RI Standing Committee	Guidelines adopted by MoESTD	/

	2.4. Adopt rules and procedures for conducting public calls for proposals for domestic and international RIs (and application forms)[8]	2019	MoETSD	RI Standing Committee	Rules and procedures adopted by MoESTD	/
3. Update RI Roadmap	3.1. Implement Call for proposals for domestic and international RIs	2020	MoESTD	RI Standing Committee	/	/
	3.2. Update RI Roadmap based on results of Call for proposals	2021	MoESTD	RI Standing Committee	Updated RI Roadmap adopted by MoESTD	/
	3.3. Continuous implementation of updated RI Roadmap	2021-2024	MoESTD	RI Standing Committee, Public Investment Management Unit and others	/	To be determined following the adoption of the updated RI Roadmap

[8] Draft rules and procedures and application forms for both domestic and international RIs can be found in Annexes A through C

ANNEX A: Description of all RIs showcased in the RI Roadmap

1. Centers of Excellence

1.1. CENTER FOR MOLECULAR FOOD SCIENCES

Faculty of Chemistry, University of Belgrade (accredited Center of excellence and FP7 Regpot supported)

About

Center for Molecular Food Sciences (CMFS), Faculty of Chemistry, University of Belgrade, was established through activities of FP7-REGPOT during 2010-2013. At the moment, CMFS is the only functional center for proteomics in Serbia, and as such has great significance for research development and education of future researchers. CMFS is developing the latest methods of protein analytics on a large scale, with the appropriate use of biostatistics methods and bioinformatics, and applies them to biochemistry, biotechnology, biology, medicine, agriculture, and food science with collaboration with a large number of institutions in the country. A total of 28 researchers and associates are engaged at the Center, 9 of whom are full-time professors and scientific advisors of the Faculty of Chemistry.

Infrastructure and Services

High Pressure Liquid Chromatography System Agilent Infinity 1260 The recently obtained Agilent 1260 Infinity offers the greatest flexibility for solvent selection and automation in HPLC method development, research and all HPLC applications requiring continuous access to a wide range of solvent choices. The Agilent 1260 Infinity have availability to rapidly switch between methods using different solvents and the capability of using binary, ternary or quaternary solvent gradients.

Bioreactor BIOSTAT Bplus 2L DW 230V BIOSTAT Bplus 2L DW 230V Bioreactor is autoclavable laboratory fermentor/bioreactor system suitable for a wide range of research, education and industrial applications, applicable for: Microbial culture - growth of bacteria, yeast and fungi; Cell culture - growth of animal, insect and plant cells; Transition from shaker or tissue culture flask; Small scale protein expression.

CD Spectrophotometer JASCO J-815 The recently obtained CD spectropolarimeter offers circular dichroism (CD analysis of proteins and nucleic acids) and thermal denaturation spectra acquisition and analysis. Jasco J-815 spectropolarimeter (picture) is equipped with Peltier temperature control for thermal unfolding studies and is the world's most sensitive chiro-optical spectrometer.

Hybrid Mass Spectrometer LTQ Orbitrap XL with Acella UHPLC and easyLC II nanoLC Systems The recently obtained mass spectrometer is a state of the art machine, capable of performing almost any mass spectrometry related task. The hybrid setup, comprised of a linear ion trap and an Orbitrap

analyzer gives unprecedented amount of information per run. Dual front end enables a very wide scope of analysis, ranging from intact proteins to complex biological samples to small molecule structural and stereoscopical analysis.

Rotor-Gene Q Rotor-Gene Q (Qiagen, Germany) is a real-time nucleic acid amplification and detection system, which measures nucleic acid signals from amplified DNA using fluorescent detection. It has optimal thermal and optical performance, due to rotary format and robust technology, requiring minimal maintenance.

Spectrofluorimeter FluoroMax-4 Spectrofluorimeter FluoroMax-4 HORIBA Jobin Yvon offers analytical speed and the ultimate sensitivity in fluorescence investigations. Fluorescence spectroscopy has assumed a major role in analysis, as for applicable compounds fluorescence gives high sensitivity and high specificity.

Collaborations

CFMS takes part in numerous national and international (bilateral) projects. To name a few:

COST Programs: Improving Allergy Risk Assessment Strategy for new food proteins (ImpARAS) (COST Action FA 1402); Native Mass Spectrometry and Related Methods for Structural Biology (COST Action BM 1403); Between Atom and Cell: Integrating Molecular Biophysics Approaches for Biology and Healthcare, CA15126.

Collaboration with EU companies: Cooperation with DBV Technologies (France) and Hal-Allergy (the Netherlands) in the field of proteomics of food allergens and design of new products for treatment of allergic diseases.

Bilateral and other international projects: OCUVAC project of the bilateral Chemistry Faculty (Laboratory for Proteomics) and the Medical University of Vienna (Laura Bassi Center of Expertise); Bilateral project between Serbia and Croatia for the period 2016-2017: *Bilateral strengthening of institutions aimed at achieving leading roles in the field of authenticity of bee products*; Bilateral project between Serbia and Croatia for the period 2016-2018: *Application of proteomics and glycoproteemics in the characterization of protease food allergens and identification of their substrates on epithelial cells: correlation between protease activities and allergies*; Bilateral project between Serbia and Slovenia for the period 2016-2017: *Improving research capacities for reliable authentication of bee products*; DAAD project: *Development of high-efficiency screening systems based on flow cytometry and microfluidics for conductive evolution of glucose oxidase, celobiozodehydrogenase and hemicellulase* (451-03-01038 / 2015-09 / 21). etc.

National projects: Simultaneous bioremediation and soil degradation, for conservation of natural resources of biological active substances and the development and production of biomaterials and dietary products (III 43004); Structure-Function Relations Tests in cell wall of plants and change of the wall structure by enzymatic engineering (OI 173017); Development of new encapsulating and enzyme technologies for the production of biocatalysts and biological active ingredients of food in order to increase its competitiveness, quality and quality security (III 46010); Allergens, antibodies, enzymes and small physiologically significant molecules: design, structure, function and significance (OI 172049); Molecular properties and modifications of some respiratory allergens and food allergens (OI 172024); Correlation of the structure and properties of natural and synthetic molecules and their complexes with

metals (OI 172017); Production, isolation and characterization of enzymes and small molecules and their application in dissolved and immobilized form in biotechnology of foods to biofuels and protection environment (OI 172048); Application of improved oxidation processes and nanostructured oxide materials for removing pollutants from the environment, development and optimization of the instrumental efficiency monitoring techniques (OI 1720300; Immunomodulatory effects of xenobiotics and biotic environmental factors on population of mouse-like rodents (OI 173039).

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1.2. CENTER OF RESEARCH EXCELLENCE IN NUTRITION AND METABOLISM (CENM)

Institute for Medical Research (IMR), University of Belgrade (accredited Center of excellence)

About

Centre of Research Excellence in Nutrition and Metabolism (CENM) is part of the Institute for Medical Research (IMR), involved in fundamental and applied nutritional research in Serbia and Western Balkan region. The Centre is comprised of food scientists, nutritional researchers, medical doctors, molecular biologists, pharmacists, biochemists, and bioinformatics, all of whom are active in basic and applied nutritional research, most advanced country's studies on nutrition, food and human health. CENM is dedicated to understanding why there are individual as well as epidemiological differences in nutrient requirements and metabolism. Using recent advancements in nutritional science and molecular biology, CENM is using the synergistic approach between basic bio-medical sciences and clinical research, and between clinical research and population health research, with the common goal of better understanding the nutrient role and action underlying obesity and diabetes.

Infrastructure and Services

Laboratory for lipid analysis and determination of lipid status

Laboratory for web applications, software packages, Serbian food composition database: NutPlan – Software for individual and group nutritional planning (FCD base with up to 46 nutrients and wide applications); Nutri-RecQuest (a web-based tool developed by EURRECA to share the data collated and critically reviewed by the network).

Laboratory of experimental research models: Objective**:** to examine the effects of treatment with different food supplements and active substances in order to get information on biochemical plasma parameters, phospholipids fatty acids profiles in tissues and plasma and oxidative stress parameters.

Department for public health nutrition: The Department aims at improving health in Serbia through excellence in public health nutrition (PHN) research, and becoming a regional center for PHN research and training in the Balkans. It is done by working on research projects in partnership with leading European academic institutions and by establishing and conducting PHN capacity development activities in Central and Eastern Europe (CEE).

Laboratory for mathematical modeling and statistical analysis: Objective: to support evidence-based nutritional research by applying statistical methodology, and to become a regional center for nutritional epidemiology.

Nutritional advisory unit: Adequate nutrition is a key factor in maintaining and improving health. In order to prevent diseases, improve health and educate about proper and balanced nutrition, Counseling office for diet and nutrition is established as part of CENM.

Laboratory for molecular and cell biology and immunochemistry (LMCBI) is a new and young laboratory aiming at developing and scientifically exploiting cellular and tissue in vitro models.

Laboratory for dietary intervention studies with experimental kitchen: Design and conduction of dietary intervention studies aiming to elucidate the effects of nutrients and non-nutritive dietary compounds in the prevention of chronic diseases, with special focus on prevention of cardiovascular diseases (CVD).

Collaborations

The Institute for Medical Research (IMR), Belgrade, is an active partner in the European Food Information Resource Network (EuroFIR), EuroFIR-Nexus www.eurofir.net (2011) and EFSA project "Updated food composition database for nutrient intake" (2012). The IMR developed and used web based Food Comp Data Management (FCDM) software, harmonized with EuroFIR standards, to create FCDB.

CENM takes part in numerous national and international projects:

FOLOMEGA – "Biological effects, nutritional intake and status of folate and polyunsaturated fatty acids: The improvement of nutrition in Serbia", 2011-2017 (national)

European Food Safety Authority (EFSA) Projects:

Support to National Dietary Surveys in Compliance with the EU Menu methodology (sixth support) "The adults' survey", including subjects from 10 to 74 years old (Ref: OC/EFSA/DATA/2016/03)

Support to National Dietary Surveys in Compliance with the EU Menu methodology (sixth support) "The children's survey", including subjects from 3 months up to 9 years old (Ref: OC/EFSA/DATA/2016/02)

Contracting authority: European Food Safety Authority (EFSA), Parma, Italy, 2017 – 2022

FP6 and FP7 EU Research Projects:

BACCHUSS FP7 Beneficial effects of dietary bioactive peptides and polyphenols on CVD health in humans, 2012-2016

ODIN FP7 Food-based solutions for optimal vitamin D nutrition and health through the life cycle, 2013-2017

CHANCE FP7 – Low cost technologies and traditional ingredients for the production of affordable, nutritionally correct foods improving health in population groups at risk of poverty, – 2011-2014

EuroFIR NEXUS FP7 The EuroFIR Food Platform: Further integration, refinement and exploitation for its long-term self-sustainability, 2011-2013

EURRECA FP6 EURopean micronutrient RECommendations Aligned – 2007-2011

BaseFood FP7 Sustainable exploitation of bioactive components from the Black Sea Area traditional foods – 2009-2011
EFSA Updated food composition database for nutrient intake, 2012; "Dietary monitoring tools for risk assessment" 2012-2013

COST actions:
POSITIVe COST Action – Interindividual variation in response to consumption of plant food bioactives and determinants involved POSITIVe COST Action (FA1403), 2014 – 2018

Bilateral Projects:
Folate status in populations at risk: young adult women of reproductive age and elderly (2011-2013) - with Croatia
Identification of cellular and molecular targets of plant bioactives on human blood cells: clinical and in-vitro studies (2011-2013) - with France

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1.3. CENTER OF EXCELLENCE FOR FOOD- AND VECTOR-BORNE ZOONOSES (CEFVZ)

Institute for Medical Research (IMR), University of Belgrade (accredited Center of excellence)

About

Center of excellence for food- and vector-borne zoonoses (CEFVZ) at the Institute of Medical Research (IMR) of the University of Belgrade (BU) was established on the grounds of the former Department, later Group for Parasitology of IMR, and today's Microbiology with Parasitology Group, as a statutory organizational unit of IMR. CEFVZ is the leading research institute in the field of parasitology, especially parasitic zoonoses, in which the knowledge and efforts of doctors, veterinarians and biologists are united. Particular importance is given to the field of Toxoplasma gondii protozoan infection, whose quality resulted in the appointment of the IMR Toxoplasmosis Laboratory for the National Reference Laboratory for Toxoplasmosis (NRL Toxo) by the Ministry of Health of Serbia. CEFVZ also engages the only group of researchers who work in the field of medical entomology in Serbia. This very neglected area is today, due to climate change and the consequent spread of areas of certain insects / vector of infectious diseases, very actualized at the global level.

Infrastructure and Services

CEFVZ comprises three statutory laboratories:

Laboratory for Medical Parasitology. Research is directed to the most current problems of national pathology, as well as to those at the center of attention of researchers at the global level.

Laboratory for Medical Entomology: The current research of the laboratory is primarily focused on the study of ticks such as ectoparasites, reservoirs and vectors of tick-borne pathogens (Babesia spp., Borrelia spp., Rickettsia spp., Anaplasma spp., Ehrlichia spp., Coxiella burnetii, Francisella spp., Bartonella spp, Crimean-Congo haemorrhagic fever virus, tick-borne encephalitis virus).

Laboratory for Molecular Diagnostics: The youngest laboratory of the CEFVZ, formed with the funds of the FP6 project 043702 SERBARZOON in 2007 to support research at the molecular level. Various techniques based on PCR are used in the Laboratory, and in accordance with GLP standards, it consists of three independent units: nucleic acid extraction units, 'clean room' (non-input DNA) and instrument rooms, where segregation units reduce the possibility of cross-contamination between processed samples. It is equipped with state-of-the-art laboratory furniture as well as all the equipment necessary for working in the field of molecular biology including molecular diagnostics, genotyping of proven causes and expression of genes in human materials as well as in experimental conditions.

Collaborations

The current work program of CEFVZ, which builds on long-term research, takes place through work on national and international projects:

National: 2006-2010: Infections by intracellular microorganisms of growing significance: transmission, pathogen-host relationship, molecular epidemiology and clinical significance (OI 145002); 2011-2015: Control of infection to apicomplexic pathogenes: from new places of drug action to prediction (III 41019); 2011-2015: Enzootic transmission cycle of tick-borne pathogenic micro-organisms (OI 173006).

International: FP6 PROJECT: 2007-2009: REINFORCEMENT OF THE SERBIAN CENTER FOR PARASITIC ZOONOSES from the Sixth Framework Program for Research and Technological Development of the European Community (FP6-INCO-CT-043702 - SERBPARZOON). **WHO COLLABORATIVE STUDY**: 2013-2015: EVALUATION OF NIBSC 13/132 AS A CANDIDATE INTERNATIONAL STANDARD FOR ANTI-TOXOPLASMA IgM (WHO International Collaborative Study 505)**. EFSA PROJECT**: 2013-2015: RELATIONS BETWEEN SEROPREVALENCE AND THE MAIN LIVESTOCK SPECIES AND PRESENCE OF TOXOPLASMA GONDII IN MEAT. **ESCMID PROJECT**: 2014-2016: REVIEWING PREVENTION MEASURES AND EVALUATING THE BURDEN OF TOXOPLASMOSIS IN TRANSPLANT PATIENTS IN EUROPEAN COUNTRIES

Cost actions: 2009-2013: GOAT-PARASITE INTERACTIONS: FROM KNOWLEDGE TO CONTROL (Action FA 0805 – CAPARA). 2013-2017: EUROPEAN NETWORK FOR NEGLECTED VECTORS AND VECTOR-BORNE INFECTIONS (Action TD 1303 - EURNEGVEC). 2013-2017: EUROPEAN NETWORK ON TAENIOSIS/CYSTICERCOSIS (Action TD 1302 – CYSTINET)2014-2018: European Network for Foodborne Parasites (Action FA1408 – Euro-FBP).

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1.4. CENTER FOR MATHEMATICAL RESEARCH OF NONLINEAR PHENOMENA (CMRNP)

Department of Mathematics and Informatics, Faculty of Natural Sciences, University of Novi Sad (accredited Center of excellence)

About

Center for Mathematical Research of Nonlinear Phenomena (CMRNP) is a research unit at the Department of Mathematics and Informatics, Faculty of Sciences, University of Novi Sad. It gathers researchers from 3 research groups financed by the MoESTD, who have merged in order to: (i) establish closer cooperation; (ii) increase the level of scientific results; (iii) promote cooperation between mathematics and applied science and technology; (iv) further develop international cooperation in applied mathematics; (v) stimulate interest for science among young people. The Center also has an important role in the organization of courses at the doctoral level at the University of Novi Sad. The main research areas are functional analysis, PDEs and numerical methods for nonlinear equations (PDEs and nonlinear optimization).

Infrastructure and Services (ADDITIONAL INFO NEEDED)

The activity in the Center is primarily scientific and it integrates the work of three research groups at the Department of Mathematics and Informatics: Group for Analysis, Probability and Geometry, Group for Numerical Mathematics and Groups for forcing model theory and set theoretical logic.

Collaborations

The work of the Centre is conducted through scientific and other projects, international cooperation, seminars, conferences and through work with young researchers. International scientific cooperation exists with a large number of EU universities, universities in USA, Canada, South America and WBC. Several internationally funded projects are coordinated by researchers from CMRNP as well as a number of national research projects. The center participates in a DAAD program – Center of Excellence for Applications of Mathematics, as well as bilateral cooperation with Croatia and Germany. Two IPA projects on teaching mathematics are also implemented at the Centre.

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1.5. NANOTECHNOLOGY AND FUNCTIONAL MATERIALS CENTER (NFMC)

Faculty of Technology and Metallurgy, University of Belgrade (accredited Center of excellence)

About

Nanotechnology and Functional Materials Centre was established and reinforced by Faculty of Technology and Metallurgy, University of Belgrade through the FP7 REGPOT-2009-1 project NANOTECH FTM (Grant Agreement No 245916, TOTAL COST: EUR 1,455,840.00, EU CONTRIBUTION: EUR 1,298,774.00) in January 2010. NFMC was created in order to integrate small faculty research groups or individuals, who have all conducted their research in the field of nanotechnology and functional materials independently, and in such a way to improve and strengthen resources and perform competitive and up-to-date research activities. The NFMC consists of three groups: (1) Group for inorganic materials, (2) Group for polymers, and (3) Group for composite materials. These groups deal with materials for application in environmental engineering, biotechnology, biomedicine and pharmaceutics, photovoltaics, batteries, fiber-optic light guide, nanocomposite coatings etc.

Infrastructure and Services

A number of highly specialized equipment has been acquired by NFMC through the abovementioned REGPOT project and other sources. Some examples include:

A high-pressure reactor system which was modified in such a way as to enable additional working modes by the inclusion of a Carberry spinning basket high pressure reactor.

Micromeritics' ASAP® 2020 Accelerated Surface Area and Porosimetry Analyzer which uses the gas sorption technique to generate high-quality data for research and quality control applications.

MIRA3 XM Tescan FEGSEM - a third generation of MIRA XM series of high resolution scanning electron microscopes equipped with a high brightness Schottky Field Emission gun.

The Hysitron TI 900 TriboIndenter - a complete automated nanomechanical test system, ideal for measuring the hardness and elastic modulus of thin films and coatings. The TI 900 provides quantitative nanomechanical testing capabilities with the convenience of modern automation.

Collaborations

NFMC has established strong cooperation with outstanding research institutions from Europe and other regions of the World (European Centre for Nanostructured Polymers ECNP, Italy, CNRS Institut De Physique Et De Chimie De Strasbourg, France, Agriculture University of Athens, Greece, etc.), as well as numerous industrial partners (Procter & Gamble-Technical Centres Ltd, UK; Veolia Water Solutions and technologies, France, MaHyTec Ltd., Dole, France; Tehnomed Impex Co S.R.L, Romania; Plasma and Ceramics Technologies Ltd (Pct Ltd), Latvia; NIS GAZPROM NEFT, Serbia)

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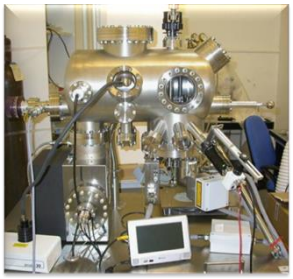
1.6. CENTER FOR SOLID STATE PHYSICS AND NEW MATERIALS (CSSPNM)

Institute of Physics, University of Belgrade (accredited Center of excellence)

About



Center for Solid State Physics and New Materials (CSSPNM) is an interdisciplinary research Center of the Institute of Physics, University of Belgrade, devoted to optical spectroscopy research of a wide group of materials (from semiconductors and high-temperature superconductors to insulators and magnetic materials). The principal interests of the Center are vibrational properties of these materials at the nanoscale. Very close interactions between experimental and theoretical activities are key elements of their approach.

Infrastructure and Services

Laboratory for material synthesis and crystal growth consists of several crystal growth techniques such as Czochralski, Bridgman or floating zone, thin film technology methods (thermal evaporation, spattering, laser ablation), sol-gel technology, sintering, etc.

Laboratory for nanoscopy (STM, AFM, SNOM) is equipped with state of art equipment for measuring the properties of materials at nano-level (Omicron variable temperature SPM and AFM, model B002645 SPM PROBE VT AFM 25 with MATRIX control system, SNOM, model TwinSNOM R).

Laboratory for FT-infrared spectroscopy and ellipsometry is equipped with two FTIR systems: a Bomem DA-8, and a SPECAC spectrometers, which allow the measurements in the wide frequency (30-25000 cm-1) and temperature range (between 4 and 300 K). The spectroscopic ellipsometer (SOPRA GES5E-IRSE) is a combined system consisting of: DUV-Visible-NIR and Fourier transform infrared spectroscopic ellipsometers.

Laboratory for Raman scattering and photoluminescence is equipped with double grating U1000 Jobin Yvon monochromator, Ar, Kr, He-Ne and He-Cd ion lasers, and Peltier effect cooled photomultiplier (model RCA 31034A) as a detector (single photon counting detection system). For low-temperature measurements (10 K-400 K) there is the Leybold closed cycle helium cryostat.

Laboratory for μ-Raman scattering spectroscopy is equipped with triple Jobin Yvon T 64000 spectrometer (gratings with 1800 grooves/mm), a Coherent Ar- Kr mixed gas ion laser, and a CCD detection system. The set-up contains a confocal microscope and an x-y-z microscope stage. For variable temperature measurements, there is a Linkam THMS 600 heating and cooling microscope stage, which allows for the micro-Raman measurements to be performed within the 77 to 900 K temperature range.

Another micro-Raman set-up is a TriVista 557 spectrometer. A Konti liquid helium microscope cryostat is also part of this laboratory.

Laboratory for Brillouin scattering spectroscopy is equipped with Tandem Fabry Perot Interferometer TF-1 (JRS Scientific).

Laboratory for transport properties measurements (Hall effect set up) is equipped with a conventional electro-magnet (magnetic field up to 1.5 T), a Hall effect set-up and an ARS Displex DE-202N closed-cycle-helium cryostat (for low temperature measurements between 7 and 300 K).

Laboratory for magnetic and magneto-optic measurements is equipped with a 14 T cryogen free measurement system (Cryogenic Ltd. superconducting magnet with a vibrating sample magnetometer, a resistivity and Hall effect set-up, a specific heat system). This system has an optical window at the bottom of the cryostat for optical connection with the TriVista TR557 triple Raman system so that Raman and photoluminescence measurements can be performed at low temperatures and in high magnetic fields.

Collaborations

CSSPNM has been part of several national and international (multi and bilateral) projects. A few examples include:

- FP6 Projects: OPSA 026283 SSA Project; CoMePhS STREP project no. 517039
- FP7 Projects: NanoCharm project no. 218570; NIM_NIL Project no. 228637
- HORIZON2020: “Dafneox”
- COST Actions: P16 ECOM; 539 ELENA; IC1208; MP1302; CA16215; CA15128; BM1401;
- Bilateral projects with Germany (6), China (2), Italy (3), France (1), Switzerland (1), Bulgaria (1), Romania (2), Austria (1), Belarus (2), Qatar (1), Poland (1), Croatia (2), Montenegro (1).
- National projects: (1) Nanostructured multifunctional materials and nanocomposites; (2) Physics of nanostructured oxide materials and strongly correlated systems, etc.

In the last year, the number of research collaborations with industries increased, with typical duration from six months to two years. Currently under negotiation is the Micro- and nano-structuration of surfaces for applications in high-performance engines for automotive industry.

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1.7. CENTER OF MICROELECTRONIC TECHNOLOGIES

Institute of Chemistry, Technology and Metallurgy, University of Belgrade (accredited Center of excellence)

About

Centre of Microelectronic Technologies (CMT), is a department within the Institute of Chemistry, Technology and Metallurgy (ICTM), member of the University of Belgrade. CMT performs research and development in the field of microelectronic technologies, microsystems and nanosystems. CMT is the only producer of microchips in Serbia. CMT is mostly oriented to research and development of various types of sensors, detectors and measurement transmitters. In the course of its research CMT mastered a number of technologies, the most important ones being: (i) planar technology of silicon and other semiconductors; (ii) technologies of bulk and surface micromachining; (iii) technologies of epitaxial growth of single crystal layers; (iv) technologies of fabrication of bulk single crystals; (v) thin film deposition.

Infrastructure and Services

Laboratory for planar and MEMS technologies: dedicated to the fabrication of microchips from concept to a finished product. It consists of several units complementing each other, comprising a complex technological system.

Laboratory for transmitter program – department for planning and production: Here, electronic measurement transmitters are mounted, packaged and tested. All transmitter parts are produced in the center: sensor microchips, processing circuitry and housings.

Laboratory for electronics and measurement instruments: testing and calibration of different electronic measurement systems. It includes a system for measurement and calibration of pressure sensor microchips, as well as of different types of electronic measurement transmitters like absolute and gauge pressure transmitters, pressure difference, level and flow transmitters. Laboratory is equipped with high-precision pressure calibrators and temperature chambers.

Laboratory for atomic force microscopy and optica spectroscopy: dedicated to precision characterization of materials, structures and systems. It is equipped with two atomic force microscope (AFM) units, an UV-vis spectrometer, FTIR infrared spectrophotometer and infrared microscope/spectrophotometer.

Laboratory for nanoparticles: equipped with a planetary mill and a glove box with nanoparticle handling in inert atmosphere, which makes it convenient for work with flammable and unstable materials. Laboratory was established through EU funds (FP7 project MagDrive).

Laboratory for plasmonics and chemical sensors: under construction, its main purpose being the characterization of nanocomposite materials and structures for detection of chemical, biochemical and biological analytes, as well as devices based on these structures.

Laboratory for photodetectors: equipped for measurement of responsivity and noise of photodetectors for visible and near infrared range (PIN photodiodes), as well as for measurements of responsivity and noise of detectors for mid and long infrared range (3-5 and 8-14 micrometers). It is equipped with two lock-in analyzers and a blackbody simulator.

Collaborations

CMT is ISO 9001:2001 certified. A part of the research is performed for the Power Industry of Serbia, for instance for Thermoelectric power plants Nikola Tesla, Morava and Vlasina power plants, also for Oil Industry of Serbia, Jugopetrol, various drinking water systems, sugar factories, etc. The CMT participates in a number of international projects (FP7, BMBF and COST supported). Researchers at CMT are also implementing three national research projects: TR 32008 - Micro and Nanosystems for Power Engineering, Process Industry and Environmental Protection MiNaSyS**,** 2) TR32005 – Algorithms and software for simulations in frequency and time domain for RF subsystems and electromagnetic sensors in ICT**,** 3) TR-32019 – Measurements in the concept of smart distributive network.

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1.8. PHOTONICS CENTER

Institute of Physics, University of Belgrade (accredited Center of excellence)

About

Photonics Center at the Institute of Physics, University of Belgrade is comprised of 4 research professors, 12 associates and assistants and 12 researchers and students. Photonics combines the physics of light, including optics and lasers, and covers the interaction between light and matter, which is an important area in modern atomic and molecular physics. Photonics, with its term coined from the "electronics" (the science of electrons), is slightly more oriented to applications and technology, with the emphasis to the wave/particle duality of photons. As a technology, photonics is rapidly growing research and development area – one of key technologies important for the 21st century, also called "the photon century". In industry, photonics secures the leadership in fields like manufacturing, communication, information transmission, health care, lighting, security, environmental monitoring, metrology...

Infrastructure and Services

The research activities in the Photonics Center are conducted through several research groups and laboratories: Laboratory for quantum and nonlinear optics, Laboratory for holography, optical materials and photonic crystals, Laboratory for metamaterials, Laboratory for biophysics, Laboratory for fiberoptics, Laboratory for photoacoustics, Laboratory for plasma spectroscopy and lasers and Laboratory for lasers and laser spectroscopy. Rooms (laboratories) for experimental research include rooms for quantum optics, lasers, granular systems, holography and a darkroom.

Collaborations

In its research, the Photonics Center has established cooperation with the following organizations (institutions): University of Seville (Seville, Spain); University of Angers (Angers, France); University of Fribourg (Fribourg, Switzerland); Russian Academy of Sciences – P N Lebedev Physical Institute (Moscow, Russia); Spanish National Scientific Research Council – Institute of Fundamental Physics (Madrid, Spain); Old Dominion University – Department of Physics (Norfolk, VA); Bulgarian Academy of Sciences – Institute of Electronics "Academician Emil Djakov" (Sofia, Bulgaria); Institute of Physics (Zagreb, Croatia); Massachusetts Institute of Technology (Cambridge, Massachusetts, USA); Medical Faculty, University of Novi Sad (Novi Sad, Serbia); University College London (London, UK); University of Graz (Graz, Austria); Foundation for Research and Technology - Hellas / FORTH (Crete, Greece); University of Pisa (Pisa, Italy).

In the Center, there are several on-going projects: Ramsey spectroscopy in rubidium vapour cells and application to atomic clocks (joint research SCOPES programme project, funded by SNSF, 2013–) and national projects, Production and characterization of nano-photonics functional structures in bio-medicine and informatics (III045016), Holographic methods for the generation of specific wavefronts for the efficient control of quantum coherent effects in the interaction of atoms and lasers (OI171038), Reconfigurable, metamaterial-based multiband and scanning antennas for wireless communication systems and sensors (TR32024), Reconfigurable and Multiband Devices and Antennas Based on Innovative Metamaterial Concept (bilateral project with the Microwave group of the University of Seville, Spain, 2012 –), Eye-safe rangefinder (funded by MNTRS).

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1.9. CENTER FOR COMPLEX SYSTEMS (Scientific Computing Laboratory – SCL)

Institute of Physics, University of Belgrade (Accredited Center of excellence and supported through FP7 and Horizon 2020)

About

Since 2006 the Scientific Computing Laboratory (SCL) has been recognized as an EU Centre of Excellence for modeling of complex systems. Its researchers use state-of-the-art High-Performance Computing resources to conduct numerical simulations and visualizations of classical and quantum many-body systems. The main research topics covered include numerical evaluation of path integrals, study of strongly correlated quantum systems, investigation of granular compaction, and modeling of transport in

nano-porous materials. In the past four years, the number of senior researchers employed at SCL-IPB has grown from 5 to 8 (1 promoted, 2 reintegrated from abroad). During the same period the laboratory recruited 23 new PhD students and trainees. So far these have successfully defended 1 PhD, 2 MSc, and 6 BSc theses. Active participation in international projects and collaboration has made it possible for SCL-IPB to conduct extensive researcher mobility, particularly for its younger researchers. Five students have benefited from long-term missions in France, Slovenia, and Switzerland.

Infrastructure and Services

SCL-IPB is at the focal point of the development of high-performance computing in Serbia and South East Europe. Its researchers look at simulations and models as heuristic tools in a broad problem-solving process. Modern high-performance computing facilities make possible the first step in this process: a view of new and previously inaccessible domains in science and the building up of intuition regarding new phenomenology. The final goal of this process is to translate this newfound intuition into: Better algorithms, New analytical results, Novel technological applications.

SCL provides high performance computing and storage facilities for eScience research. In total, more than 1000 CPUs and 50 TB of storage capacity are logically divided into three Grid sites (AEGIS01-IPB-SCL, AEGIS07-IPB-ATLAS, and AEGIS08-IPB-DEMO) and one local cluster.

AEGIS01-IPB-SCL Grid site consists of 89 worker nodes (2 x quad core Xeon E5345 @ 2.33 GHz with 8GB of RAM) and 15 service nodes (Xeon-based nodes). As the largest Grid site in Serbia, it is the Tier-0 site in the Serbian Grid infrastructure, providing all core services and management of national AEGIS Virtual Organization. All computing and core service nodes at AEGIS01-IPB-SCL Grid site are interconnected by the star topology Gigabit Ethernet network through three stacked high-throughput Layer 3 switches, each node being connected to the switch by two Gigabit Ethernet cables in channel bonding. In terms of storage resources, AEGIS01-IPB-SCL provides 27 TB of disk space to the Grid community. The site uses Scientific Linux 5.4 with gLite 3.2 middleware, and supports national AEGIS, regional SEE, SEEGRID, SGDEMO, METEO, ENV, SEISMO, pan-European ATLAS and CMS, and DESKTOPGRID Virtual Organizations.

AEGIS07-IPB-ATLAS is the second-largest Serbian Grid site is based on 128 Intel Xeon processors with 32-bit architecture and the total of 96GB of RAM. The site supports several virtual organizations, but is mainly dedicated to the ATLAS VO community of the CERN LHC experiment.

AEGIS08-IPB-DEMO Grid site is used purely for educational/training purposes. It is based on Xen virtual machines deployed on a single node with two Intel Xeon Quad-core CPUs with 16 GB of RAM. It is used in various training events for demonstration of installation and configuration of different Grid services.

Local cluster consists of several nodes based on the new computing architectures: IBM POWER6, PowerXCell, the latest Intel, and AMD Opteron CPUs. The hardware is located in one IBM BladeCenter, and in several separate 1U rack-mount servers. IBM BladeCenter has three kinds of servers (two Intel Xeon E5405, two POWER6, and two IBM PowerXCell 8i processors) within the H-type chassis, and one server based on latest Intel Nehalem Xeon processor with InfiniBand interconnection. In terms of storage resources, local cluster has 20TB storage capacity interconnected with 10 Gigabit Ethernet, as well as with the rest of the infrastructure.

Collaborations

SCL-IPB has decisively increased the quality and impact of its research effort, and has grown into a recognized leader in HPC in South East Europe. During this time SCL-IPB has been partner in Europe's flagship e-Infrastructure projects EGEE II, EGEE III, and this continues in PRACE and EGI-INSPIRE. The laboratory has been extremely active at the regional level in SEE-GRID, SEE-GRID-2, SEE-GRID-SCI, and the new HP-SEE project. The research on complex materials is principally funded through a seven-year National research grant ON141035, and EU Centre of Excellence grant CX-CMCS. Specific SCL-IPB activities are funded through a NATO reintegration grant, a Swiss SCOPES project, and several bilateral projects. Outreach to education has been conducted through the LA@CERN project. SCL is also in the process of implementing a number of COST actions.

Active Projects (National): ON171017: Modeling and Numerical Simulations of Many-Body Systems (2011-2014), III43007: Climate Change and its effects on the Environment - Monitoring, Modeling, Adapting, Mitigating (2011-2014)**,** III45018: Nanostructured multifunctional materials and nanocomposites (2011-2014).

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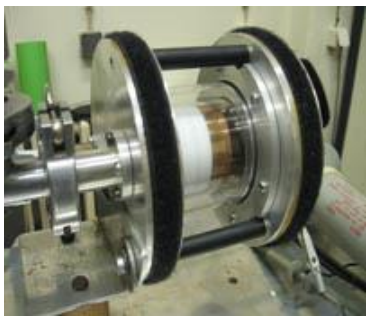
1.10. CENTER FOR NON-EQUILIBRIUM PROCESSES (CNEP)

Institute of Physics, University of Belgrade (Accredited Center of excellence and supported through FP7 Regpot)

About



Activities in the Centre for Non-Equilibrium Processes are focused on studies of the non-equilibrium plasmas and its application in Nano-technologies, etching of integrated circuits and environmental research. These are related to: (i) studies motivated by the development of 40 nm technologies for integrated circuits related to plasma and fast neutral etching; (ii) interaction of non-equilibrium plasmas with surfaces to achieve nanostructured hydrophobic surfaces and treatment of biological materials; (iii) growth and control of nanotubes on surfaces and nano-particles in gas phase; and (iv) suspended particles as atmospheric pollutants.

Infrastructure and Services

RF Capacitively coupled plasma generator, **Pulsed glow discharge experiment** is used in studies of electrical and emission properties of low-pressure DC. **ICCD** (**Andor iStar ICCD detector DH720-18U-13)** Extensive knowledge of high voltage, high speed electronic design has been brought together with the latest in image intensifier tube technology to provide the most technically advanced, easy to operate

ICCD camera available. **Swarm - excitation experiment**: Understanding the kinetics of excited rare gases is of practical importance for modeling and optimizing kinetics process in gas discharges devices, such as plasma displays, light sources, excimer lasers, ion lasers, ion thrusters, particle detectors and in microwave afterglows. **Monte Carlo transport codes**: In this work we follow the space and time development of a swarm of electrons under the influence of electric and magnetic fields. **Plasma Molecular Beam Sampling Mass Spectrometer** HIDEN Analytical HPR-60 Molecular Beam Sampling Mass Spectrometer for collisionless molecular beam analysis of high-speed, atmospheric pressure processes. **Energy DispersiveXRF Spectrometer - MiniPal 4**: The PANalytical's energy-dispersive X ray fluorescence (XRF) bench-top spectrometer MiniPal 4 performs non-destructive analysis of elements from sodium to uranium, in concentrations from 100% down to ppm levels. **Proton Transfer Reaction Mass Spectrometer (PTR-MS):** Sensitive real-time trace gas detector. It uses a soft ionisation technique based on proton transfer from H3O+ ions to all compounds in a sample under study, which have a higher proton affinity than water. **Gasseous Electronics Laboratory Data Centre (GELDC):** Its mission is to compile, evaluate, recommend and disseminate transport and collision data of charged particles relevant to various scientific and technological areas including atomic and molecular physics, plasma physics and gaseous electronics, surface physics, astrophysics and other technologies.

Collaborations

CNEP has a number of long standing international collaborations: Department of Electronics and Electrical Engineering, Keio University, Yokohama Japan, School of Mathematics and Physical Sciences, James Cook University, Cairns Australia, Research School of Physical Sciences, Australian National University, Canberra Australia, Research Institute for Solid State Physics and Optics of the Hungarian Academy of Science, University of Antwerp (Campus Drie Eiken), Dept. of Chemistry, Frank Laboratory of Neutron Physics, Joint Institute of Nuclear Research, Atmospheric Research and Environment Programme, World Meteorological Organization and the University of Nova Gorica. The Center has also implemented a number of projects with industry partners and through international projects.

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1.11. CENTER FOR VIBRO-ACOUSTIC SYSTEMS AND SIGNAL PROCESSING (CEVAS)

Faculty of Technical Sciences (FTN), University of Novi Sad (Accredited Center of Excellence)

About

The Centre for Vibro-Acoustic Systems and Signal Processing (CEVAS) is a formal organizational unit of the Faculty of Technical Sciences (FTN), Novi Sad, formed in October 2014. CEVAS integrates three research groups from the FTN: (1) Group for Nonlinear Dynamics and

Oscillations, (2) Group for Acoustics and Speech Technology, (3) Group for Biomedical Signal Processing.

Infrastructure and Services

CEVAS (Group for Nonlinear Dynamics and Oscillations) has a wide range of interest in the mechanical and mathematical modelling of dynamical and oscillatory systems. This also includes the use and development of quantitative and qualitative methods to study their behavior and associated phenomena. The focus is on nonlinear systems, where the nonlinearity can be material, or stem from physical configurations or excitations. The activities cover the whole spectrum, from fundamental theoretical and applied studies in structural engineering to the problems arising in living organisms, such as, for example, the dynamics of cell microtubules, DNA, neurons and vocal cords. Besides theoretical investigation, another area of work includes environmental and workplace noise monitoring and control as well as vibrodiagnostics of machines and structures. Very successful cooperation with local industry has been developed in this respect.

NO SPECIFIC INFO ON EQUIPMENT FOUND

Collaborations

NO SPECIFIC INFO ON PROJECTS/COLLABORATIONS FOUND

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1.12. CENTER FOR SYNTHESIS, PROCESSING AND CHARACTERIZATION OF MATERIALS FOR USE IN EXTREME CONDITIONS (CEXTREME LAB)

Institute of Nuclear Sciences, University of Belgrade (Accredited Center of Excellence)

About

Center for the synthesis, processing and characterization of materials for use in extreme conditions “CEXTREME LAB” within the Institute of Nuclear Sciences, Belgrade University was founded in 2014. The center is accredited in September 2015 by the Committee for Accreditation of Scientific Research Institutions and is the only officially accredited Center of excellence of the largest institute in the country. CEXTREME LAB is engaged in research that require an interdisciplinary approach; i.e. basic and applied research in the border area of basic sciences (chemistry, physics, biology) and engineering. Therefore, the research groups from different fields have joined, i.e. Laboratory made to work on the same task and Efficient solved problems, with the aim of increasing the necessary human resources and research infrastructure, and the capacity

to perform specific and current research activities, as well as connect with other scientific-research institutions and centers in the country and abroad. Laboratory within the Center are formed not only for fundamental research, but also for specific development and applied research.

Infrastructure and Services

Laboratory for Theoretical Investigation of Materials (L-TIM): Theoretical research carried out at L-TIM ranges from the theoretical prediction of new materials and new (meta) stable modification of existing compounds with no initial information, followed by experimental synthesis of calculated models, to theoretical modeling of properties of new materials and their structure, where the initial parameters come from experimental research. Special interest of L-TIM is behavior of materials under extreme conditions (primarily pressure and temperature), due to limitations of experimental methods.

Laboratory for Laser Sintering: Research within the Laboratory for laser sintering is directed towards the synthesis of metallic materials, as well as metal-ceramics and metal-polymer composites by consolidation of homogenized and mechanically alloyed powders using laser energy.

Laboratory for Identification and Structural Characterization of Materials Using X-Ray Diffraction Analysis: The objective of this Laboratory is X-ray powder diffraction (XRPD) structural analysis, which is actually identification and examination of the crystal substances. X-ray diffraction provides an answer to the questions which crystalline phases are present in the polycrystalline sample and provides a detailed analysis of the structure of the material.

Mechanical Testing Laboratory: Mechanical testing laboratory performs measurements of micro and macro hardness, as well as compressive, tensile and flexural strength. All mentioned tests are carried out in static conditions.

Laboratory for the Physical and Chemical Surface Characterization of Materials for Application in Extreme Conditions: Characterization of materials for application in extreme conditions, by calculating the specific surface and porosity (pore size distribution and morphology), is performed in the Laboratory for the physical and chemical surface characterization of materials for application in extreme conditions.

Laboratory for Processing and Synthesis of Materials for Application in Extreme Conditions: Materials for application in extreme environment are usually manmade materials which are obtained by complicated processes. The first step towards fabrication of the material with desired final properties in our Laboratory is synthesis of the starting material, normally powder, from appropriate precursors. Various methods such as reactions in solid, liquid, vapor or combined phases are used for this purpose.

Laboratory for Qualitative and Quantitative Microstructural Analysis: During the synthesis and processing of materials for application in extreme conditions, it is necessary to constantly monitor changes in the microstructure of the material at all stages, i.e. changes in structure parameters such as the fraction of individual phases, grain size and morphology. For the qualitative and quantitative characterization of the structure, modern research techniques are used allowing examination of the phenomena of phase transformations, strength, plasticity and toughness at the microscopic level, as well as the monitoring and analysis of behavior causing failure of material during operation of the machines and devices in service conditions. Light microscopes and scanning electron microscope with software packages are available for detailed analysis of microstructures.

Equipment: From the complete list of the equipment from the Center for the synthesis, processing and characterization of materials for use in extreme conditions "CEXTREME LAB", highlighted are the following: Nd: YAG millisecond laser- HAAS LAY 100K; HPC-2 Computer Centre; HPC-1 Computer Centre; Freeze-dryer; Hot Press, Astro; High-temperature vacuum furnace to 2200ºC, Gero HBO W; Dilatometer DIL BÄHR 802S; Surfer: Device for testing the physical and chemical adsorption characteristics of the material; X-ray powder diffractometer (XRPD) and Small-angle x-ray scattering (SAXS); Scanning electron microscope (SEM) JEOL JSM 5800LV, etc.

Collaborations

International cooperation: Tokyo Institute of Technology, Research Laboratory for Nuclear Reactors, 2-12-1 O-okayama, Meguro-ku, Tokyo, Japan, Department of Mechanical and Materials Engineering, Queen's University, Kingston, Ontario, Canada, Nanoparticle Process Technology, Department of Engineering Sciences, University of Duisburg–Essen, Duisburg, Germany, Institute for Materials Science, University Stuttgart, Germany, Friedrich-Alexander-Universität Erlangen-Nürnberg, Erlangen, Germany, Max Planck Institute for Solid State Research, Stuttgart, Germany, Max-Planck Institute for Intelligent Systems, Stuttgart, Germany, Institut für Mineralogie, Leibniz Universität Hannover, Hannover, Germany, Institute of Physical Chemistry, Romanian Academy, Bucharest, Romania, National Institute for Research and Development in Microtechnologies (IMT), Bucharest, Romania, Institute of Nuclear Sciences, JINR Dubna, Russia, School of Mechanical Engineering, Tianjin University of Commerce, China, Jožef Stefan Institute, Department of Nanostructured Materials, Ljubljana, Slovenia, School of Materials Science & Engineering, Tsinghua University, Beijing, China, Shanghai Institute of Ceramics, CAS, Shanghai, China, Indian Institute of Technology, Madras, India.

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1.13. LABORATORY FOR BIOARCHAEOLOGY

Department of Archaeology, Faculty of Philosophy, University of Belgrade (accredited Center of excellence)

About

The Laboratory for Bioarchaeology was established in 2008, as a teaching and research unit of the Department of Archaeology, Faculty of Philosophy, University of Belgrade. Bioarchaeology includes research and analysis of organic material from archaeological sites, namely through scientific disciplines of physical anthropology, archaeozoology and archaeobotany. The Laboratory was founded in order to improve the teaching process in the field of bioarchaeology, by means of interaction of lectures and research.

Infrastructure and Services

The Laboratory provides macroscopic and microscopic analyses of human and animal remains, and collaborates with various institutions equipped for DNA, stable isotope and lipid analysis. The Laboratory houses two collections, the Palaeoanthropological and the Archaeozoological reference collection.

NO SPECIFIC INFO ON EQUIPMENT FOUND

Collaborations

The Laboratory staff have performed anthropological and archaeozoological analyses for a great number of local and foreign scientific institutions (Archaeological Institute in Belgrade, Republic Institute for the Protection of Cultural Monuments in Belgrade, Provincial Institute for Protection of Cultural Monuments, National Museum in Belgrade, Museum of Vojvodina, Institute for Protection of Cultural Monuments in Niš, National Museum in Kruševac, National Museum in Kikinda, National Museum in Čačak, National Museum in Zrenjanin, Museum of Republic of Srpska in Banja Luka (Bosnia and Herzegovina), The National Museum of Bosnia and Herzegovina in Sarajevo (Bosnia and Herzegovina), Regional Institute for Heritage Preservation of Kotor (Montenegro), Museum of Herceg-Novi (Montenegro), etc.).

Projects:

Bioarchaeology of Ancient Europe - humans, animals and plants in prehistory of Serbia (III 47001)

FP7 project BEAN – Bridging the European and Anatolian Neolithic (Total cost: EUR 2,535,750.54;

EU contribution: EUR 2,535,750.54)

PREFERT – *Pre*historic *Fert*ility*: length of lactation during Mesolithic and Neolithic of South-Eastern Europe (9500-5500 BC)* – is a bilateral Franco-Serbian project, co-funded by MoESTD and CNRS, France.

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2. Infrastructure projects financed through EU framework programmes for research and innovation

2.1. Strengthening and widening the European infrastructure for social science data archives (CESSDA-SaW)

Grant Agreement #674939, Total budget: €2,498,187.00, EC Contribution: €2,498,187.00

Website: http://cessdasaw.eu/

After CESSDA's successful launch we must now achieve full European coverage, and strength and sustainability for the widened network. European coverage: In each country the barriers to, and the potential value and benefits from, membership will be examined, and existing relevant infrastructure mapped. Bespoke coordination, networking activities, and stakeholder forums, all designed to address the specific barriers, will be delivered. In particular, relationships between national ministries, Research Councils, and the social science research community will be built. Relevant work in other completed initiatives (e.g. SERSCIDA, DASISH, DwB) would be taken up and moved to the next stage of practical and direct support for achieving membership of the CESSDA Research Infrastructure. National opportunities for using European structural funds and other sources of support will be explored. The approach is to ensure the national and European economic and social benefits, and the positive returns on investment, that are achieved through membership of CESSDA are wholly apparent to the relevant national decision-makers. Strength and sustainability: The widened membership must form a strong and sustained network, where global best practice is built in to the infrastructure of European social science and research. Membership of CESSDA should mean membership of a world class support infrastructure. Links with practical benefits will be established with equivalent infrastructures in other continents. The benefits of coordinated collaboration and consultation with trans-national European stakeholders (for example, Eurostat, European Parliament, Consilium) will bring benefits to all national CESSDA Members. The visibility of this research infrastructure and its importance to excellent evidence in policy making will be enhanced. Further, existing national infrastructures must complete their transition into a holistic service, capable of access services for all.

Partner Serbia: **INSTITUTE OF ECONOMIC SCIENCES (IES)**; (€16,937.50)

Institute of Economic Sciences is conducting scientifically based research in all fields of economic science. Research is focusing primarily on business economics, labor economics and social development, international economic relations and sustainable development. Presently, the Institute has a staff of 37 people, of whom 30 are professional full-time staff members, and 7 are employed in the administration and secretariat. According to their specific field of activities the professional staff members are assigned either to one of IES scientific research centers or interdisciplinary project teams (IPT). Beyond the frame of reference of IES scientific research centers, IPT carries out interdisciplinary projects gathering up members of various units as well as joint members (supplemented, where necessary, by outside experts).

Institute is a member of EADI, as well as other international, regional and national scientific organizations and associations.

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2.2. DARIAH ERIC Sustainability Refined (DESIR)

Grant Agreement #731081, Total budget: €2,717,320.00, EC Contribution: €2,717,320.00

Abstract: Europe has a long and rich tradition as a center for the arts and humanities. However, the digital transformation poses challenges to the arts and humanities research landscape all over the world. Responding to these challenges the Digital Research Infrastructure for Arts and Humanities (DARIAH) was launched as a pan-European network and research infrastructure. After expansion and consolidation, which involved DARIAH's inscription on the ESFRI roadmap, DARIAH became a European Research Infrastructure Consortium (ERIC) in August 2014. The DESIR project sets out to strengthen the sustainability of DARIAH and firmly establish it as a long-term leader and partner within arts and humanities communities. By DESIR's definition, sustainability is an evolving 6-dimensional process, divided into the following challenges: Dissemination: DESIR will organize a series dissemination events, including workshops in the US and Australia, to promote DARIAH tools and services and initiative collaborations. Growth: DESIR sets out to prepare the ground for establishing DARIAH membership in six new countries: the UK, Finland, Spain, Switzerland, Czech Republic and Israel. Technology: DESIR will widen the DARIAH research infrastructure in three areas, vital for DARIAH's long-term sustainability: entity-based search, scholarly content management, visualization and text analytic services. Robustness: DESIR will make DARIAH's organizational structure and governance fit for the future and develop a detailed business plan and marketing strategy. Trust: DESIR will measure the acceptance of DARIAH, especially in new communities, and define mechanisms to support trust and confidence in DARIAH. Education: Through training and teaching DESIR will promote the use of DARIAH tools and services. The DESIR consortium is composed of core DARIAH members, representatives from potential new DARIAH members and external technical experts. It is balanced between the different European regions.

Partner Serbia: **CENTER FOR DIGITAL HUMANITIES** (€124,750.00)

The Center for Digital Humanities is engaged in the development of theoretical foundations and practical use of digital technologies in research, continuation and promotion of philological, lexicographic, literary and other humanistic sciences. The Center serves as the National Coordinating Institution for the Republic of Serbia within DARIAH-ERIC.

2.3. European Long-Term Ecosystem and socio-ecological Research Infrastructure (eLTER)

Grant Agreement #654359, Total budget: €4,999,138.00, EC Contribution: €4,999,138.00

Website: http://www.lter-europe.net/elter

Abstract: A collective effort is needed to create the environmental research infrastructure for answering pressing questions in a world of rapid social, economic and environmental change. The overall aim of the eLTER project is to advance the European network of Long-Term Ecosystem Research sites and socio-ecological research platforms to provide highest quality services for

multiple use of a distributed research infrastructure. eLTER´s major objectives and methods are to: (1) identify user needs for the research infrastructure in relation to major societal challenges through consultations with scientific, policy and business stakeholders and horizon scanning; (2) streamline the design of a cost-efficient pan-European network, able to address multiple ecosystem research issues, in collaboration with related global and European research infrastructures, e.g. LifeWatch; (3) develop the organisational framework for data integration and enable virtual access to the LTER data by enabling data publishing through distributed Data Nodes and by providing access to data on key research challenges through a Data Integration Platform; (4) foster the societal relevance, usability and multiple use of information, data and services through new partnerships with the providers of remotely sensed data, analytical services and scenario testing models, and via the adoption of new measurement technologies. The LTER-Europe network and the European Critical Zone community will collaborate to achieve these goals. 162 sites in 22 countries will provide data on long-term trends in environmental change, some reaching back 100 years. Test cases using these data will address a range of environmental and social issues to push innovation in network level services and steer conceptual developments. The envisaged "LTER Infrastructure" will enable European-scale investigation of major ecosystems and socio-ecological systems, and support knowledge-based decision making at multiple levels.

Partner Serbia: **UNIVERSITY OF NOVI SAD** (€221,132.00)

2.4. EUDAT2020 (EUDAT2020)

Grant Agreement #654065

Total budget: €19,052,882.00, EC Contribution: €18,865,385.00

Website: https://eudat.eu/

Abstract: EUDAT2020 brings together a unique consortium of e-infrastructure providers, research infrastructure operators, and researchers from a wide range of scientific disciplines under several of the ESFRI themes, working together to address the new data challenge. In most research communities, there is a growing awareness that the "rising tide of data" will require new approaches to data management and that data preservation, access and sharing should be supported in a much better way. Data, and a fortiori Big Data, is a cross-cutting issue touching all research infrastructures. EUDAT2020's vision is to enable European researchers and practitioners from any research discipline to preserve, find, access, and process data in a trusted environment, as part of a Collaborative Data Infrastructure (CDI) conceived as a network of collaborating, cooperating centres, combining the richness of numerous community-specific data repositories with the permanence and persistence of some of Europe's largest scientific data centres. EUDAT2020 builds on the foundations laid by the first EUDAT project, strengthening the links between the CDI and expanding its functionalities and remit. Covering both access and deposit, from informal data sharing to long-term archiving, and addressing identification, discoverability and computability of both long-tail and big data, EUDAT2020's services will address the full lifecycle of research data. One of the main ambitions of EUDAT2020 is to bridge the gap between research infrastructures and e-Infrastructures through an active engagement strategy, using the communities that are in the consortium as EUDAT beacons and integrating others through innovative partnerships. During its three-year funded life, EUDAT2020 will evolve the CDI into a healthy and vibrant data-infrastructure for

Europe, and position EUDAT as a sustainable infrastructure within which the future, changing requirements of a wide range of research communities are addressed.

Partner Serbia: **UNIVERSITY OF NOVI SAD** (€64,125.00)

2.5. GÉANT Research and Education Networking - Framework Partnership Agreement Proposal (GEANT2020)

Grant Agreement #653998, Start date not set yet

Website: https://www.geant.org/

Abstract: In this Framework Partnership Agreement (FPA) the European National Research and Education Networks, united in the GÉANT partnership, propose to implement the European Communications Commons, as stipulated in the GÉANT Expert Group report of October 2011. The proposal defines the scope and priorities to be observed in the Specific Grant Agreements (SGAs) that will define the work in detail. The FPA aims to "...make every European researcher digital, increasing creativity and efficiency of research and bridging the divide between developed and less-developed regions." The future GÉANT infrastructure will provide secure, cost-effective, highly available and reliable services for very high-speed connectivity, identity inter-federation, resource virtualization, mobility, security and trust, ensuring the digital continuum of services to the Research and Educational users anywhere in the EU whether at home or on the move. Further development of the Authentication and Authorization Infrastructure, in terms of footprint and providing seamless and unimpeded access to relevant data and computing resources from anywhere, is a strategic component in this endeavor and will be undertaken in cooperation with the other European e-infrastructure providers and projects. By the very nature of the FPA, the current proposal does not include any specific work, budgets, deliverables or milestones. These details belong to the future SGAs. The vision presented here is a general overview of the actions to be proposed under the framework. The FPA will be governed by a General Assembly with advisory bodies and committees ensuring that users' views, as well as senior industry and service provider expertise, contribute to the strategic governance. One of the most successful attributes governed by the Cost Sharing Committee of the GEANT cooperation over the past decade is the ability to agree and to share costs across a greatly diversified Europe.

Partner Serbia: **UNIVERSITY OF BELGRADE**

2.6. Open Access Infrastructure for Research in Europe 2020 (OpenAIRE2020)

Grant Agreement #643410

Total budget: €13,132,500.00, EC Contribution: €13,000,000.00

Website: https://www.openaire.eu/

Abstract: OpenAIRE2020 represents a pivotal phase in the long-term effort to implement and strengthen the impact of the Open Access (OA) policies of the European Commission (EC), building on the achievements of the OpenAIRE projects. OpenAIRE2020 will expand and leverage its focus from (1) the agents and resources of scholarly communication to workflows and processes, (2)

from publications to data, software, and other research outputs, and the links between them, and (3) strengthen the relationship of European OA infrastructures with other regions of the world, in particular Latin America and the U.S. Through these efforts OpenAIRE2020 will truly support and accelerate Open Science and Scholarship, of which Open Access is of fundamental importance. OpenAIRE2020 continues and extends OpenAIRE's scholarly communication infrastructure to manage and monitor the outcomes of EC-funded research. It combines its substantial networking capacities and technical capabilities to deliver a robust infrastructure offering support for the Open Access policies in Horizon 2020, via a range of pan-European outreach activities and a suite of services for key stakeholders. It provides researcher support and services for the Open Data Pilot and investigates its legal ramifications. The project offers to national funders the ability to implement OpenAIRE services to monitor research output, whilst new impact measures for research are investigated. OpenAIRE2020 engages with innovative publishing and data initiatives via studies and pilots. By liaising with global infrastructures, it ensures international interoperability of repositories and their valuable OA contents. To ensure sustainability and long-term health for the overall OpenAIRE infrastructure, the proposed OpenAIRE2020 project will establish itself as a legal entity, which will manage the production-level responsibilities securing 24/7 reliability and continuity to all relevant user groups, data providers and other stakeholders.

Partner Serbia: **UNIVERSITY OF BELGRADE** (€72,050.00)

2.7. VRE for regional Interdisciplinary communities in Southeast Europe and the Eastern Mediterranean (VI-SEEM)

Grant Agreement #675121

Total budget: €3,300,000.00, EC Contribution: €3,300,000.00

Website: https://vi-seem.eu/

Abstract: In the last decade, a number of initiatives were crucial for enabling high-quality research - by providing e-Infrastructure resources, application support and training - in both South East Europe (SEE) and Eastern Mediterranean (EM). They helped reduce the digital divide and brain drain in Europe, by ensuring access to regional e-Infrastructures to new member states, states on path to ascension, and states in European Neighborhood Policy area – in total 14 countries in SEE and 6 in EM. This VI-SEEM proposal brings together these e-Infrastructures to build capacity and better utilize synergies, for an improved service provision within a unified Virtual Research Environment (VRE) for the inter-disciplinary scientific user communities in the combined SEE and EM regions (SEEM). The overall objective is to provide user-friendly integrated e-Infrastructure platform for regional cross-border Scientific Communities in Climatology, Life Sciences, and Cultural Heritage for the SEEM region; by linking compute, data, and visualization resources, as well as services, models, software and tools. This VRE will provide the scientists and researchers with the support in full lifecycle of collaborative research: accessing and sharing relevant research data, using it with provided codes and tools to carry out new experiments and simulations on large-scale e-Infrastructures, and producing new knowledge and data - which can be stored and shared in the same VRE. Climatology and Life Science communities are directly relevant for Societal Challenges. The driving ambition of this proposal is to maintain leadership in enabling e-Infrastructure based research and innovation in the region for the 3 strategic regional user communities: supporting multidisciplinary solutions, advancing their research, and bridging the

development gap with the rest of Europe. The VI-SEEM consortium brings together e-Infrastructure operators and Scientific Communities in a common endeavor.

Partner Serbia: **INSTITUTE OF PHYSICS** (€342,517.50)

2.8. A Data Infrastructure to Support Agricultural Scientific Communities Promoting Data Sharing and Development of Trust in Agricultural Sciences (agINFRA)

Grant Agreement #283770

Total cost: EUR 4,503,029.00, EU contribution: EUR 3,750,000.00

Website: http://www.aginfra.eu/

Abstract: agINFRA is an Integrated Infrastructure Initiative (I3) project that will try to introduce the agricultural scientific communities into the vision of open and participatory data-intensive science. In particular, agINFRA aims to design and develop a scientific data infrastructure for agricultural sciences that will facilitate the development of policies and the deployment of services that will promote sharing of data among agricultural scientists and develop trust within and among their communities. agINFRA will try to remove existing obstacles concerning the open access to scientific information and data in agriculture, as well as improve the preparedness of agricultural scientific communities to face, manage and exploit the abundance of relevant data that is (or will be) available and can support agricultural research. Ultimately, agINFRA will demonstrate how a data infrastructure for agricultural scientific communities can be set up to facilitate data generation, provenance, quality assessment, certification, curation, annotation, navigation and management.

Partner Serbia: **INSTITUTE OF PHYSICS**

2.9. Collaborative EuropeaN Digital/Archival Infrastructure (CENDARI)

Grant Agreement #284432

Total cost: EUR 8,785,695.05, EU contribution: EUR 6,500,000.00

Website: http://www.cendari.eu/

Abstract: The Collaborative EuropeaN Digital Archive Infrastructure (CENDARI) will provide and facilitate access to existing archives and resources in Europe for the study of medieval and modern European history through the development of an enquiry environment. This environment will increase access to records of historic importance across the European Research Area, creating a powerful new platform for accessing and investigating historical data in a transnational fashion overcoming the national and institutional data silos that now exist. It will leverage the power of the European infrastructure for Digital Humanities (DARIAH) bringing these technical experts together with leading historians and existing research infrastructures (archives, libraries and individual digital projects) within a programme of technical research informed by cutting edge reflection on the impact of the digital age on scholarly practice. The enquiry environment that is at the heart of this proposal will create new ways to discover meaning, a methodology not just of scale but of kind. It will create tools and workspaces that allow researchers to engage with large data sets via federated multilingual searches across heterogeneous resources while defining workflows enabling the creation of personalized research environments,

shared research and teaching spaces, and annotation trails, amongst other features. This will be facilitated by multilingual authority lists of named entities (people, places, events) that will harness user involvement to add intelligence to the system. Moreover, it will develop new visual paradigms for the exploration of patterns generated by the system, from knowledge transfer and dissemination, to language usage and shifts, to the advancement and diffusion of ideas.

Partner Serbia: **MATHEMATICAL INSTITUTE OF SANU**

2.10 Distributed Research Infrastructure for Hydro-Meteorology (DRIHM)
Grant Agreement #283568

Total cost: EUR 4,777,076.00, EU contribution: EUR 3,500,000.00

Website: http://www.drihm.eu/

Abstract: Predicting weather and climate and its impacts on the environment, including hazards such as floods and landslides, is still one of the main challenges of the 21st century, with significant societal and economic implications. At the heart of this challenge, as also suggested by the DRIHMS (Distributed Research Infrastructure for Hydro-Meteorology Study) project, lies the ability to have easy access to hydro-meteorological data and models, and to facilitate the collaboration between meteorologists, hydrologists, and Earth science experts for accelerated scientific advances in hydrometeorological research (HMR). The proposed DRIHM (Distributed Research Infrastructure for Hydro-Meteorology) project intends to develop a prototype e-Science environment to facilitate this collaboration, and provide end-to-end HMR services (models, datasets and post-processing tools) at the European level, with the ability to expand to the global scale. The objectives of DRIHM are to lead the definition of a common long-term strategy, to foster the development of new HMR models and observational archives for the study of severe hydrometeorological events, to promote the execution and analysis of high-end simulations, and to support the dissemination of predictive models as decision analysis tools. DRIHM combines the European expertise in HMR, and in Grid and High Performance Computing (HPC). Joint research activities will improve the efficient use of European e-Infrastructures, notably Grid and HPC, for HMR modelling and observational databases, model evaluation tool sets and access to HMR model results. Networking activities will disseminate DRIHM results at the European and global levels in order to increase the cohesion of European and possibly worldwide HMR communities, and to increase the awareness of the potential of ICT for HMR. Service activities will deploy the end-to-end DRIHM services and tools in support of HMR networks and virtual organizations on top of the existing European e-Infrastructures.

Partner Serbia: **REPUBLIC HYDROMETEOROLOGICAL SERVICE OF SERBIA (RHMS)**

2.11. European Clinical Research Infrastructures Network - Integrating Activity (ECRIN-IA)
Grant Agreement #284395

Total cost: EUR 10,977,046.66, EU contribution: EUR 7,999,930.53

Website: http://www.ecrin.org/

Abstract: ECRIN is a distributed ESFRI-roadmap pan-European infrastructure designed to support multinational clinical research, making Europe a single area for clinical studies, taking advantage of its population size to access patients. Servicing multinational trials started during its preparatory phase, and it now applies for an ERIC status by 2011. The ERIC budget will be restricted to core activities required to enable provision of services, and the ECRIN-IA project is designed to expand ECRIN partnerships and impact beyond this core activity. Networking activities will promote pan-European expansion, capacity building, and partnership with other world regions, and address the funding issue (WP2). ECRIN-IA will develop e-services, education material to train professionals and patients' associations, and communication with users, patients, citizens and policymakers (WP3). It will support the structuring and connection to ECRIN of disease-, technology-, or product-oriented investigation networks and hubs focusing on specific areas: rare diseases (WP4), medical device (WP5), nutrition (WP6). Transnational access activities will support the cost of multinational extension of clinical trials on rare diseases, medical device and nutrition selected by the ECRIN scientific board (WP7). Joint research activities are designed to improve the efficiency of ECRIN services, through the development of tools for risk-adapted monitoring (WP8), and the upgrade of the VISTA data management tool (WP9). This project will build a consistent organization for clinical research in Europe, with ECRIN developing generic tools and providing generic services to multinational studies, and supporting the construction of pan-European disease-oriented networks, that will in turn act as ECRIN users and provide the scientific content. Such organization will improve Europe's attractiveness for industry trials, boost its scientific competitiveness, and result in better healthcare for European citizens.

Partner Serbia: **SERBIAN MEDICAL SOCIETY (SMS)**

CAMPUS Database. Aimed at promoting and facilitating multi-national clinical research projects in Europe, CAMPUS Database – an online database including country-specific information on regulatory and ethical requirements in clinical research across Europe – was launched in December 2015 by the European Clinical Research Infrastructure Network (ECRIN). It provides simple and easy access to regulatory information for people involved in planning, initiating and conducting clinical trials on a national and international level. The CAMPUS Database encompasses up-to-date regulatory and ethical requirements applicable to clinical research projects in medicinal products for human use, medical devices, and/or nutrition. It currently includes information for over 22 European countries in these different research fields.

Competent Authority: **Medicines and Medical Devices Agency of Serbia**/ Agencija za lekove i medicinska sredstva Srbije (ALIMS), Phone: +381 11 3951-158; +381 11 3951-199; Fax: +381 11 3951-158, Email: hygia@alims.gov.rs, Address: Vojvode Stepe 458, 11221 Belgrade, Serbia (RS), Website: http://www.alims.gov.rs/eng/medical-devices/

Ethics Committee: There are approximately 30 local ECs in Serbia. Hospitals, health care institutions, clinical centers and the Serbian Medical Society have their own EC for review of clinical trial (CT) applications. There is no central Ethics Committee (CEC). For ECRIN the CEC is the Ethics Committee of the Serbian Medical Society (ECSMS).

2.12. Distributed Infrastructure for Experimentation in Ecosystem Research (EXPEER)

Grant Agreement #262060

Total cost: EUR 9,414,736.19, EU contribution: EUR 7,400,000.00

Website: http://www.expeeronline.eu/

Abstract: EXPEER will bring together, major observational, experimental, analytical and modelling facilities in ecosystem science in Europe. By uniting these highly-instrumented ecosystem research facilities under the same umbrella and with a common vision, EXPEER will form a key contribution to structuring and improving the European Research Area (ERA) within terrestrial ecosystem research. EXPEER builds on an ambitious plant for networking research groups and facilities. The joint research activities will provide a common framework and roadmap for improving the quality, interaction and individual as well as joint performance of these infrastructures in a durable and sustainable manner. EXPEER will provide a framework for increased use and exploitation of the unique facilities through a strong and coordinated programme for Transnational Access to the infrastructures. Extensive outreach and collaboration with related networks, infrastructures as well as potential funding bodies will ensure that EXPEER will contribute with its key experiences to the shaping and designing of future research networks and infrastructures, and that it has full support from all stakeholders in reaching its long-term objectives. The establishment of the EXPEER Integrated Infrastructure will enable integrated studies of the impacts of climate change, land use change and loss of biodiversity in terrestrial ecosystems through two major steps: 1. Bringing together the EXPEER Infrastructures to enable collaboration and integration of observational, experimental and modelling approaches in ecosystem research (in line with the concept developed in ANAEE); 2. Structuring existing network of ecosystem observational, monitoring and experimental sites across Europe (LTER-Europe). Through its integrated partnership, uniting both the experimental, observational, analytical and modelling research communities, EXPEER has the multidisciplinary expertise and critical mass to integrate and structure the European long-term ecosystem research facilities providing improved services and benefits to the whole research community as well as the society in general.

Partner Serbia: **UNIVERSITY OF NOVI SAD**

2.13. Virtual Atomic and Molecular Data Center (VAMDC)

Grant Agreement #239108

Total cost: EUR 3,393,220.00, EU contribution: EUR 2,900,000.00

Website: http://www.vamdc.eu/

Abstract: Many research groups and institutes within the European Research Area (ERA) are playing a central role in the production of a vast range of atomic and molecular (AM) data, data that is of critical importance across a wide range of applications such as astrophysics, atmospheric physics, fusion, environmental sciences, combustion chemistry and in industrial

applications from plasmas to lighting. Through the auspices of this infrastructure the Virtual Atomic and Molecular Data Centre (VAMDC) aims to build a secure, documented, flexible and interoperable e-science environment-based interface to the existing AM data. The VAMDC will be built upon the expertise of existing AM databases, data producers and service providers with the specific aim of creating an infrastructure that is easily tuned to the requirements of a wide variety of users in academic, governmental, industrial or public communities both within and outside the ERA. The project will cover the building of the core consortium, the development and deployment of the infrastructure and the development of interfaces to the existing AM databases as well as providing a forum for training potential users and dissemination of expertise across the ERA. It is expected that VAMDC becomes a European legal entity during the course of the project.

Partner Serbia: **ASTRONOMICAL OBSERVATORY OF BELGRADE**

2.14. Advanced Research in Agricultural and Food Sciences

Faculty of Agriculture, University of Belgrade

Funding Body: European Commission, Seventh Framework Programme, SP-4 Capacities, Coordination and Support Action, Support action (FP7-REGPOT-0212-2013 -I), Project number: 316004

Project coordinator: Prof. Radmila Stikić (rstikic@agrif.bg.ac.rs)

Abstract: AREA aim is to reinforce and advance the research capacity of 13 excellent groups at the Faculty of Agriculture, University of Belgrade, led by scientists with unique expertise in Serbia, specifically in crop physiology and anatomy, biodiversity, weed science, horticulture, plant pathology, aquaculture, food biochemistry, food technology and biotechnology. AREA project is focused on a set of coherent activities that will both improve the research capacity of each individual group, allowing it to advance its own state-of-the-art research programmes, as well as stimulate interactions amongst research groups, by enhancing implementation of existing DNA marker technologies and introducing innovative technologies (such as Raman micro-spectroscopy) from which all research teams will benefit. In collaboration with EU partner organizations, following the purchase of the necessary equipment as well as the essential training in new techniques, the achieved expertise in DNA-based technologies will encompass: Characterization of genes responsible for crop stress responses and response to herbicides, Molecular taxonomy of plants, Microbial pathogenic populations analyses, DNA-based GMOs and food tracing, Marker-assisted selection in fish and fruit breeding, Genetic diversity of zooplankton and zoobenthos, Molecular characterization of lactic acid bacteria.

The acquired Raman micro/spectroscopy expertise is focused on: Chemical analyses and localization of various chemical compounds in plants and plant products, Microbes, Fish meat, Food constituents, Practical application in recent food technology methods, such as encapsulation.

2.15. SERBORDISinn

INSTITUTE FOR MOLECULAR GENETICS AND GENETIC ENGINEERING (IMGGE)

Strengthening the Research Potential of IMGGE through Reinforcement of Biomedical Science of Rare Diseases in Serbia – en route for innovation

IMGGE is an EU grant recipient under the work programme topic FP7-REGPOT-2012-2013-1 for the project “Strengthening the Research Potential of IMGGE through Reinforcement of Biomedical Science of Rare Diseases in Serbia – en route for innovation”- SERBORDISinn.

Institute of Molecular Genetics and Genetic Engineering, University of Belgrade, Belgrade, Serbia (IMGGE) is the leading Serbian MG research institution, employing scientists with the highest expertise in molecular biology and molecular genetics. Research in the field of biomedical science of rare diseases (RD) is one of the major interests of IMGGE’s Laboratories.

EC-FP7-REGPOT Project SERBORDISinn will enable IMGGE to become the most recognizable molecular genetic (MG) centre in the Balkans. The Project will reinforce IMGGE’s research and innovation capacity by implementation of cutting-edge MG methodologies for the study of molecular markers of RD, establishment of Serbian and Balkan RD-specific databases and biobanks. This would be accomplished through exchange of know-how and experience with EU partnering organizations, experienced in the field of RD (trans-national two-way mobility will be realized through visits of eminent European experts, training of IMGGE’s staff in the EU partnering organizations and technology-related training for newly acquired equipment); reinforcement of human resources by creating new jobs for experienced researchers and technicians; upgrading and acquiring sophisticated research equipment (Next-Generation Sequencing System), to ensure high-quality research; gaining expertise on IP issues and networking with local hospitals and SME. Organization of workshops and regional conferences, dissemination and promotional activities will increase the visibility of Project achievements.

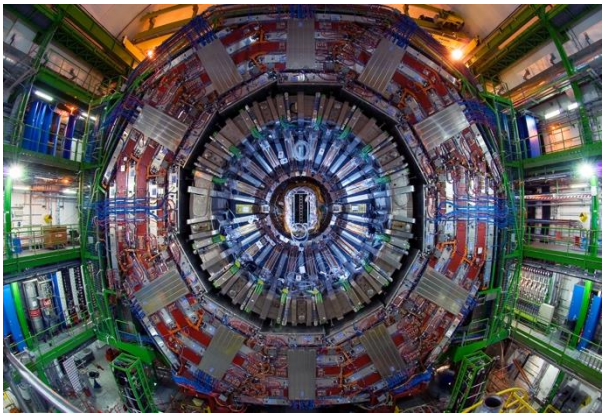
The implementation of SERBORDISinn will have an impact on unlocking and developing IMGGE’s research and innovation potential, improvement of public health in Serbia, strengthening of cooperation with local partners, Balkan and EU research institutions. SERBORDISinn activities will lead to the establishment of a high proficiency expert centre for MG studies of RD in IMGGE and to a real integration of IMGGE into the ERA.

3. Serbia's Participation in International Research Infrastructures

3.1. CERN

European Organization for Nuclear Research

About



The **European Organization for Nuclear Research**, known as **CERN** (derived from the name *Conseil Européen pour la Recherche Nucléaire*), is a European research organization that operates the largest particle physics laboratory in the world. Established in 1954, the organization is based in a northwest suburb of Geneva on the Franco–Swiss border, and has 22 member states. The term CERN is also used to refer to the laboratory, which in 2016 had 2,500 scientific, technical, and administrative staff members, and hosted about 12,000 users. In the same year, CERN generated 49 petabytes of data. CERN's main function is to provide the particle accelerators and other infrastructure needed for high-energy physics research – as a result, numerous experiments have been constructed at CERN through international collaborations. The main site at Meyrin hosts a large computing facility, which is primarily used to store and analyze data from experiments, as well as simulate events. Researchers need remote access to these facilities, so the lab has historically been a major wide area network hub. CERN is also the birthplace of the World Wide Web.

Serbian scientists have an involvement with CERN that goes back to the very origins of the Organization: Yugoslavia was a founder Member State of CERN in 1954, and remained a Member State until 1961. Nevertheless, scientists from the former Yugoslavia continued to be involved with CERN.

Through the 1980s and 90s, Serbian physicists were active in the DELPHI experiment at CERN's LEP facility, and have long been active in the ISOLDE facility, which carries out a range of research from particle astrophysics to medical physics. Serbia formally rejoined CERN in 2001 through a Cooperation Agreement, leading to involvement in both the ATLAS and CMS experiments at the LHC. In addition, Serbia is involved in the ACE and NA61 experiments. Serbian industry has successfully participated in the construction of both detectors, and Serbia is also active in GRID computing.

Since 15 March 2012, Serbia is an Associate Member in the pre-stage to Membership of CERN. At the moment, there are four scientific institutions from Serbia that actively participate in projects and experiments at CERN:

1) Vinca Institute of Nuclear Sciences, University of Belgrade
2) Institute of Physics, University of Belgrade
3) Faculty of Physics, University of Belgrade
4) Faculty of Sciences, University of Novi Sad

Teams of researchers and specialists from these four Serbian institutions are involved in the ATLAS and CMS experiments at the LHC, as well as in the ACE and NA61 experiments. The teams of Serbian researchers are also active in the nuclear physics experiments at the ISOLDE facility, and in the GRID computing project.

As of 31 January 2013, there were 30 scientists and engineers associated with Serbian Institutions which are officially involved in CERN experiments and projects. There are also about 20 Serbian scientists and engineers associated with other Institutions involved in CERN projects. Serbian scientists and engineers have been actively involved over more than a decade in design, construction and commissioning of the sophisticated CERN experiments used to investigate the fundamental building blocks of nature.

Several Serbian scientists were also having leading roles in the discovery of a Higgs boson, which has been announced on 4 July 2012 and has resulted with the Nobel prize in physics in 2013 (awarded jointly to Dr. François Englert and Dr. Peter Higgs).

Industry collaboration

CERN conducts procurement of all supplies and services in a way which meets all the contractual requirements at the lowest possible overall cost, while achieving balanced industrial return for the CERN Member States and respecting the CERN Code of Professional Ethics.

All Serbian public and private companies are eligible to participate in the tender offers and to be awarded a CERN contract. Examples of jobs Serbian industrial companies had completed for CERN projects, as of January 2014:

July 2003 - "**Zastava alati**" Kragujevac completed 120 hydraulic connectors, of the total weight of 12.5 tons and worth of 400 kCHF, for the CMS experiment.

March 2007 - "**Lola Corporation**" Železnik and "**Kryooprema**" Belgrade delivered two stainless steel shielding disks and forward shielding supports, with the total weight of 88.3 tons and worth 300 kCHF, for the ATLAS experiment.

December 2013 - Company from Gornji Milanovac completed supporting platforms, approximately worth 20 kCHF, for the CMS experiment.

Committee for the collaboration between CERN and Serbia:

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3.2. CERIC-ERIC

Central European Research Infrastructure Consortium

About

The Central European Research Infrastructure Consortium (CERIC) puts together the national multidisciplinary analytical, synthesis and sample preparation capabilities of eight countries - Austria, Croatia, the Czech Republic, Hungary, Italy, Poland, Romania and Slovenia. Serbia is in the process of appointing the Representing Entity.

CERIC-ERIC exploits the full scientific potential of the Central European area in the synchrotron light and other microscopic probes for analytical and modification techniques for a broad range of applications in the fields of life sciences, nanoscience and nanotechnology, cultural heritage, environment and materials sciences.

Infrastructure and Services

CERIC operates in the wide research area of nanoscale analysis and synthesis of materials sciences, including connections to biomaterials and structural biology.

Analytical facilities for materials sciences operating at the nano (atomic) level are based on the use of probes capable of sensing single atoms/electrons/nuclei: these probes are electromagnetic waves from radio to ultra-short-wavelengths in the hard X-Rays region (with techniques ranging from NMR and photon spectroscopies to microscopies), electrons (in high definition transmission, diffraction or reflection microscopies), neutrons (in scattering and or transmission spectroscopies). Other more specialized probes (protons, muons, positrons etc.) are used in particular cases but are not planned at the moment in CERIC.

The equipment used in the analytical facilities consists typically of an advanced-quality source of the appropriate probe (from high frequency/high field NMR to high brilliance synchrotrons and free electron lasers, to high flux-slow neutrons) connected to “measuring equipment” which allows full exploitation of the quality of the source and collection of the relevant data.

Synthesis facilities for material preparation at the atomic level of control are a wide class, ranging from physico-chemical to chemical assembly (e.g. from vacuum deposition to sputtering, laser ablation, to molecular epitaxy and chemical structuring) to biological selection and assembly (e.g. PCR production of proteins). These are typically referred to as “sample preparation facilities” and are a very important asset when properly connected to the analytical facilities, e.g., bio-crystallography laboratories including the growth of protein crystals.

Modern materials and life sciences require the capability to analyze and characterize the same material with several complementary probes and techniques and also to manipulate different aspects in its synthesis and preparation.

The competitive advantage of CERIC is the ability to offer, in an integrated way and at international level, access to most high-quality probes and to a large inventory of different characterization and preparation techniques.

Collaborations

CERIC, as a distributed facility, acts as a focal point for European industry promoting technology transfer and science-driven innovation, connecting and integrating into a unique facility the know-how and technical expertise of the Partner Facilities of the Consortium, which have an exceptional body of skills and experience of interaction with industry.

Collaboration with industry is supported through several different mechanisms (e.g. joint developments, pre-qualification through prototyping, licensing, spin-off creation etc.), within a common strategy and policy for intellectual property and know-how protection and exploitation.

CERIC, as an integrated Industrial Liaison & Technology Transfer (IL&TT) facility fosters the transfer of technologies developed within CERIC and partner activities to outside industries and/or institutions, and it supports them in finding and preparing the most suitable tailored package for R&D activities addressing their specific needs.

CERIC provides analytical laboratories and expert advice for industrial research & development (R&D) activities, offering multiple instruments and characterization techniques, and leading-edge analytical measurement skills. The available tools and technologies allow the analysis and synthesis of materials, and an understanding of their behavior at the micro and nano-scale.

Industrial and commercial services include: access to multi-technique facilities, longer-term agreements, direct transfer of technology and training of staff, co-development of new products, high-tech procurement, pre-qualification through prototyping, spin-offs and start-ups creation.

These services support proprietary R&D in various industrial areas, such as health, food, energy, high-tech materials, environment and more.

Both standard and cutting-edge techniques are available, with the support of expert scientists and technicians. Confidentiality is guaranteed through specific agreements guaranteeing the customer ownership of the results.

In October 2017, the General Assembly of CERIC confirmed FAMA as perspective Serbian Partner Facility of CERIC. FAMA is the low energy part of the TESLA Accelerator Installation at the Vinca Institute of Nuclear Sciences. It us a user facility for basic and applied research in the field of modification and analysis of materials with ion beams.

Contact information

Responsible person:

Address:

Phone:

3.3. PRACE

About

Large scale simulations are the third pillar of science today alongside theory and experiment. They produce scientific insights, technological advances, and solve problems in many fields of society. Their tools are high-end computers and effective software. PRACE, the Partnership for Advanced Computing, has been created as a not for profit association in May 2010 as a permanent pan-European High Performance Computing service providing world-class systems for world-class science. Up to six systems at the highest performance level (Tier-0) will be deployed the first one being the already installed BlueGene/P in Germany. Funding for the next three systems has been committed by France, Italy, and Spain. Twenty European states are members of the PRACE Research Infrastructure (RI). Access to the PRACE resources will be through a single peer review process. The Scientific Steering Committee represents the user communities and guides the strategic directions. PRACE works closely with national, regional, and topical centers to shape the European HPC ecosystem. The PRACE-1IP project is designed to support the accelerated implementation of the RI. The project supports the evolution of the RI by refining and extending the administrative, legal and financial framework with focus on the specific requirements of industry. To enable world-class science on novel systems the project assists users in porting, optimizing and peta-scaling applications to the different architectures and deploys consistent services across the RI. The tools and techniques will be selected to have broad applicability across many disciplines. This is accompanied by advanced training in modern programming methods and paradigms, establishing a permanent distributed training infrastructure. The PRACE brand is already well established in the international HPC scene; extensive dissemination and outreach will be continued. The project advises PRACE on procurements of the next generation of systems. Finally, promising technologies, especially with respect to energy efficiency, will be evaluated with the ultimate goal to collaborate with industrial partners to develop products exploiting STRATOS, PRACE advisory group for Strategic Technologies created in the PRACE Preparatory Phase project.

Partner Serbia: **INSTITUTE OF PHYSICS (IPB)**

The Institute of Physics Belgrade (IPB, http://www.ipb.ac.rs/) was founded in 1961 by the Government of the Republic of Serbia with a mission to conduct high quality research in the area of physics. At present, it contributes more than 10% of the total scientific output of the country. In the past, IPB was involved in several Grid-related projects (EGEE-II, EGEE-III, SEE-GRID-, SEE-GRID-2, and SEE-GRID-SCI). Presently, IPB coordinates the Academic and Education Grid Initiative of Serbia. In SEE-GRID series of projects, IPB was leading SA1 activity, coordinating Grid operations in the region, interoperation and collaborative activities with EGEE and other regional Grid infrastructures.

IPB is designated by the Ministry of Science and Technological Development of the Republic of Serbia as the referent institution for HPC in the country and appointed to represent Serbia in European HPC-related projects. IPB is also designated by the Ministry as the host of the Blue Danube National Supercomputing and Data Storage Center, and as a coordinating institution of the seven-year National Supercomputing Initiative (2010-2016).

3.4. DARIAH-ERIC

Digital research infrastructure for the Arts and Humanities

About

DARIAH ERIC is a pan-European infrastructure for arts and humanities scholars working with computational methods. DARIAH enhances and supports digitally-enabled research, as well as the teaching of digital research methods, across the humanities and arts. It works with research and education communities to explore and apply ICT-based methods to research questions, new and old.

DARIAH is a network. It connects several hundreds of scholars and dozens of research facilities to improve research opportunities and outcomes through linking distributed digital sources materials and exchange knowledge, expertise, methodologies and practices across domains and disciplines.

DARIAH ERIC is hosted by France and has Austria, Belgium, Croatia, Cyprus, Denmark, Germany, Greece, Ireland, Italy, Luxembourg, Malta, Netherlands, Serbia and Slovenia as members.

The representing entity of the Republic of Serbia within DARIAH-ERIC is the Ministry of Culture and Information. The National Representative is the National Library of Serbia, whereas the National Coordinating Institution is the Belgrade Center for Digital Humanities.

Infrastructure and Services

Virtual Competency Centre (VCC) e-Infrastructure is responsible for DARIAH's technological foundations. It is working on a digital environment that allows to share community-developed data and tools to ensure the quality, permanence and growth of e-Infrastructures and technical services in the Arts and Humanities. Among our main goals is the availability of infrastructure services for as many researchers in the A+H disciplines as possible which consequently will safeguard Europe's role as a global player in the Arts and Humanities. This includes e.g.

- local data stores for the trustworthy management of research data: large national data archives as well as smaller specialized collections,
- digital scholarly tools: infrastructure components as well as digital research environments and
- standards to ensure interoperability across different locations, different disciplines, different scholarly and cultural traditions as well as different languages.

Working in VCC1 involves a great deal of interaction with both institutional partners such as humanities centers, data centers etc. and with developers and researchers.

Open Archive HAL is an open archive service, where authors can deposit scholarly documents from all academic fields. The service is available in English and French. It is a contribution to DARIAH from 2015

of the French Centre pour la Communication Scientifique Directe (CCSD). The CCSD a joint service center of CNRS, INRIA and the University of Lyon.

DARIAH Wiki is an internal resource of information on DARIAH, its plans and activities. People associated with DARIAH can generally get access to the wiki.

Digital Humanities Course Registry is an open online inventory of DH modules, courses and programs in Europe, which aims to help students, researchers, lecturers and institutions (from DARIAH and beyond) to find, promote and connect to teaching and training activities related to Digital Humanities. The registry can be used freely and without registration by students, teachers and anyone interested. In order to add your own courses to the database, you only need to register at the website. Upon approval by the National Moderator of your respective country, the course becomes visible on our interactive map. The DH Course Registry is a key DARIAH-EU service developed in the Working Group "Training and Education" of VCC 2 (Research and Education): a fine showcase of European collaboration, the registry has been conceptualized, realized and sustained by colleagues from The Netherlands, Germany, France and Austria, with additional data and feedback provided by colleagues from Switzerland, Ireland, Spain, Serbia and many more

The representing entity of the Republic of Serbia within DARIAH-ERIC is the Ministry of Culture and Information. The National Representative is the National Library of Serbia, whereas the National Coordinating Institution is the Belgrade Center for Digital Humanities.

Coordinator for e-Infrastructure: Zoran Ognjanović

Coordinator for Research and Education: Toma Tasovac

Coordinator for Scholarly Content Management: Adam Sofronijević

Coordinator for Advocacy, Impact and Outreach: Tamara Butigan

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3.4. ESS
European Social Survey

About

The European Social Survey (ESS) is a pan-European research infrastructure providing freely accessible data for academics, policymakers, civil society and the wider public. It was awarded European Research Infrastructure Consortium (ERIC) status in 2013. The work of the ESS ERIC includes organising a survey every two years measuring social attitudes and behaviour; utilising and developing the highest

standards in cross-national research; providing direct and virtual training programmes; and supporting free access to its growing data and documentation archive (www. europeansocialsurvey.org).

The European Social Survey ERIC was recognised as an ESFRI Landmark by the European Strategy Forum on Research Infrastructures (ESFRI) in March 2016. The announcement was a significant achievement for the ESS ERIC reflecting the maturity of the infrastructure.

The survey has measured the attitudes, beliefs and behaviour patterns of diverse populations in more than thirty nations. The main aims of the ESS are:

• To chart stability and change in the social structure, conditions and attitudes in Europe and to interpret how Europe's social, political and moral fabric is changing;

• To achieve and spread higher standards of rigour in cross-national research in the social sciences, including for example, questionnaire design and pre-testing, sampling, data collection, reduction of bias and the reliability of questions;

• To introduce soundly-based indicators of national progress, based on citizens' perceptions and judgements of key aspects of their societies;

• To undertake and facilitate the training of European social researchers in comparative quantitative measurement and analysis;

• To improve the visibility and outreach of data on social change among academics, policy makers and the wider public.

Participation of Serbia

Serbia officially became a member of the European Social Survey at the meeting of the General Assembly of the European Research Infrastructure Consortium held in February 2018 in Frankfurt.

ESS will involve over 100 social science researchers from Serbia and will bring multiple benefits to the Serbian research community: transfer of theoretical and methodological knowledge and practices; enhancing their visibility in international circles, as well as their inclusion in international academic networks. Serbian policy institutions will also benefit by accessing comparable research data from over 30 European countries.

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4. Research Infrastructures under development

4.1. CENTER FOR MOLECULAR MEDICINE AND STEM CELL RESEARCH

Faculty of Medical Sciences, University of Kragujevac

About

Center for molecular medicine and stem cell research was established at the Faculty of Medical Sciences, University of Kragujevac in December 2013. Core research activities of the Center include: Testing of new cellular and molecular determinants important in the development of organ specific autoimmune and growth and metastasis of experimental tumors; Examination of stem cell characteristics as well as the applicability of embryonic stem cells, induced pluripotent stem cells, and adult stem cells (Regenerative medicine); Investigation of the importance of congenital immunity in the pathogenicity of periapical granulomas (Pathogenesis of peripacial lesions); Examination of the type of receptors and ion channels through which endothelin, complexes with gold and platinum, and drugs from the group of antidepressants, antipsychotics and antihypertensive agents affect the tone and spontaneous activity of the isolated smooth muscles of the gastrointestinal and urogenital tract; Determination of genetic changes, biochemical disorders of signaling pathways and immunophenotyping changes in patients with leukemia, lymphoma, lung tumor, colon tumors, breast tumors and odontogenic tumors of the face; Analysis of processes and materials for the effective removal of toxic substances that enter into the environment (water courses, soil and food), and which show genotoxicity; Examination of the immunostimulatory and cytotoxic characteristics of the peptide and the compound of the metal complex (gold, platinum, ruthenium). Every other week, the Center organizes laboratory meetings and journal discussions at the Faculty of Medical Sciences.

Infrastructure and Services

NO INFO FOUND.

Collaborations

Cooperation with the international scientific community is reflected through collaboration with leading scientists from abroad and organization of scientific meetings and conferences.

International projects: Centre for Pre-Clinical Testing of Active Substances - CPCTAS FP7, Galectin-3 in the pathogenesis of type 2 diabetes: the role in ß-cell proliferation, insulin secretion and anti-inflammatory mechanisms within islets, Role of blood flow and SDF-1/CXCR4–induced recruitment of mononuclear cells in intussusceptive angiogenesis

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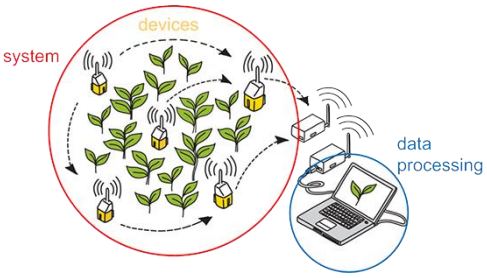
4.2. BIOSENSE INSTITUTE
University of Novi Sad

About

Recognizing that ICT today plays a pivotal role in ensuring sustainable, smart and inclusive growth of agriculture, the Research and Development Institute for Information Technologies in Biosystems, also known as the BioSense Institute, has been founded to focus multidisciplinary, game-changing and needs-driven research and disseminate it to a global ecosystem of forward-looking stakeholders. BioSense cross-fertilizes two most promising sectors in Serbia: ICT and agriculture. Multidisciplinary research is performed in the fields of micro and nanoelectronics, communications, signal processing, remote sensing, big data, robotics and biosystems, with a common goal to support the development of sustainable agriculture and create a positive impact to the lives of people. Bio-Sense advances and integrates all that ICT can offer today – nanomaterials, low-cost miniature sensors, satellite imaging, robotics, big data analytics – to provide as much information as possible to the agricultural sector. The final goal of BioSense is to incorporate all efforts and results of various research groups into a unique BioSense integrated system for agricultural monitoring. The Institute fosters close cooperation with 68 researchers from various fields (including 28 with a PhD degree) and relies on the state-of-the-art laboratories, foremost in this part of Europe.

Infrastructure and Services



Main fields of research performed at BioSense Center involve ICT as the core tool to address challenges in Environment, Agriculture, Forestry and Ecology, such as: Sustainable Agriculture, Water Management, Desertification, Air Pollution, Biodiversity, Habitat Preservation etc. This structure consolidates and shares knowledge and experiences from a range of fields and allows the Center to address different research and technological challenges: from development of novel sensors for detection and measurement of specific pollutants, to the integration of EO data into a unique data base.

Laboratories:

Nano and Microelectronics Laboratory Unique in the region, it has been established to support the development of new sensors for agricultural, environmental and food security sectors, such as semiconducting, microwave, chemical, optical, or magnetic sensors. To support this multidisciplinary approach, a unique scientific infrastructure has been established, comprising of clean room facilities (ISO_5…), state-of-the-art fabrication equipment and new generation measurement instruments.

Fabrication capacities

Research and development of sensors and sensing devices currently not available on the market is based on multidisciplinary fabrication approach. Namely, solutions are sought by combining various nano- and microelectronic fabrication technologies, realized on a wide range of flexible, rigid or robust substrates with a variety of functional layers. The following facilities are available in-house at the BioSense Laboratory:

Infrastructure:

1) Clean room 1 – photolithography, nano and MEMS, class ISO 5 / ISO 7 (ISO 146441), DI water Grade 1 (ISO 3696), nitrogen, argon and air class ISO 5, vacuum;
2) Clean room 2 – thin and thick films Class ISO 5 / ISO 7, DI water Grade 3 (technical water), nitrogen and air class ISO 5, vacuum;
3) Clean room 3 – nano and micro manufacturing, characterization & measurement, optical laboratory, class ISO 8, nitrogen and air class ISO 5, vacuum;
4) Chemical laboratory – general chemistry, nanomembranes, nano-structured films, DI water Grade 2, nitrogen and air, vacuum;
5) Mechanical and electronic workshop.

Photolithography process down to 1 µm

Essential to any part of microfabrication process, photolithography process is used to pattern thin films that can be used to realize sensing elements with enhanced sensing effect. Complete photolithography line for thin films, with resolution 1 – 100 µm. The equipment is located in clean room class ISO 5 / ISO 7 and it comprises the following:

Capital equipment:

Wet bench Class One (USA), Mask aligner Karl Suss MJB4 (Germany), Spin coater – Laurell WS-650Mz (USA), Mask writer Rofin-Sinar Power Line D-100 (Germany), UV exposure unit Technigraf Variocop S (Germany);

Supporting equipment:

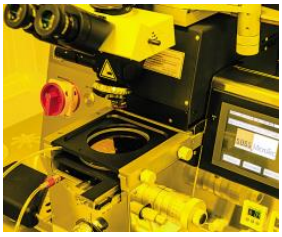
Memmert oven UN30 2pcs. (Germany), Ultrasonic cleaner Telsonic Tec – 25 (Swiss), Magnetic stirrer Yellow line MSH (Germany), Refrigerator Elin (Germany), glassware, tools;

Thin films

A number of sensors for liquid and gaseous chemicals are based on thin film technology. Owing to this technology one is able to fabricate optical filters and observe plant's health in certain parts of the electromagnetic spectrum. Thin films are also used to enhance sensor durability in the field since it enables the realization of hard layers and protection coatings against corrosion/oxidation. Deposition of thin films with thickness range of nm-µm, on commercially available substrates or on pre-deposited layers. Thin layer deposition includes thermal deposition, e-gun and sputtering in vacuum or reactive atmosphere. Also, thin films with atomic precision of thickness can be realized using

automatized layer-by-layer deposition and spin-coating. The equipment, located in clean room class ISO 5 / ISO 7, includes:

Capital equipment:



Thermal evaporation, e-gun, sputtering system Leybold Heraeus L560Q (Germany), Potentiostat/Galvanostat PAR Model 273A (USA), Spin-coater TORCH (China), Plasma generator Comdel CX 600 (USA), Laser system Rofin-Sinar Power Line D – 100 (Germany);

Supporting equipment:

Robotic arm Arrex RA1-Pro for layer-by-layer deposition, Memmert oven UN30 (Germany), Ultrasonic bath Bandelin Sonorex (Germany);

Thick films

Thick film technology has two major application areas: supporting structures (housing, hybrid circuits, integrated sensors and multisensors) and thick film layers as primary transducing elements in gas, chemical, humidity, thermal flow, pressure, and temperature sensors.

Thick film technology involves the deposition of a number of layers of conductor, resistors, and dielectric materials onto rigid or flexible substrates (ceramic, glass, polyimide film, paper, etc.) using screen/stencil printing, inkjet printing or spin coating techniques. Thick films can be deposited more efficiently by electrochemical techniques of electroplating and selective oxidation of metals. In addition, all listed thick film methods can be combined on the same substrate. Laser trimming process is used for structuring of thick films. The equipment is located in clean room class ISO 5 / ISO 7 / ISO 8, and it includes the following:

Capital equipment:

Screen and stencil printer EKRA M2H (Germany), Ink-jet printer Fuji Dimatix DMP-3000 (USA), Potentiostat/Galvanostat EGG 730A (USA), Spin-coater TORCH (China);

Supporting equipment:

Memmert oven UN20 (Germany), Ultrasonic bath Bandelin Sonorex (Germany);

LTCC

LTCC (Low Temperature Co-fired Ceramics) technology simultaneously fulfills the requirements for miniature size, low cost, and high resistance to harsh environment, needed in outdoor sensing and communication applications. In addition, LTCC supports fabrication of complex, three-dimensional structures with integrated electronic components, and micromechanical and microfluidics elements into a lab-on-chip and advanced sensor. LTCC equipment is located in clean room class ISO7/ISO8 and comprises the following:

Capital equipment:

Screen printer and doctor blade EKRA M2H (Germany), Box furnace Nabertherm L9/11/ SKM (Germany), Uniaxial press Carver 3895CEB (USA), Laser cutter Rofin-Sinar Power Line D – 100 (Germany);

Supporting equipment:

Dryer Memmert UN30 (Germany), UV exposure unit Technigraf Variocop S;

MEMS

Micro-electro-mechanical systems (MEMS) can realize a large number of microsensors for almost every possible sensing modality (pressure, temperature, chemical species, magnetic fields, radiation etc.). Furthermore, MEMS can perform actuation and therefore allow simultaneous sensing and control of the environment. Owing to the in-house facilities MEMS can be fabricated using thin/thick film deposition, photolithography, electroplating, laser machining, and inkjet printing.

Acoustic metamaterials

Artificial structures composed of sub-wavelength elements that exhibit acoustic phenomena generally not found in nature, allow us to tailor effective mass density and effective compressibility of acoustic structures. With the help of acoustic materials nonreciprocal acoustic devices (acoustic circulators and diodes) or acoustic cloaking devices have become possible.

Nanomembranes

One of exclusive technologies available in the Laboratory are nanomembranes – ultrathin structures with thickness of several atomic layers) and with large area of few cm2. Since they can be made surprisingly robust or designed to offer “smart” functionalities, similar to selective cell membranes, nanomembranes exhibit a practically unlimited potential for applications in sensor design, energy conversion, etc.

Chemical laboratory

For synthesis and analysis of various materials used in available fabrication technologies for sensor design.

Equipment: Ultrasonic homogenizer Bandelin ND-70 (Germany), Ultrathermostat bath Haake B7 (Germany), Magnetic stirrer IKARTC (Germany), Robotic Arm Arrex Pro (China), glass and plastic ware;

Optical laboratory

Optical sensors have wide application in environmental sensing – they can sense the quality of water, photosynthetically active radiation, plant’s health and many more environmental parameters can be monitored by optical sensors. Optical laboratory enables spectroscopy and optical inspection in UV, VIS and IR spectra, as well as surface analysis with resolution of 10 nm. Optical laboratory also facilitates a dark room equipped with an optical table and accessories for setting up variety of optical experiments. The following equipment is included in the optical laboratory:

Equipment: Optical tables Newport with accessories, FTIR/FT-NIR spectrometer Interspec 301-X, DSH-L6/L6S Series UV-Vis Spectrophotometer, Microscopes Baush & Lomb, Optical profilometer Huvitz HRM-

300, Hyperspectral camera 400 – 1000 nm SPECIM SP-HS-CL-30-V10E-Std, Hyperspectral camera 900 – 1700 nm SPECIM SPNIR-VLNIR-CL-100-N17E, Hyperspectral camera 600 – 975 nm Ximea MQ022HG-IM-SM5X5-NIR;

Electronic & Mechanical workshop

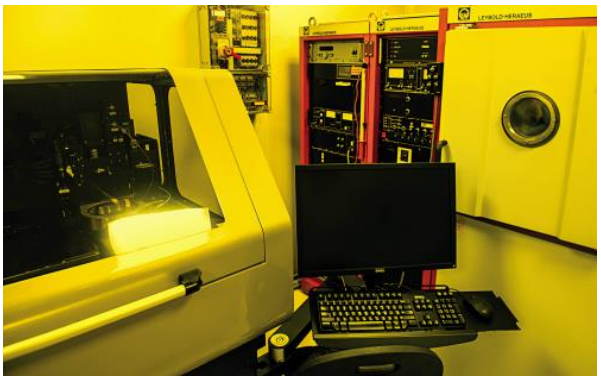
Electronic workshop serves as a unit for assembling sensor prototypes, microwave circuits and supporting electronics. Designed devices can be integrated into supporting electronics by means of soldering and wire bonding. Mechanical workshop is mainly used for manufacturing of a special experimental apparatus. Its capacities are well suited to fabricate microwave waveguides, acoustic devices, housing for sensors and a variety of aids for available technologies in BioSense laboratory. In this manner, developed devices are prepared for the measurement and characterization. The workshop facilitates the following equipment:

Capital equipment: Machining center Bernardo Proficenter 700 BQV (Germany), 4 – axe CNC mill Syil X5+ (China), Wire bonder (K&S 4124), 3D printer Felix 3.0;

Supporting equipment: Small machines and tools.

Characterization and measurements

Designed to serve all other technologies. The following equipment is primarily used for characterization and measurement:



Capital equipment: Electron microscope with EDX and surface analysis Hitachi TM3030 (Japan), Nano Indenter Agilent G200 (USA), Hall Measurement System Ecopia HMS-3000 (USA), Vector Network Analyzer Agilent E5071C (USA), Semiconductor parameter analyser HP 4145A (USA), System multimeter HP 3457A (USA), Digital oscilloscope HP545120B (USA), Probe station Ultracision 680E (USA), Lock – In amplifier EGG SR530 (USA), Thin film measurement Inficon XTC (USA), Surface analyzer Huvitz HRM-300 (Korea), Surface profile measurement TIME TR-200 (China), Optical table Newport 60 x 60 + Optical table Newport 90 x 60 cm with accessories (USA), UV- Vis monohromator Yobin Ivon H20 (France), UV – Vis spectrometer UV-6300PC (China), FTIR spectrometer Interspec 301X (Estonia), Mass spectrometer MKS – PPT-1A-200FC (USA), UV fluorescence microscope B&L Balplan (USA), IC microscope B&L Balplan (USA), XRF ANALYSER Olympus DP-DP-2000-CX-E-EN-ENAP, Thermovision system FLIR i7 (USA);

Supporting equipment: Microscope Müler Researcher (Germany), Oscilloscopes Tektronix 7623A, Tektronix THS720A, UNI-T (USA), Thickness measurement Mutotoyo – Absolute (Japan), power sources 10 V – 10 kV, analog and digital instruments (moisture & humidity, temperature, pressure, particle counter, UV dose, lux-meter, sound level, pH-meter, conductometer, etc.);

Remote Sensing and GIS Laboratory supports research activities of the Institute in the fields of processing, storage and retrieval of data acquired from multimodal sensors, integration of large

amounts of multimodal data acquired from different sources (such as WSNs, satellites, meteorological measurement stations, field surveys, etc.), development of systems for instant access to relevant data presented in the most informative manner to end-users (such as GIS database), as well as in the development of imaging techniques and state-of-the-art machine learning approaches such as support vector machines, deep learning and evolutionary algorithms.

Equipment: Thermal camera FLIR SC620 Researcher; 4-channel multispectral camera with 4 lenses TeraCam MCA; 3-channel multispectral camera with one lens Weatherproof ADC II "Air"; Hyperspectral camera 400 – 1000 nm SPECIM SP-HS-CL-30-V10EStd; Hyperspectral camera 900 – 1700 nm SPECIM SP-NIR-VLNIR-CL-100-N17E; Hyperspectral camera 600 – 975 nm; Ximea MQ022HG-IM-SM5X5-NIR; EM probe Geomatrix EM38MK2;2 UAV lightweight airplanes, MicroPilot; 2 UAVs with paraglide, Vision du Ciel; Professional WSN kits at 2.4 GHz, Crossbow; Professional WSN kits on 868/916 MHz, Crossbow; Development WSN kits for IRIS platform, Crossbow; Development WSN kit at 2.4 GHz, Crossbow; Large range eKo WSN kit at 2.4 GHz with wired sensors, Crossbow; TinyNode WSN kit with 65 sensors, TinyNode; Data base server with GIS support; Educational WSN kit with accessories, Crossbow; Development kit of IMOTE2 WSN for integration with image sensors, Crossbow; Development kit for radio communications with WSN, EBV; GPRS gateways, HCP; BRP Outlander L MAX 450 DPS, Robotic sensor platform Clearpath Robotics Husky A200 UGV.

Knowledge Discovery Laboratory provides support to the Institutes' research activities in the development of advanced mathematical techniques and pattern recognition algorithms aimed at discovering of interdependencies and correlations hidden within large sets of data.

Equipment: HP ProLiant ML370 G6 Large Form Factor Tower High Performance Server hardware; SERVER HP ML330 G6 hardware; Data base server with GIS support; Datalogger Grant Squirrel SQ 2040 with accompanying equipment, Tectra AG; Sun Blade 2500 Workstation.

Mechatronics and Robotics Laboratory conducts Institute's research in agro-robotics and identification technologies, including the development of interfaces for presenting information in a clear and intelligible way for all types of operators, as well as the application of multiple sensing modalities for the assessment of crops, detection of crop and field boundaries, identification of novel events in the agricultural environment, optimization of yield, etc.

Equipment: Robotic sensor platform Clearpath Robotics Husky A200 UGV, BRP Outlander L MAX 450 DPS; Identification technologies: RFID readers/writers, UHF, HF and LF, barcode scanners, biometrical readers; Motion control: linear electric and pneumatic actuators, frequency and servo regulators, position sensors; Process control: PLC (10 types), SCADA systems, industrial PCs, pneumatic and electro pneumatic components, various sensors.

Collaborations

BioSense Institute coordinates or participates in a large number of international research projects, including Horizon2020, FP7 and Eureka.

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6.4.3. VERROCCHIO

Institute of Physics Belgrade

About

Verrocchio Center is a dedicated educational-innovation facility at the heart of the Danube campus of the Institute of Physics Belgrade (IPB), the first National Institute of the Republic of Serbia. The goal of Verrocchio Center is to forge education, research and innovation into unique creative process. Verrocchio aims to create a new type of educational framework fit for the needs of the post-industrial world. The endeavor gets its name from the Italian Renaissance sculptor and painter whose workshop was the place of training for several of Renaissance's greatest artists, including Leonardo da Vinci. Verrocchio Center is financed as a priority social innovation project of the Government of the Republic of Serbia with additional supported by IPB and its strategic partners: CERN, INFN and DESY. A key additional partner is the Petnica Science Center (PSC), a unique institution in Serbia that has for more than 35 years successfully worked with talented young people throughout the region interested in science and technology.

Working with its partners the ultimate goal of Verrocchio is to create an interlinked education and innovation environments embedded in established research centers throughout Europe. The goal will be achieved through the creation of a distributed institution that uses the technology and reality of the 21st century to bring together the successes of the Renaissance and the Age of Enlightenment (quality training and innovation) with those of the Industrial Age (massive outreach). The name and the history behind Verrocchio represent the fulcrum, while the High Energy Physics community in Europe (centered around CERN) represent the lever needed to set up a distributed network of interacting and complementary institutional experiments throughout Europe working to set up innovative learning through doing environments that are much more efficient in transforming potential creativity (existing in large segments of the population throughout the world) into manifest creativity of the highest level.

Partners and Roles

Institute of Physics Belgrade is the host institution of the Verrocchio Center and a first-class research institution from Serbia dedicated to the study of physics and related disciplines. IPB is one of Serbia's (and the surrounding region's) leading research institutions, and the first National Institute of the Republic of Serbia. IPB is host to four EU centers of excellence, two ongoing CERN collaborations, an active ERC grant, a dozen H2020 projects as well as around 100 smaller international projects. IPB is unique in Serbia and the region in that it has stopped brain drain through setting up a sustainable and robust process of two-way researcher mobility – EU funding has been absolutely crucial in realizing this milestone. IPB has ongoing strategic partnerships with leading European institutions, including CERN, INFN and DESY collaborating with them to bring best practices in research, innovation, education and organization to Serbia and the wider region. IPB is host to a substantial part of the national research

infrastructure related to physical sciences, new materials and information technology. Its Danube Campus is also home to commercial spin-off companies and the IPB Innovation Center.

Government of the Republic of Serbia has agreed to fund Verrocchio Center as priority social innovation project. The funding covers cost of building and basic equipping of Verrocchio facilities.

Verrocchio Center is a product of collaboration with leading research institutions and **IPB strategic– The European Organization for Nuclear Research (CERN), Italy's National Institute for Nuclear Physics (INFN) and DESY, the largest scientific facility in Germany**.

Verrocchio Center is currently in the process of mapping out a **network of local academic and business partners** (Universities, Faculties, National Institutes and other relevant institution) that will play a central role for guaranteeing the necessary number and quality of incoming students, as well as the relevance of training conducted to the

The construction of Verrocchio Center is funded by the Government of the Republic of Serbia, sustainability of functioning is guaranteed by IPB, while IPB strategic partners CERN, INFN and DESY have pledged their support for equipment, training and mobility. The strategic partners have also committed to facilitating integration of Verrocchio into a network of related multidisciplinary initiatives throughout Europe.

Infrastructure and Services

Verrocchio's mission is to conduct advanced project-centered training of undergraduate and graduate students. This specialized training is designed to be multidisciplinary and geared towards teamwork focused on the realization of ambitious innovative projects implemented through one or more year-long modules. Verrocchio relies heavily on the existing expertise and scientific and technological infrastructure of IPB and its partner institutions. For this reason, while being multidisciplinary, the projects implemented will be a bit more centered on the physical sciences and their associated technologies. Individual projects vary from year to year, and the themes of these projects determine the composition (and skills) of the corresponding generation of Verrocchio students. The project-centered training conducted is designed to serve as a complement to the (dominantly theoretical) educational process through which students go through during their undergraduate studies in Serbia and the surrounding region.

At the same time, Verrocchio Center is a fabrication and test facility dedicated to the realization of research and innovation projects related to international programs for the development of new generations of accelerators and detectors. Within these activities will be realized key components of the technological cooperation between the Republic of Serbia and CERN and other leading High Energy Physics centers. These activities represent an important part of IPB activities related to innovation and commercialization. At the same time, they are expected to boost the efforts of IPB in both research and education. In fact, the key aspect of the Verrocchio process is to forge education, research and innovation into a unique creative process. Verrocchio will also serve as a hub for building stronger ties between academia and companies making up Serbia's growing IT sector. All of these activities tie in crucially with the realization of the key stated societal goals of IPB as the first National Institute of the Republic of Serbia.

Verrocchio Center is currently in its two-year pilot phase which coincides with building and equipping of its specialized facilities: one building primarily dedicated to education and training (3000 square meters) and another dedicated to prototyping and innovation (Prototype Fabrication Facility, 2000 square meters). During the pilot phase Verrocchio relies on the existing capacities of IPB and those of the Petnica Science Center (PSC). Full implementation of Verrocchio will start in 2021.

Most of the research and education activities will be undertaken in the Main Building of the Verrocchio Center, while prototyping and innovation activities will primarily be realized in adjoining and specially equipped Prototype Fabrication Facility. The sky bridge connecting the two buildings gives a symbolic link between these two principle types of activities of the Verrocchio Center.

Although these two principle activities define Verrocchio, they do not exhaust its planned field of actions. During those times when the principle activities are not at their peak, a series of special events will be organized (both at Verrocchio and the surrounding IPB campus) that in different ways depict exciting areas in which research, education and innovation interweave, and promote creativity, curiosity and innovation spirit. Examples of these activities are: organizing scientific and technological challenges, hackathons, workshops, think tanks, various expert and popular lectures, open days for students and the general public, teacher training courses.

The common goal of all these activities is to connect the general public (especially young people) with researchers and other experts from IPB, with students trained at Verrocchio Center, with visiting experts from the world's top scientific and technological centers. All these diverse activities bring together and link people with the goal of generating new ideas and working together in a specific environment that fosters creativity, multidisciplinary and teamwork, and focus those efforts on the solving of specific societal challenges.

Collaborations and Projects

Verrocchio Center fills an important gap in the innovation sphere in Serbia, the region of Eastern and South-Eastern Europe, and indeed in Europe. It will operate as an academic incubator, building a bridge between universities, as teaching institutions, the research establishment, talented students and business – particularly investors ready to support start-ups. The particular focus will be on the development of new technologies in high energy physics, including new generations of accelerators and detectors. When successfully implemented, it can become a model for inspiring innovation actors around the globe. Ultimately Verrocchio Center plans to become a network of networks, connecting research establishments, hubs, science and technology parks, etc.

Verrocchio Center will create a new environment for advanced project-centered training of underground and graduate students, under leadership of highly professional mentors from the IPB and PSC, from CERN, INFN and DESY, as well as from other relevant institutions.

The technological and innovation activities that will be undertaken will loosely fall into three broad categories of flagship projects:

1. Activities related to existing CERN obligations with defined partners and timelines. These projects are clearly anchored in existing activities, obligations and timelines of Serbia as CERN member, of IPB and its strategic partners.

2. Multidisciplinary projects that are wider, that branch off and have less definite timescales, e.g. various bio mimicry activities along the line of the initiated activities IPB is already conducting under the name Teslagram, various activities related to high performance computing and complex system modelling as key IPB strengths.
3. Activities and projects centered around software engineering, e.g. data mining, socio-economic modeling, visualization and analysis.

In addition, Verrocchio will also conduct a wide array of miscellaneous activities and projects targeting in particular the needs of the ICT sector, e.g. hosting technological challenges, hosting multi-disciplinary think tanks.

Governance

The key scientific and technological advisory body at the center of the Verrocchio initiative is its International Advisor Board (IAB) consisting of the following members:

- Prof. Rolf Heuer, President Deutsche Physikalische Gesellschaft (DPG), Former Director General CERN (President of Verrocchio IAB)
- Prof. Fernando Ferroni, President Istituto Nazionale di Fisica Nucleare (INFN)
- Prof. Antonio Zoccoli, Vice President Istituto Nazionale di Fisica Nucleare (INFN)
- Dr. Manfred Krammer, Head of Experimental Physics department, European Organization for Nuclear Research (CERN)
- Dr. Markus Nordberg, Head of IdeaSquare, European Organization for Nuclear Research (CERN)
- Prof. Joachim Mnich, Director for Particle and Astroparticle Physics, Deutsches Elektronen-Synchrotron (DESY)
- Prof. John Ellis, Clerk Maxwell Professor of Theoretical Physics, King's College London

Once Verrocchio Center is completed and starts running a Governing Body will be formed consisting of the representatives of all relevant stakeholders including Government of the Republic Serbia, Strategic partners and IPB. At that point IAB will answer to that Governing Body in their capacity of scientific and technological advisors.

Contact information
Responsible person: Aleksandar Bogojevic, PhD
Address: Pregrevica 118, 11080 Belgrade, Serbia
Phone: +381 11 3713 152
E-mail: alex@ipb.ac.rs

4.4. ASTRONOMICAL STATION VIDOJEVICA
Astronomical Observatory of Belgrade

About

Founded jointly with the Meteorological Observatory on April, 7 1887, the Astronomical Observatory of Belgrade (AOB) is one of the oldest scientific institutions in Serbia. Scientific research carried out at the AOB closely followed the trends in the astronomical and astrophysical research of the 20th century, from observations of minor planets, comets and double stars and determination of their orbits, stellar photometry, spectroscopy and polarimetry (mostly eruptive stars, cool supergiants and Be stars), spectrography of the Sun and monitoring of the large scale photospheric motions to modelling of line emission in a large variety of astrophysical plasma. Research is financed by MoESTD, though a 4-years project grants at the Department for basic research, section Earth sciences.

Astronomical Station Vidojevica is an observation site established by AOB, where observations of celestial objects are carried out for the purpose of their study. AS Vidojevica is located on Mt. Vidojevica near Prokuplje, at an elevation of 1150m. In the previous years, the living pavilion (main HQ building) and the dome for the 60cm telescope have been constructed on the site.

The site itself is reserved for the construction of the new telescope "Milankovic", with an automated dome and an auxiliary building for technical equipment, service and computer systems. AZ1400 "Milankovic" 1.4 m big telescope arrived on April 28, 2016, and is mounted in a temporary roll-roof pavilion.

As satellite data shows, Mt. Vidojevica is one of the few places remaining in Serbia with a dark night sky. This year we will initiate a detailed measuring campaign to quantify the astro-climate conditions on the summit itself. These measurements are necessary for the efficient exploitation of the future instruments. An automatic meteorological station, all-sky camera and a seeing monitor will be placed on the summit in the near future. We are also working on establishing Internet connection on the AS Vidojevica, so that all measurements are available in real time on-line.

Infrastructure and Services

AOB purchased one 60cm Cassegrain telescope from Astrooptic company in Austria (which in the meanwhile became part of the Astro System Austria - a much bigger company in Austria for manufacturing telescopes) in 2005. It was finally installed and rectified in Jun 2011 and began to work in the same month.

AOB provided several cameras and instruments to be able to work on both the 60cm Cassegrain and the future 1.5m Nasmyth telescopes. These instruments are: Apogee U42, Apogee E47+, SBIG ST-10ME, SBIG AO-7 Adaptive Optics, OPTEC Intelligent Filter Wheel, SpectraPro 750 portable spectrograph.

Collaborations

A number of national projects are implemented with the use of the resources in Vidojevica: ON176001 Astrophysical spectroscopy of extragalactic objects**,** ON176002 Influence of collisional processes on the astrophysical plasma**,** ON176003 Gravitation and structure of universe on large scales**,** ON176004 Stellar physics, ON176011 Dynamics and kinematics of celestial bodies and systems, ON176021 Visible and invisible matter in nearby galaxies: theory and observations, ON44002 Astroinformatics: Application of IT in astronomy and related fields of research

The station is also being used within Serbia's participation in the EU framework project: **VADMC (Virtual Atomic and Molecular Data Center) – Grant Agreement # 239108.**

Contact information **Astronomical Observatory Belgrade**

Responsible person: Gojko Djurašević

Address: Volgina 7, P.O.Box 74, 11060 Belgrade, Serbia

Phone: +381 11 2419553

Contact information **AS Vidojevica**

Address: Coordinates: longitude: 21° 33' 20.4"; latitude: 43° 08' 24.6"; elevation: 1150 m

Phone: +381 11 2419553; +381 27 310 177

E-mail: contact@aob.rs

ANNEX B: Draft Guidelines for Call for Proposals

DRAFT GUIDELINES, RULES AND EVALUATION PROCEDURES

The purpose for this document is to provide the guidelines for the public consultation process through which priority Research Infrastructures will be selected as part of the revised Research Infrastructure Roadmap of the Republic of Serbia. The document also outlines the rules for application and the procedure through which the proposals will be evaluated and selected.

1. Background information

The Ministry of Education, Science and Technological Development (MOESTD) of the Republic of Serbia has launched the revision of the national Research Infrastructure (RI) Roadmap.

The objective of the RI Roadmap is to guide future national investments into research infrastructure, to enable stronger integration into the European Research Area (ERA), to foster regional cooperation and to create conditions for scientific excellence and innovation in Serbia. The RI Roadmap IS NOT a list of projects that will automatically receive financing from the budget or external sources. The title of priority research infrastructure which the proposed projects will receive will only serve as guidance for future investments.

2. Definition of Research Infrastructure

For the European Commission[9], the term 'research infrastructures' refers to **facilities, resources and related services** used by the scientific community to conduct top-level research in their respective fields, ranging from social sciences to astronomy, genomics to nanotechnologies. Examples include singular large-scale research installations, collections, special habitats, libraries, databases, biological archives, clean rooms, integrated arrays of small research installations, high-capacity/high speed communication networks, highly distributed capacity and capability computing facilities, data infrastructure, research vessels, satellite and aircraft observation facilities, coastal observatories, telescopes, synchrotrons and accelerators, networks of computing facilities, as well as infrastructural centres of competence which provide a service for the wider research community based on an assembly of techniques and know-how.

RIs may be **'single-sited'** (a single resource at a single location), **'distributed'** (a network of distributed resources), or **'virtual'** (the service is provided electronically). RIs offer **unique research services** to users from different countries, attract young people to science, and help to shape scientific communities.

For the purpose of developing the Research Infrastructure Roadmap of the Republic of Serbia the abovementioned EU definition will be followed. The Roadmap will distinguish between the development of national RIs and the participation of Serbian researchers in international RIs. A national research infrastructure is an RI that has at least national relevance, with a strong potential for regional or international relevance.

[9] https://ec.europa.eu/research/infrastructures/index_en.cfm?pg=what

3. Public Consultation Process

Priority Research Infrastructures in the Republic of Serbia will be selected based on an open consultation process with the scientific community followed by both international and domestic review of proposals that are received.

Timeline: The consultation process will last for one month starting from XXXX. Applications can be sent to the attention of XXXX at the Ministry of Education, Science and Technological Development until 5 PM on XXXXX. Following this period the MoESTD will conduct the evaluation process and draft the RI Roadmap. The draft RI Roadmap containing the selected priority research infrastructures will be shared with the National Council for Science and Technological Development and other relevant stakeholders prior to adoption by the Government of Serbia. The final document will be available on the MoESTD website.

Eligibility: Applicants can be individual research organizations in Serbia (registered according to the Law on scientific research activities) or consortia of institutions (individual researchers in their personal capacity are not eligible to apply). If a single research organization is applying, this does not imply that the whole institution must become a research infrastructure. The research organization can apply for a research center or unit within this organization to become a national RI. If a consortium is applying, a lead institution must be selected. The lead institution must be a research organization in Serbia, however the consortia can also include other types of relevant actors (private sector, civil society, innovation support institutions, hospitals and other). No priority scientific domains are defined. Researchers are invited to submit proposals from all areas of both basic and applied research.

Proposals for priority RIs: Applicants can propose either the development of a national research infrastructure or the participation of their institution (or the country as a whole) in an international research infrastructure. Both types of proposals will be evaluated against the same set of criteria. Researchers are encouraged to consult the ESFRI Roadmap[10] to determine whether priority EU RIs are potentially of interest for membership and to consult with their colleagues in the same research field to submit joint applications for participation in such RIs.

Language: The entire application process is conducted in English. The reason for this is to secure international evaluation of the applications, to ensure comparability with EU methodology for RI Roadmap development and to ensure the international relevance of the proposals. Supporting documentation can be provided in Serbian if it is not available in English.

4. Evaluation criteria and procedure

The proposals received through this public consultation process will be evaluated against the following set of criteria:

1. Applicants: Preference will be given to consortia applications which include all potentially relevant stakeholders (users of either domestic RI or international RI). Applicants will also be evaluated against their scientific accomplishments so far, their participation in international projects and in the case of applied research there existing links with industry.

[10] http://www.esfri.eu/sites/default/files/20160308_ROADMAP_single_page_LIGHT.pdf

2. Feasibility of implementation: Proposals with a higher degree of preparation will be scored higher. In the case of domestic RIs this implies that feasibility studies or detailed plans have already been developed. For membership in international RIs this implies that communication with the management of the international RI has already been established and there has been interest expressed for institutions from Serbia to join.

3. Scientific excellence: Proposals will be evaluated against how the proposed RI can improve scientific excellence and relevance in Serbia, how many young researchers can it help develop, how many existing researchers can use this RI, will it improve mobility and international cooperation.

4. International cooperation: Preference will be given to those Proposals which have a clear plan and potential to develop regional and international cooperation, to attract top researchers and to improve Serbia's capacities to obtain Horizon 2020 or other international projects.

5. Socio-economic impact: Proposals will be evaluated against their potential impact on the economy and society as a whole based on the potential to create links with industry, to solve relevant economic and societal challenges for Serbia, to spur innovation, support the development of startup companies and to develop new applicative technologies.

6. Financial aspect: As the RI Roadmap does not have a direct budget associated with it, the level of financing itself will not be a primary evaluation criteria. What will be scored is how well the financial planning estimates have been made and how much of an effort has been put already (or is planned) into obtaining alternative sources of funding. Annual operating costs will be assessed in terms of their proportionality to the benefits for the Serbian science, industry, economy and society.

Evaluation procedure

Each Proposal will be evaluated by two international reviewers, which will be selected by the Ministry of Education, Science and Technological Development, and who have expertise in the preparation of RI Roadmaps or the management of international RIs. In addition, a national committee established by the MoESTD will also evaluate the proposals based on inputs from international reviewers.

Each criterion will be scored from 1 to 5. Evaluators will receive additional guidelines on what each score implies for every individual evaluation criteria.

The international reviewers will evaluate criteria 1 through 4. The mean score for each criterion will be assigned to the application. The national committee will evaluate criteria 5 and 6.

In total, each application can receive a total of 30 points.

Proposals which receive a score of less than 3 on any individual criteria will not be considered for inclusion in the RI Roadmap. The highest scored 20 Proposals will be included in the RI Roadmap. They will be organized by research field and by whether they are domestic or international RIs. They will not be ordered in terms of the scoring they received (meaning that all selected priority RIs will be presented equally in the RI Roadmap in alphabetic order).

Proposals which are not included in the RI Roadmap as part of this consultation process will receive a short summary highlighting the key comments from the reviewers which can serve as additional guidance for further improvement of their proposals. Revisions of the RI Roadmap as expected every

three years when researchers will have a new opportunity to present their ideas for developing RIs in Serbia.

ANNEX C: Draft Application form for National RIs

DRAFT APPLICATION FORM FOR NATIONAL RESEARCH INFRASTRUCTURES

1. Information about Applicant

The applicant can be a research institution (as defined per Law on scientific research activities) or a consortia of research institutions. If a consortium of institutions is applying, one research institution must apply as the lead institution. The consortia can also consist of private sector actors, innovation centers, science and technology parks and other relevant partners but the lead institution must be a registered research institution.

Name of lead institution	
Responsible person	
Contact person	
Telephone no.	
E-mail address	
If a consortium of institutions is applying, please list all the institutions which are part of the consortia with a contact person in each of them:	
Brief description of the institution applying (if consortia is applying, then please provide brief description of each partner) with a particular focus on key fields of research, existing capacities, participation in international projects and other relevant information:	

2. Information about the proposed Research Infrastructure

For inclusion in the RI Roadmap, research institutions can propose either existing research infrastructures which require additional investments or construction of new research infrastructures.

Name of Research Infrastructure	

(Examples from ESFRI: Integrated Structural Biology Infrastructure, Extreme Light Infrastructure, European X-Ray Free-Electron Laser Facility, Consortium of European Social Science Data Archives)	
Abbreviation (Examples from ESFRI: INSTRUCT, ELI, European XFEL, CESSDA):	
Type of research infrastructure:	☐Single-sited ☐Distributed ☐Virtual
Class:	☐Major upgrade of existing Research Infrastructure ☐New Research Infrastructure
Website (if available):	
Image (please select an image that can represent your Research Infrastructure):	
Scientific domain (please select multiple answers if relevant):	☐Energy ☐Environment ☐Health and food ☐Physical sciences and engineering ☐Social and cultural innovation Sub-domain:_____
Background (Summarize the science background of your RI, the reference scientific community (-ies) and the current landscape, maximum 1000 characters with spacing):	
Description (Summarize the general characteristics and aim of your RI, including the impact on the quality and quantity of national and European research in the main field of action and the interdisciplinary aspects and potential socio-economic impact, maximum 2000 characters with spacing):	

3. Implementation details

Estimated costs in EUR (please feel free to provide justification	Design: Preparation:

for the estimates):	Equipment: Implementation (construction): Average annual operation costs:
Sources of financing (please describe potential sources of financing other than the Budget of the Republic of Serbia (private sector, Horizon 2020 and other) and the status of these funds (in application phase, approved…):	
Timeline (please provide an estimated timeframe for each phase of implementation in months):	Design: Preparation: Implementation (construction):
Preparatory work done so far (please summarise the actions which have been conducted so far to develop, plan, design this proposed Research Infrastructure):	
Does this Research Infrastructure require the construction of a new building? If yes, please describe the status of land ownership, construction permits, building design… If no, please describe the current state of the building which would house this RI and the existing equipment.	
Have any of these documents already been prepared (if yes, please feel free to submit them along with this application):	☐Feasibility study ☐Technical Design Report ☐Cost Benefit Analysis ☐Other technical documentation:
Human resources Does this Research Infrastructure require additional staffing? If yes, please describe the number and skills and competences needed. If no, please describe which existing staff will operate this RI and what are their competencies.	
Governance and management (Please describe what is the plan for governance and	

management of this Research Infrastructure. Will it be a separate legal entity (research organization) or a research center/facility within an existing research organization? Will it have a separate international Advisory Board? Is independent scientific monitoring and evaluation of its operations planned?	

4. Scientific relevance

Outline **the scientific vision and mission**, its short and long term impact on the main research field (-s) and its potential impact on other fields - if any - as well as on innovation	
Outline **the greatest scientific achievements** of the institution (or members of the consortia) submitting this application (articles, patents, EU projects, other international projects).	
How many **researchers in Serbia** can benefit from this RI (and from which institutions/ research centers/teams)?	
How many **international researchers** can benefit from this RI (and from which countries/institutions)?	
Would this national RI partner with any international research infrastructures and which ones?	
How would this RI positively affect **the development of young researchers** (number of PhDs per year, number of newly employed researchers and other estimates)?	

5. Socio-economic impact

Describe the expected **direct**	

economic impact of your RI, e.g. the economic impact from direct spending in the site and region hosting the facility or the headquarters and the nodes of a distributed RI:	
Estimate the **impact on the innovation activity** in the production of goods and services that will result from your RI, e.g. in terms of well-trained people, knowledge transfer, access programmes and services provided:	
Describe the potential and role your RI can play in technological and social innovation:	
Describe how your RI will contribute to **tackling societal challenges**:	
Have any private sector actors (or other relevant institutions such as civil society actors, hospitals, public institutions and other) already expressed interest in this RI? If so, please list (letters of support can also be sent along with this application)	

6. User strategy and access policy

Describe in detail the **user community** for this research infrastructure (with countries of origin, institutions and number of users where possible):	
Has the **user community been consulted** in any way in the preparation of this proposal? If yes, how have they been consulted.	
Describe the **user strategy** agreed within your consortium and the possibilities to develop a reasonably sized user community considering costs	

and services based on your identification of demands and needs:	
Describe the envisaged **access policy** of the proposed RI in terms of the conditions for access, the process of access and measures which will be implemented to facilitate access of various users:	

7. Supporting documentation

Please list any supporting documentation which is being submitted together with this proposal:
1.
2.
3.
4.

By submitting this proposal, the applicant is in agreement with the terms and conditions of the Public consultations for the development of the national Research Infrastructure Roadmap and agrees for the data submitted in this application to undergo international and domestic review and to be used for the preparation of the final document.

Submission date:

Name of responsible person:

Signature and stamp: _____

ANNEX D: Draft Application form for Participation in International RIs

DRAFT APPLICATION FORM FOR MEMBERSHIP IN INTERNATIONAL RESEARCH INFRASTRUCTURES

1. Information about Applicant

The applicant can be a research institution (as defined per Law on scientific research activities) or a consortia of research institutions. If a consortium of institutions is applying, one research institution must apply as the lead institution. The consortia can also consist of private sector actors, innovation centers, science and technology parks and other relevant partners but the lead institution must be a registered research institution.

Name of lead institution	
Responsible person	
Contact person	
Telephone no.	
E-mail address	
If a consortium of institutions is applying, please list all the institutions which are part of the consortia with a contact person (and e-mail address) in each of them:	
Brief description of the institution applying (if consortia is applying, then please provide brief description of each partner) with a particular focus on key fields of research, existing capacities, participation in international projects and other relevant information:	

2. Information about the international Research Infrastructure

For inclusion in the RI Roadmap, research institutions can propose to become members of international Research Infrastructures. These international RIs can be those that are listed in the European Strategic

Forum on Research Infrastructures (ESFRI) Roadmap[11], research infrastructures that are part of other national RI Roadmap's[12] or other international RIs.

Name of Research Infrastructure (Examples from ESFRI: Integrated Structural Biology Infrastructure, Extreme Light Infrastructure, European X-Ray Free-Electron Laser Facility, Consortium of European Social Science Data Archives)	
Abbreviation (Examples from ESFRI: INSTRUCT, ELI, European XFEL, CESSDA):	
Type of research infrastructure:	☐Single-sited ☐Distributed ☐Virtual
Class:	☐Operational research infrastructure ☐Research Infrastructure in the planning/construction phase
Website (if available):	
Image (please select an image that can represent this Research Infrastructure):	
Is this research infrastructure part of the ESFRI Roadmap? If not, is it part of any national roadmap or other relevant strategic document.	
Scientific domain (please select multiple answers if relevant):	☐Energy ☐Environment ☐Health and food ☐Physical sciences and engineering ☐Social and cultural innovation Sub-domain:_____
Background (Summarize the science background of this RI, the reference scientific community (-ies) and the current landscape, maximum 1000 characters with spacing):	
Description (Summarize the general characteristics and aim	

[11] http://www.esfri.eu/sites/default/files/20160308_ROADMAP_single_page_LIGHT.pdf
[12] A full list of EU member state RI roadmaps can be found here: https://ec.europa.eu/research/infrastructures/index_en.cfm?pg=esfri-national-roadmaps

of your participation in this RI, including the impact on the quality and quantity of national research in the main field of action and the interdisciplinary aspects and potential socio-economic impact for Serbia, maximum 2000 characters with spacing):	

3. Implementation details

Estimated costs of participation in EUR per year (please feel free to provide justification for the estimates):	
If this international RI is still in development/construction phase, would Serbia need to participate in the construction costs and to what extent?	
Sources of financing (please describe potential sources of financing other than the Budget of the Republic of Serbia (private sector, Horizon 2020 and other) and the status of these funds (in application phase, approved…):	
Timeline (please provide an estimated timeframe for membership in this RI):	
Preparatory work done so far (please summarise the actions which have been conducted so far to become a member of this RI and specifically whether contacts have been established with the management of this RI. If a support letter has been obtained from the management for Serbia to join, please submit it together with this application):	
Human resources Does participation in this Research Infrastructure require	

additional staffing? If yes, please describe the number and skills and competences needed. If no, please describe which existing staff will participate in this RI and what are their competencies.	
Rules and procedures for membership (Please describe what are the necessary steps for Serbia to join this international RI, whether any official negotiations have been conducted at any point and whether there are any special requirements for joining)	

4. Scientific relevance

Outline **the scientific vision and mission**, its short and long term impact on the main research field (-s) and its potential impact on other fields - if any - as well as on innovation in Serbia.	
Outline **the greatest scientific achievements** of the institution (or members of the consortia) submitting this application (articles, patents, EU projects, other international projects).	
How many **researchers in Serbia** can benefit from this RI (and from which institutions/research centers/teams)?	
How would this RI positively affect **the development of young researchers** (number of PhDs per year, number of newly employed researchers and other estimates)?	

5. Socio-economic impact

Estimate the **impact on the innovation activity** in the	

production of goods and services that will result from participation in this RI, e.g. in terms of well-trained people, knowledge transfer, access programmes and services provided:	
Describe the potential and role this international RI can play in technological and social innovation in Serbia:	
Describe how this international RI will contribute to **tackling societal challenges in Serbia**:	
Have any private sector actors (or other relevant institutions such as civil society actors, hospitals, public institutions and other) already expressed interest in this RI? If so, please list (letters of support can also be sent along with this application)	

7. Supporting documentation

Please list any supporting documentation which is being submitted together with this application:
1.
2.
3.
4.

By submitting this application, the applicant is in agreement with the terms and conditions of the Public consultations for the development of the national Research Infrastructure Roadmap and agrees for the data submitted in this application to undergo international and domestic review and to be used for the preparation of the final document.

Submission date:

Name of responsible person:

Signature and stamp: _____