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#### ESFRI, NEXT STEPS FOR THE NEW STRATEGY FOR EUROPEAN RESEARCH INFRASTRACTURES

Interview with José Luis Martínez Peña, Research Professor at Instituto de Ciencia de Materiales de Madrid (CSIC) and Chair of the ESFRI Physical Sciences and Engineering Working Group.

September 2019 saw the launch in Europe of the ESFRI Roadmap 2021 update, a two-year process that will ultimately lead to define the forthcoming strategy for European Research Infrastructures. Established in 2002 and made up of representatives of the member states of the European Union appointed by the research ministers, and representatives of the European Commission, the Forum establishes a European Roadmap for the coming 10-20 years for new research infrastructures with a pan-European interest. Main goal of the Forum is the development of a joint vision and a common strategy beyond individual policies, thus providing Europe with the most up-to-date Research Infrastructures, also advancing the knowledge-based technologies and their extended use. The Roadmap combines ESFRI projects, which are new research infrastructures underway towards implementation, and ESFRI landmarks, successfully implemented research infrastructures. The strategic report on research infrastructures will be published by ESFRI in 2021, having 5 May 2020 as the deadline for the submission of proposals.

The Roadmap envisages the internationalization of infrastructures and the expansion of research objectives in a pan-European direction. In this sense, in recent years the INFN has consistently strengthened the participation in European research infrastructures and the internationality of its infrastructures. Two projects involving INFN are included in the 2018 Roadmap: KM3Net 2.0, currently at an advanced stage of implementation in Sicily, under the coordination of the INFN Southern National Laboratories, dedicated to the detection of high energy neutrinos, with important connections with interdisciplinary environmental research; and, in the cultural heritage sector, the E-RHIS (European Research Infrastructure for Heritage Science) project, promoted by the Italian National Research Council (CNR), which sees in the LABEC laboratory of INFN, in Florence, one of its pillars. Among the "Landmarks", the latest Roadmap lists the profitable upgrading of large projects in which the INFN participates significantly. Among these, there are the Cherenkov Telescope Array (CTA), the High-Luminosity LHC (HL-LHC), the Facility for Antiproton and lion Research (FAIR) and SPIRAL2 (Système de Production d'Ions Radioactifs en Ligne de 2<sup>e</sup> génération).



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In addition, numerous landmarks of the ESFRI Roadmap 2018 are the result of the common strategy of INFN with CNR and Elettra Sincrotrone Trieste, which define the programs for the construction of accelerator machines and their exploitation by users: the output of this process is the partecipation of Italy in different European projects, such as the XFEL (EU XFEL), the European Spallation Source Facility Extremely Brillian Source (ESS EBS), the Extremely Light Infrastructure (ELI), the European Synchrotron Radiation Facility (ESRF) and the SESAME accelerator, in Jordan. Among the projects not yet included in the ESFRI Roadmap, on which Europe is focusing and that see the INFN in the front row, the EUPRAXIA (Compact European plasma accelerator with superior beam quality) project and the Einstein Telescope (ET) project, for the construction of a large third generation underground interferometer.

Fundamental for drafting the ESFRI Roadmap is a clear picture including societal challenges, the state of the art of research and its projection in the future, the sustainability of projects and their impact on Europe in terms of innovation, knowledge development and investment in incubators for pan-European and global research infrastructures. To pursue this goal, specific working groups have been set up with the task of developing a series of key performance indicators to address the most common objectives of pan-European research infrastructures.

We've asked to José Luis Martínez PEÑA, Research Professor at Instituto de Ciencia de Materiales de Madrid (CSIC) and Chair of the ESFRI Physical Sciences and Engineering Working Group to outline the next steps in the ESFRI Roadmap preparation.

The Physical Sciences and Engineering Strategy Working Group that you lead is one of the six ESFRI Working Groups, besides Energy, Health and Food, Environment, Social and Cultural Innovation, Data, Computing and Digital Research infrastructures. These are research domains that play a relevant role in facing grand societal challenges and give fundamentals to the whole ESFRI strategy building process. How will it be possible to manage the balance among such different themes to enhance a proficient and coherent strategy?

Actually, the organization of ESFRI in six Strategy Working Groups (SWG) is a practical approach, in order to perform the evaluation of the new proposals and the landscape analysis. However, ESFRI is a non-budget Forum and for this reason, as we work without money, we don't need to guarantee "a balance" among the six SWGs. On the other hand, our work is performed after the different proposals are presented by the European researchers. In this sense, at the beginning of ESFRI many requests came from Physical Sciences and Engineering (PSE) SWG, while in recent years the demand is much stronger in Health and Food or Environment.

Nevertheless, the challenge is the development of a coherent strategy in order to face the Societal



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challenges, which are usually multidisciplinary or at the interface among the different areas in the classical thematic organization. For that purpose, in the last ESFRI RoadMap, in 2018, we launched a new section about the interconnections between the ESFRI Research Infrastructures (RI) and the scientific domains, also relating to the way the different RIs are contributing – and they will do it much more in the future - to the various technical and scientific domains.

# What are the specific objectives set for this and for the other working groups, in terms of guidelines or recommendations?

All the information, objectives, guidelines and recommendations are public and available on the <u>ESFRI</u> <u>website</u>. The main principle of ESFRI is to work in this process of the Roadmap of RI under a transparent, equal opportunities and non-bias approach.

The main principle is to select the cutting edge RI that will reinforce the position of excellence in Europe, by a pan-european added value of the proposals and the progress of the knowledge, in order to contribute to the Excellence Pilar of the Horizon Europe 2020 and, consequently, to the new challenges of Europe.

# Can you envisage possible multi-lateral agreements between research infrastructures working in different research domains? What is the best way to optimize efforts and investments by enhancing collaboration and following common or interconnected objectives?

Actually, a clear movement is under way between different RIs in PSE-SWG. And, for the moment, referring to the last two years, this happens between different RIs inside a similar area. As an example, I'd like reporting about the recent effort made by different synchrotrons in Europe to create the League of European Accelerator based Photon Sources (LEAPS), in order to coordinate the technical and development work made by the different members, to enhance the collaboration among them and with the EU, in order to better contribute to the main challenges of the EU (New Green Deal, batteries, ...). In a similar way, the European Neutron Facilities created the LENS (League European Neutron Sources), having similar goals and a similar approach. To simplify, there are two added values in these initiatives: from one side, the optimization of the investments made by the different RIs, which could achieve better results by focusing on synergy and complementarity; from the other side, the possibility to deal with societal challenges and achieve better results faster and using a multidisciplinary and coherent approach. Probably, the next step will be the collaboration between both entities (LENS and LEAPS), in order to bring this Societal Challenges to a further result in the cutting edge of knowledge and technique.

A similar approach is also present in different domains of PSE, for example in Nuclear Physics, a field that operates in Europe under the umbrella of NuPECC, or in the area of High Energy Physics, which is pushed



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#### forward by the know-how developed at CERN.

It is clear that the main development and progress in the near future, in relation to the Challenges of the Society, will come from this interdisciplinary approach among scientific domains and the collaboration of different excellent RIs. The definition of clear and achievable objectives - as for instance a new type of battery for the energy storage, based on raw material available, with the possibility to be recycled - will be a step forward in the achievement of a better collaboration among RI and a substantial progress to solve the Societal needs.

# In your opinion, how can cutting-edge research in Physics contribute in implementing research infrastructures that can be useful to face great societal challenges, stimulate innovation and advanced technologies development in Europe?

I think that this question is very much related to the previous one. Probably the best approach to contribute to the societal challenges inside the RIs will come from the collaboration and the implementation of an objective approach. Nevertheless, the first step (sine-qua-non condition) is providing that the RIs are constantly at the cutting edge of the technical and scientific knowledge. This means that the European RIs should be under a constant upgrade and improvement approach in order to keep a leadership in the technical and scientific domain.

Finally, the RIs are mostly a knowledge "HUB", not simply a Research Infrastructure. Usually, around the knowledge HUBs there is a development of industry, academia and research, that gives a strong contribution to the development of the geographic region where the HUB is located, also enhancing the progress of knowledge and of societal challenges.

At this point, the question could be how many of these HUBs are necessary? And how should they be distributed around Europe?

#### How does Particle Physics fit in the context of research infrastructures in physics or engineering? What indicators can represent the strengths and weaknesses of infrastructures for fundamental research born to solve quests such as, for example, the nature of dark matter or that of neutrinos?

Particle Physics is a "classical" area for RIs in Europe. The history of the Particle Physics RIs in Europe is one of the best examples of how collaboration improves the quality and brings the knowledge to excellence. Regarding the indicators and monitoring of RI, I would like to mention that this issue is extremely important and ESFRI recently created a working group on this topic, that has recently finished the work and presented a report that, after being accepted by the ESFRI FORUM, has been made available on the <u>ESFRI website</u>. In relation to that, the concept of the long-term sustainability of the RIs is also important. ESFRI also raised



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this topic through a specific working group, to offer a complementary approach to the monitoring. Results were also published on the <u>ESFRI website</u>. In particular, talking about Infrastructures in the area of dark matter or neutrinos research, probably these topics are very suited to a highly complementary approach with different techniques and different approach, and probably with a "Global Approach, in the OECD terminology", not only at the European scale.