

The first strategy of physics research in Romania wisely strengthens the future of the field

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Dr. Florin Buzatu, Director General of the Institute of Atomic Physics (IFA)

A third of scientific papers published in ISI journals in the last decade come from physics. Approximately 50% of the total citations of publications produced by Romanian authors come from within the borders of this area. In addition, the presence of our physicists in all major international scientific projects and the set up of the largest research infrastructures in Eastern Europe, ELI, at Magurele, shapes the image of a research area with results and enormous potential. Symbolically, Romanian physics was, until now, an army of giants who fought separately on various fronts of research. IFA, through the ESFRO project - "Evaluation of Romanian potential in physics research and development of the national strategy of international cooperation" (www.ifa-mg/esfro) - aims to unite these forces through a strategic plan that has the consensus of the combatants. In an integrated manner, Dr. Florin Buzatu, IFA director general, coordinated this process of designing an intelligent future for Romanian physics.

This is practically a première. For the first time in Romanian scientific research, IFA succeeds to create the strategy of a field on scientific basis. How was the framework that allowed the development of such a construction created?

Physicists, by this I mean scientists, are builders by essence, but of a special type: they build new models, new experiments, they even build new instruments when they feel they need them for the Construction they are constantly working on – understanding the Universe. Romanian physicists have “tore up bits” of their usual working time for an auxiliary construction, which is absolutely necessary at this time: a plan, a common platform, a strategy for a future with many challenges, but also uncertainties.

The necessary framework for the construction, that was realized in a broad and representative partnership (9 research-development national institutes and 6 profile faculties from the main research and university centers from around the country) appeared naturally, out of the need for a solid basis and an enduring flexible structure. The evaluation of the current potential of physics research in Romania was based on internationally recognized criteria and on indicators accepted by the entire community: scientific performance (publications), resources (human, infrastructure, funds obtained through project-based competitions) and socio-economic impact (PhD students, patents, technologies, services). In my opinion, the main element of novelty of the assessment is the elaboration of a methodology for identifying and even ranking the most active / visible thematic areas in a particular field of research.

We have dealt with physics, but the procedure – based on a thematic classification scheme (Science Citation Index Expanded - SCIE), adopted by the mainstream journals (those from Web of Science – WoS, developed by ISI Thomas Reuters), and on the information provided by institutions participating in the project – can equally well be applied to other disciplines, can be adapted or extended by including other indicators or by modifying the respective weights. Once the foundation is laid (the evaluation, practically based solely on statistics, is therefore strongly objective), we have moved onto elaborating a strategy that takes into account, from a qualitative and selective point of view, the existing expertise (through notable achievements and in a much broader thematic specter than SCIE categories), the perspectives of the field at an international level as well as the Romania’s open opportunities. This was achieved within 11 thematic groups in which over 70 Romanian experts participated, the most representative ones for the respective fields. The role of the Project Steering Committee, composed of personalities of contemporary Romanian physics with a rich experience in leadership and management, was crucial. The reports drawn up were discussed within the institutions participating in the project and within the Council of Representatives; therefore, we can speak about a consensus of the physics research at a national level.

Indeed, ESFRO project is a première in the scientific research in Romania: it is the first time when scientists from a specific field – Physics – self-evaluate and draw up a strategy. Thus, physics sets a new standard in Romanian research and I am glad that IFA played a major part in this process.

The internet, the biggest database in the world, is a revolution that bares no comparison and that was the “fruit” of physics research. Currently, IFA created the first complex database of Romanian physics. Is this the beginning of a revolution in local physics, of a change in direction and destiny?

First of all, I hope our database will put things in their place, as concerns the evaluation of scientific performance and the real capacity we have in various research thematic areas. It is important to set high standards based on criteria and indicators of international usage that can provide a proper “snapshot” of the field. The database created within the project allows an efficient processing of the recorded data and the correlation of various indicators, so that it can strongly develop both the interpretation of the “snapshot” (“the diagnosis”) and the options for choosing strategic directions and priorities (“the treatment”). In this respect, I do not consider it to be a “revolution” in local physics, but rather an entry into normality. Of course, I hope it will be a major change in terms of strengthening the decision-making process concerning the strategy of Romanian scientific research, in physics and not only.

What are the most important aspects to surface after evaluating the potential of Romanian physics?

I consider important the fact that we can now give a documented answer to apparently simple questions, such as: which thematic categories, out of more than 200 that appear in WoS, can be considered as the most representatives for Romanian physics (that “belong” to physics and not other fields)? And we can mention 16 such thematic areas. What are the main thematic categories (not necessarily “of physics”) at which Romanian physicists bring their contribution? And we can mention 25 thematic areas, out of which 10 are practically considered being “of physics” (the most relevant example is Physics Chemistry, ranking in the first six, but also other branches of Chemistry, Polymer Science or Electric and Electronic Engineering). Which are the most high-performance institutions from the viewpoint of scientific output, in different thematic areas? The graphic database allows immediate visualization of the “ranking”. Of course, it was known that physics research in Romania is good, together with chemistry and mathematics, in comparison both with other local disciplines, and with the physics research in other countries. The performed analysis allowed, however, a quantitative assessment of this potential: in addition to the data you mentioned at the beginning (over 1/3 of ISI publications and about 1/2 of citations attributed to Romania come from physics), the physics research in Romania – through the number of ISI publications – ranks 32 in the world (out of 127 countries), while the entire Romanian research ranks 41; as to the number of citations per document, a highly-relevant qualitative indicator (with proper statistics), Romania ranks 77 overall; better positions at this indicator, above the average of physics and comparable to the level achieved by Western Europe, are held by nuclear and elementary particle physics and by the physics of surfaces and interfaces. At a regional level (Eastern Europe) and taking into consideration the number of ISI publications, Romanian physics ranks a commendable 5th place (out of 23 states), surpassed only by Russia, Poland, Ukraine and Czech Republic. The conclusion is that Romanian Physics is still maintaining a high international standard. The important thing is to preserve it and even becoming more performant, at least in certain directions.

From 2008, through the new status, IFA assumed the mission of becoming the integrator of Romanian physics. ESFRO is the first project in which IFA successfully plays this role, without a previous similar experience. What are the types of energy, the laws of physics that set this vehicle of change into motion?

The giants from your metaphor are the results of a phenomenon that even to this day is called IFA and that, I hope, is not over. It is not easy to establish a strong scientific community and it is, perhaps, equally difficult to maintain it. I don't think it is enough to have "giants" in order to achieve something HUGE in this field. Physics teaches us that macroscopic phenomenon are mainly due to correlations between particles, their collective movements, coherence and less to free, non-interactive spread of the constituents. The current challenges of science surpass institutional or single-disciplinary boundaries; performance at a macro level requires unified efforts in certain directions (thematic focus), a common strategy, coherence in actions. On the other hand, the difficulties we are up against, like the ever-increasing difficulty in attracting young people to this field, a decrease in the number of graduates with a proper training for entering the field of research, a system that does not sufficiently encourage a wide scope research and stability – all these problems require to "close ranks", to assume a high degree of responsibility towards the future. In a nutshell, if we want to continue tradition and if we want physics to remain a standard in Romanian research we need a strategy. Nowadays IFA assumed the role of integrator of Romanian physics precisely for this purpose - expanding this field, an objective that can only be reached with the consensus and involvement of the "combatants", as you first noticed.

The strategy represents the result of consultation between all key-actors from Romanian physics, it is a plan assumed at the entire community level. How important is the achievement of unity in diversity, motto and phenomenon under which the European Union is, in fact, also operating?

When diversity can act as a unity, there is an organism, a community, a nation. Although extremely important, a plan that was assumed does not automatically mean achieving unity in action, but only the beginning of the road towards this desideratum, road that can be long and difficult. The effort must be constant, it must be maintained, it requires sacrifices, it takes time; the process must unfold "adiabatically" (somewhat "natural"), the diversity must gradually feel the advantages of the unity, otherwise the plan falls apart. I consider our strategy to be a good beginning, it remains for the future to confirm its viability.

Metaphorically speaking, IFA aims to (re)build the bridge that connects Romanian research to international physics by elaborating a strategy dedicated to international cooperation. What will be the main pillars that will sustain the bridge of external collaborations?

The main pillars of the bridge towards international physics are the national institutes of physics together with the faculties of physics from the major universities. An essential ingredient is the development and the involvement of the technological/industrial environment. Major international collaborations are extraordinary opportunities for the economy and it is the credit of the researchers for opening these "gates". Cementing the

bridge requires a consistent and stable financing. But, above all, the project needs more work, the elaborated strategy constituting, so to speak, the general plan, that parametrically depends on conditions external to the field.

It is well-known the relation existing between the allocated funds and the results, between input and output. How do you solve the problem of financial resources in order to ensure the success of the strategy?

Within the project I have made an assessment of the financial resources (and human, also) necessary to achieve the objectives set. We hope for a financing directed towards these objectives; then we will do all we can in order to optimize the usage of the allocated funds and to obtain an output equal to the input. Directing the funds can be done by organizing a competition with a given theme (top-down), which will surely contribute to a focusing of effort and increasing scientific performance in the respective directions.

What will Romanian physics look like in 2020, taking into consideration the elements and objectives that are integrated into the strategy at this moment? What is the pessimist and optimist scenario?

I prefer a realistic scenario: I see a much more... interdisciplinary physics!



Dragoș Ciuparu, President of the National Authority for Scientific Research (ANCS)

A promising start

“It is remarkable the way in which the physics scientific community managed to unite its efforts for this project and the results obtained match the implication. Of course, it is a very good start from which we must continue to built and truly identify those areas and themes in which Romania can make a difference, not in Romanian research, but in

European and global one. I wish that those groups which are stimulated and helped into developing their research capacity to end up playing in Champions League at an international level and not in an Eastern or Central Europe regional competition. Perhaps the 11 fields that have been identified as priority and with major developing potential could be differentiated as to select those we can truly propel among the stars of physics research.” **Dragoş Ciuparu, President of the National Authority for Scientific Research (NASR)**



Nicolae Zamfir, General Director of Horia Hulubei-National Institute of Physics and Nuclear Engineering (IFIN-HH)

The right time

“A mature field, such as physics research in Romania, based on a solid school, with a prestigious tradition and with an active worldwide presence, needs – of course – a development strategy. Romanian physics is not at its first strategy; however, it is the first after the changes that occurred in 1989, when it opened itself to the world.

ESFRO appears at the right time. After the hardships of the transition period of the ‘90s, in the last 5-6 years the situation of the scientific research funding stabilized and improved considerably. Thus, the salaries of the researchers were ensured and the research infrastructure was modernized to international standards. As a result, many talented young people, including some of those who studied in large doctoral and postdoctoral research centers in the world, began their activity in institutes of physics from Romania. Furthermore, in 2010 Romania became a founding member of FAIR – Darmstadt, infrastructure of over 1.5 billion euro and officially began its 5 years period for becoming a member of CERN – Genève.

In conclusion, now is the time to elaborate the Strategy for Developing Romanian Physics, as it can realistically approach the two key components: developing a strong high top research program “at home” and a solid anchoring in major international

collaborations. I consider the Strategy of Physics to be a reference document in the development of this field in Romania.”

Nicolae Zamfir, General Director of the Horia Hulubei-National Institute of Physics and Nuclear Engineering (IFIN-HH)



Florin Vasiliu, Scientific Director of National Institute of Materials Physics (INCDFM)

Strengths and threats

“Following the evaluation of the current potential of physics research in Romania, I believe the main strengths of the field to be, in the order of their importance: good scientific output, above the national research average; tradition, including the existence of schools that have been active for long periods; intense international cooperation; modern European research infrastructure, acquired in recent years; access to major research infrastructure existing or currently underway in Europe.

At the same time, this highly visible field faces a series of “threats” that may endanger the level attained at present. I would mention some that I consider being essential: low number of graduates with a level of training at the necessary standard for beginning a career in research; limited access to documentation (scientific journals and databases), especially lately; the speed-up of physical and moral wear of the equipment used, in the absence of constant funds for maintenance and modernizing; the insufficient understanding by the political leaders of the strategic importance of education and research in the field; infrequent and difficult financing of the scientific research.”

Florin Vasiliu, Scientific Director of the National Institute of Materials Physics (INCDFM)



Academician Valentin Vlad, Vice-president of the Romanian Academy

National assets

“The ESFRO project brings solid and remarkable information on the most visible research field in Romania, physics. The scientometric database developed and the scientific analysis of this data are national assets with added value. This base could highlight the most active fields in physics research in Romania, the major international collaborations in which we will continue our research (Extreme Light Infrastructure, CERN, EURATOM, ESA, etc) and the experts that can develop the strategy and guiding of these researches.

The Physics strategy developed is capable to focus the research funding from Romania (currently a modest one in comparison with those from developed countries) on key directions, that can propel us to more advanced places in international research. This strategy, elaborated with modern scientific means, is yet another added value good and an example to other scientific fields in Romania.”

Academician Valentin Vlad, Vice-president of the Romanian Academy