

Newsletter Interview

A NEW ROADMAP FOR EUROPEAN RESEARCH IN ASTROPARTICLE PHYSICS



Interview with Aldo Ianni, researcher at INFN Gran Sasso National Laboratories, newly-elected Chairman of the APPEC (Astroparticle Physics European Consortium) Scientific Committee.

Solar neutrinos, geoneutrinos, the phenomenology of neutrino interactions, and the search for dark matter with liquid argon and sodium iodide detectors: this is the perimeter within which Aldo Ianni moves, and to which he

has dedicated his research activities, since 2001, in the world's most important laboratory for underground astroparticle physics research, INFN Gran Sasso National Laboratories (LNGS). At LNGS, Ianni has taken on various roles, from head of the Research Division to being in charge, in 2021, of Science Strategy and International Collaboration between underground laboratories, which marked the beginning of his collaboration with APPEC (Astroparticle Physics European Consortium), the consortium that coordinates research activities in astroparticle physics in Europe. And it is with his election as Chairman of the consortium's Scientific Committee, last month, that a broader horizon and a major challenge opened up for Ianni: charting the direction of European research in astroparticle physics for the next decade. The 2027-2036 roadmap will identify strategic research projects in which to invest in Europe, taking into account the goals of the scientific community, national strategic plans, and technical and financial feasibility. We asked Aldo to tell us how it will be drafted and what challenges he expects to encounter in the process.

Let's start with an overview of research in astroparticle physics. Where do we stand? What are the open issues?

Astroparticle physics is a vast field of study, inaugurated rather recently. In fact, astroparticle physics was born at the end of the 1980s, just before one of its founders, the Russian scientist Veniamin Berezinsky, started his research activities right here at Gran Sasso. Currently, the discipline focuses on cosmology, gravitational waves, dark matter, rare events, and all those particles generated somewhere in the cosmos, with the aim of characterising them and identifying their sources. Examples include neutrinos generated in the Sun, or neutrinos generated by a supernova explosion, and neutrinos and cosmic rays of very high energy. Astroparticle physics offers unique opportunities in understanding their nature and, with it, also in finding the key to improve the standard model. Among the newest and most powerful tools we have for interpreting cosmic events, there is multi-messenger astronomy, which makes use of the simultaneous emissions from a single source and observes and interprets them with a coordinated approach. This happens, for example, when there are gravitational collapses, from which electromagnetic waves, neutrinos and gravitational waves are generated at the same time. The range of research possibilities in astroparticle physics is extremely broad, and this makes the management of the APPEC roadmap very complex.

Let's turn to the APPEC roadmap, how will it be implemented?

We will start with a questionnaire, in order to directly involve the European scientific community. We are keen on understanding what use they make of the current roadmap (2017-2026), which aspects of it they would like to see improved, and which scientific objectives they see as priorities for the new strategy. We will be sending out the questionnaire in the autumn, and what we hope to get out of it is not only desiderata with respect to research activity, but also information concerning the members of this community – who they are, how old they are, what they are involved in – so that we can get to know them better, and thus value them better. For example, we care a lot about the perspectives and ideas of young researchers, and we would like to give them space and actively involve them. We will have the opportunity to do so at the kickoff meeting in June 2025, a session that will start from the results of the questionnaire to then proceed in a collaborative and interactive manner. As already experienced at the APPEC Town Meeting in 2022, we will arrange researchers in working groups, according to research areas, and after a day of brainstorming, we will collect their impressions. Having recorded also this data, the development of the roadmap will begin, which we will present to the scientific community first (June 2026) and to officials, representatives and sponsors by the end of 2026.

What needs do you expect to emerge from the questionnaire?

The questions are divided into sections and cover various aspects, from the need to further develop certain research technologies and infrastructures, to how to organise and manage the APPEC network, also from a financial point of view. We are currently structured as a consortium, whereby each participating country pays a fee, generally for bureaucratic activities, roadmap work and interim meetings. We do not have the resources available to support precise scientific areas or make independent decisions. What are the community's expectations regarding these limitations? Are they looking for a change? Would astroparticle physics research be more effective if we had a new organisation? I am very curious to investigate this need, which I have sensed on several occasions.

You mentioned the financial issue. APPEC currently depends on 22 funding agencies operating in different Member States: how are their interests balanced with those of the European scientific community?

Actually, this is the main difficulty: being able to harmonise the efforts of the Member States to improve the impact of investments in this research field. Indeed, each participating country has its own national research programme and ongoing funding, which we must take into account. Consider, for example, INFN: it decides its strategy and funding through the National Scientific Commissions, Commission 2 for astroparticle physics. The same happens in France, in Germany, in Spain. So the APPEC General Assembly, which is one of the three organs of the consortium together with the Joint Secretariat and the Scientific Committee, tries to get the various agencies to talk to each other, to create a convergence of efforts at both scientific-technological and financial level, to achieve the scientific result and to enhance European research and infrastructures.

Where does European research in astroparticle physics stand compared to the rest of the world?

We can undoubtedly say that Europe is the leader in certain fields of astroparticle physics. This is the case with double beta decay, dark matter and high-energy cosmic rays, and we also make a significant contribution in the field of high-energy neutrinos and gravitational waves, although we are not the only ones. With APPEC, we want to make the most of the expertise and research infrastructures we have in Europe, such as those of the INFN, which has always played a crucial role in this field. However, it is now imperative to adopt a global approach when conceiving a new experiment. Once the scientific case has been validated as a fundamental point, feasibility does indeed come into play, and it depends on the existence of strong international collaborations, the number of people involved, the general interest, the financial capabilities, and the necessary research infrastructures.

In short, you will have quite a number of factors to bear in mind as Chairman of the Scientific Committee.

What has this appointment meant for you?

It has given me great satisfaction, especially because this acknowledgement does not come from above, but from within the working group, where I have had the opportunity to meet highly experienced and capable colleagues. At the same time, I am aware of the responsibility that comes with this appointment. Drafting the roadmap will require a great effort, the ability to condense information and exchange views: it is a document that has its weight, or at least I hope it does, and it is important to draft it in a way that is truly useful for the community.