ECFA EUROPEAN COMMITTEE FOR FUTURE ACCELERATORS

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Subject: 2017 RECFA visit to Bulgaria

Dear Minister,

It is my privilege to write to you on behalf of the European Committee for Future Accelerators (ECFA), which met in Sofia on 24 and 25 March 2017, in accordance with its mandate to visit CERN's Member States on a rotational basis and to report its findings to the national scientific authorities, as well as to the CERN Council during the European Strategy Sessions.

During the first day of the meeting, in addition to a very interesting introduction to the projected funding policies of the Bulgarian government by the former Minister of Education and Science, Prof. Nikolai D. Denkov, the Committee was presented with an overview of the activities of the particle physics, nuclear physics and astrophysics communities in Bulgaria. As has now become a tradition on such visits, the Committee also heard presentations on activities in accelerator science, outreach and education, and grid computing. Please find below the conclusions reached by the members of the ECFA delegation who participated in the visit.

The organisation of the Bulgarian particle physics community is based on two main pillars, the Institute of Nuclear Research and Nuclear Energy (INRNE) of the Bulgarian Academy of Sciences and the Atomic Physics Department of the Faculty of Physics at the University of Sofia. This dual system allows the technological strengths of the Institute to be combined with a source of high-quality students from the University. The community is focused on activities within the CMS experiment at the Large Hadron Collider at CERN, where it has made significant and highly visible contributions to the hadron calorimeter system and the resistive plate chambers (RPC) of the muon system. There have also been important

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contributions to the fixed-target programme at CERN, at the NA61 and NA62 experiments. However, there is a substantial number of excellent Bulgarian physicists that, due to funding limitations, participate as individuals in various other experiments at CERN and elsewhere. The Committee felt that with an appropriate funding scheme and a well thought through road map, the Bulgarian community could concentrate on fewer projects and, with the available human resources, become a real powerhouse within the international community.

Bulgarian nuclear physics activities have historically been concentrated around research at the Joint Institute of Nuclear Research (JINR) at Dubna. JINR was also the entry point for Bulgarian nuclear physicists to experiments at the ISOLDE project at CERN. The involvement of Bulgarian scientists in the ISOLDE collaboration is longstanding and visible but since Bulgaria is not a member of the collaboration due to lack of funding, this involvement is mostly personal rather than institutional. It was clear to the Committee that the membership of Bulgaria in the ISOLDE collaboration would allow Bulgarian teams to assume more active roles and responsibilities in the experiments and allow more Bulgarian scientists and students to conduct their research at CERN.

There is a small astroparticle physics community in Bulgaria, mainly at the INRNE, interested in high-energy gamma sources. It participates in the Major Atmospheric Gamma Imaging Cherenkov (MAGIC) and also in the future Cerenkov Telescope Array (CTA). For the community to grow and acquire more visibility, the Committee would recommend close contacts with the Astroparticle Physics European Consortium, which recently defined its roadmap.

The theoretical physics community is dominated by mathematical physicists, and its interaction with the experimental physics community appears limited. Many of the staff are close to retirement, and young theorists tend to leave the field after completing their MSc thesis. An increased focus on theoretical aspects relevant to the Bulgarian experimental programme could help to revitalise this community.

The Committee was impressed by the excellent technical skills being developed within the INRNE which are well-recognised at CMS. The team produced a large fraction of the RPCs and plays a key role in RPC detector management at CMS. It is participating in the Phase II LHC upgrade with contributions to the Gas Electron Multiplier (GEM) detectors. This unique facility was used also by the University groups to build detectors for other experiments. The Committee recommends that these valuable technical skills be maintained and possibly even expanded. To attract new personnel, in particular young people, into science, the modernisation of the laboratory's equipment is of the utmost importance.

The financial return from CERN to industry is excellent and Bulgaria has for a long time been among the CERN Member States with the highest return. While at present no technology transfer to Bulgarian industry is taking place, there are plans to develop the RPC technology for medical applications such as positron emission tomography (PET), which the Committee wholeheartedly supports. There is no direct accelerator research in Bulgaria. However, a cyclotron facility has been built at INRNE to produce medical radioisotopes and radiopharmaceuticals. This is providing a good opportunity to build up expertise, establish a community in radiochemistry and bring in revenue. There are further plans to create a centre for hadron therapy using protons and ions. The Committee would suggest that a prudent approach be taken in the choice of technologies, in order to increase the confidence in obtaining local funding.

The Institute of Information and Communication Technologies of the Bulgarian Academy of Sciences is providing an impressive computing infrastructure, hardware and software, for use by Bulgarian scientists. It includes both grid clusters and high-performance computing. Ensuring governmental support for upgrades and maintenance of the infrastructure is crucial for its capability to support advanced research.

As was repeatedly hinted at in the presentations, long-term sustainable funding is a stumbling block in the community's research planning. The Committee was pleased to hear from the Minister that there is a proposal for a National Programme for Collaboration with CERN, which, if adopted, would solve the legal issues around the payments associated with Memoranda of Understanding (MoU), typical vehicles for participation in CERN's activities. The same Programme would be the natural vehicle to promote the participation of Bulgaria in the Sponsoring Consortium for Open Access Publishing in Particle Physics (SCOAP^3). The Committee also hopes that calls by the National Research Agency for the funding of individual projects on a competitive basis can be issued as regularly as possible to ensure the continuity and stability required for basic research.

The Committee was made aware of the lack of fixed-term postdoc positions and of a systematic decline in the number of PhD students, in spite of a vigorous outreach programme. This can be traced back to unattractive salaries and PhD scholarship grants, as well as lack of funds to modernise the laboratory equipment. The well-trained, excellent students tend to find positions abroad and stay there. This not only deprives the Bulgarian teams of local resources but may also endanger the level of general science and technology development in the country. An effort to provide incentives for students and postdocs to stay in Bulgaria or to return after a period abroad would help invigorate the community and could stop the brain-drain effect. A concentrated effort to encourage young Bulgarian physicists to submit grant proposals to the European Research Commission could also alleviate the funding situation.

In summary, the Committee wishes to express its strong appreciation for the activities of the Bulgarian community and hopes that some of the remarks contained in this report will help the community to prosper even further and achieve its ambitious goals.

Yours sincerely,

Professor Halina Abramowicz
ECFA Chair

cc: Ms Zlatina Karova, Director of Science Directorate, Ministry of Education and Science
Bulgarian PECFA members