The Future Astronuclear Physics
A. Jorissen, S. Goriely, M. Rayet, L. Siess and H. Boffin (eds)
EAS Publications Series, Vol. 11, 2004, III-IV

Foreword

The international conference *The Future Astronuclear Physics* was held at the *Université Libre de Bruxelles* (ULB) from August 20 to 22, 2003, to celebrate Marcel Arnould on the occasion of his sixtieth birthday. Marcel Arnould is full professor at ULB and was appointed director of the *Institut d'Astronomie et d'Astrophysique* (IAA) of this university in 1983, when he was still a Research Associate of the National Fund for Scientific Research (FNRS). Since the late sixties he has played a leading role in the development of a trans-disciplinary field of research, the object of which is the study of nuclear phenomena in astrophysics. Those phenomena being the main source of energy in stellar interiors and being also responsible for the synthesis of the chemical elements, the study of the often peculiar, sometimes exotic, nuclear physics in a rich variety of astrophysical conditions, is crucial to understand almost all stages of stellar evolution as well as the chemical and isotopic content of the neighboring and remote places of our universe.

All along his scientific career, Marcel Arnould has worked to give the so-called nuclear astrophysics, born in the second half of the twentieth century and marked by a few prominent physicists in the United States and in Canada, a fertile ground for development inside Europe as a fully grown discipline, collecting the knowledge on the infinitely small with that on the infinitely large, a true interdisciplinary science that ought to be more appropriately called "astronuclear physics".

We like to remind that to achieve this goal, Marcel Arnould has promoted and directed two important projects in the framework of the EU scientific programs. The first one (1989-1992), "Nuclear Astrophysics: experimental and theoretical studies", involved 11 European research centers and led to the first measurement, at the Louvain-la-Neuve cyclotron facility, of a nuclear reaction rate involving a short-lived nuclide, ^{13}N. This experiment was performed using a radioactive ion beam technique, a new and powerful tool of investigation in nuclear astrophysics, which has since been developed worldwide. The second program, "Nuclear Astrophysics: measurement, evaluation and compilation of reaction rates, and their impact on stellar evolution and nucleosynthesis" (1992-1997), gave the scientific community the first European compilation of astrophysical reaction rates. This work was meant to supersede the compilations performed during more than forty years by a team led by the late Nobel Prize winner, William A. Fowler, at the California Institute of Technology.

A relentless scientific advisor amongst astrophysicists as well as nuclear physicists, Marcel deplores the persistent lack of communication between those two communities. For years, his hope has been to see the rise of a generation of true astronuclear physicists, but one has to admit with him that this goal is far from being achieved yet and that one still has to fight, despite all the expressions of good intentions, against the barriers that, as is usual, separate scientific disciplines.

It is therefore in tribute to the transdisciplinary and visionary nature of Marcel Arnould's scientific work that his close collaborators at the IAA decided to organize this conference, which is explicitely devoted to future developments in the field of astronuclear physics and not, as is often the case, to already completed, or even published, works. The audience has been limited from the start to invited participants chosen for the quality of their human and scientific relations with Marcel, as well as for their contribution to the domains he is exceptionally found of.

The conference program was on purpose centered on a few fields that for many years now have been central to the activities of the IAA: the stellar nucleosynthesis and its relations to stellar physics, to nuclear physics and to cosmochemistry. The organizers' choice was to concentrate on a few challenging problems: abundance determinations in stars and modeling of atmospheres, special topics in stellar evolution (rotation, mixing, binarity), multi-D modeling of stellar explosions, future progress in experimental and theoretical nuclear physics for astrophysics. The speakers were asked to give, starting from their own topic, a prospective (or "visionary") view on the evolution of astronuclear physics for the next twenty years. Of course this demand requires time and explains why the organizers chose to limit the number of speeches rather than the time allocated to each speaker. In each of the four sessions, round tables gave the participants plenty of time for discussions or for more formal contributions, some of which have been included in the present proceedings.

We hope that the reader will find the same pleasure in reading these proceedings as those who lived the three days of the Conference in a studious and friendly enthusiasm.

DOI: 10.1051/eas/20041101