

Foreword

Computational astrophysics has a long history, dating back to the computation of the first stellar structure models in the 1950s or the first evidence of chaos in gravitational systems in the 1960s. Since then astrophysics has always been a major driver of computational developments. Addressing astrophysical problems requires the capability of the fastest supercomputers and the most recent state of the art algorithms.

Within the past two decades, computational astrophysics has seen a phase transition, from being dominated by individual researchers writing and running their own “private” simulations on their personal workstation, to large projects that gather experts from different fields and use the huge computational power available through parallel machines or GRID technologies.

Many recent advances in our understanding of the formation and evolution of the Universe have been made by such projects managed by large international consortia. Many other “extreme” computational projects are on-going at various European supercomputing centers, which attempt breakthroughs in many current topics including our understanding of the formation and death of stars and the origin of planetary systems such as our solar system. Common to all grand challenge problems is the huge dynamic range in time scales and spatial scales in three dimensions, and the large number of physical processes and timescales that need to be taken into account.

Simultaneously with the development of refined numerical codes, the advancement of hardware technologies is utilized for the installation of multiple-core cluster architectures, of special-purpose boards, like *e.g.* GRAPE, and of high-speed units, like *e.g.* GPUs.

All these components make Computational Astrophysics definitively an interdisciplinary field requesting the most sophisticated and advanced codes and resources. Nevertheless, the dedication of code developments and their special-purpose applications should not lead to blind eyes for their natural limitations. It should be a MUST, at first, to perform test studies for physical problems in order to evaluate their capability to represent the “real nature” by numerical models and, secondly, to make code comparisons aiming at finding the most reliable and appropriate description.

Due to the developments of numerous codes with an identical dedication to problems but different approaches, permanent discussions and code comparisons among the developers are urgent. The astrophysical community is therefore faced with a growing number of conferences exactly following these aims.

The Joint European and National Astronomy Meeting 2008 (JENAM 2008) was held on September 8–12, 2008 in Vienna, Austria, as the joint meeting of the European Astronomical Society (EAS), the Astronomische Gesellschaft (AG), and the Austrian Society of Astronomy and Astrophysics (OEGAA). It has hosted

nine symposia under the overall topic “New Challenges To European Astronomy”. Since the time has come to review where all the simulation projects stand and what the future will be, under the JENAM 2008, the organization of a joint ESF and JENAM meeting on “Grand Challenges in Computational Astrophysics” was proposed. This symposium (No. 7) brought together scientists in different fields of modern Astrophysics to discuss computational methods and techniques, as well as scientific results achieved with high-performance computational facilities.

The success of the meeting hinged on the efforts of many people. The Local Organizing Committee was led by Gerhard Hensler and Werner Zeilinger and consisted of the further members Bastian Arnold, Angela Baier, Verena Baumgartner, Jeanette Höfinger, Ernst Paunzen, Thomas Posch, Laura Tanvuia, and Georg Zwettler. Their infallible enthusiasm for preparing this event was undoubtedly a great part of the success. Considerable help was provided by the University of Vienna staff and students, both during the preparation phase and during the meeting.

The Scientific Organizing Committee consisted of Miguel Aviliez, Dieter Breitschwerdt (vice-chair), Marcus Brüggen, Gerhard Hensler, Willy Kley, Alexander Knebe, Friedrich Kupka, Ben Moore, Volker Springel, Rainer Spurzem, Romain Teyssier and Hervé Wozniak (chair). Many thanks for their interest in the conference. Their role was crucial for the quality of the conference.

The venue of this conference was made possible through a number of sponsoring organizations and companies: the University of Vienna, the Austrian Ministry of Science and Research, the City of Vienna, the European Southern Observatory, the Centro Astronomico Hispana Aleman, comp delphin computer com., LCOCT.net, Manner, Ströck, and Wiener Städtische Insurance Group.

The European Science Foundation (www.esf.org) and the Astrosim programme (www.astrosim.net) are acknowledged for their financial contribution to the publication of these proceedings.

H. Wozniak & G. Hensler