ADVANCES IN COMPUTATIONAL ASTROPHYSICS: METHODS, TOOLS, AND OUTCOMES

COVER ILLUSTRATION:

Volume renderings of the Mach number (with velocity vectors, left panels) and vorticity (right panels) during nonlinear operation of the spiral SASI mode, at 720 ms (upper panels) and 820 ms (lower panels) taken from a 3D MHD simulation with GenASiS.

Image courtesy of Christian Y. Cardall, this volume page 87

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ADVANCES IN COMPUTATIONAL ASTROPHYSICS: METHODS, TOOLS AND OUTCOMES

Proceedings of a conference held at
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Preface

This conference was the sixth in a series of astronomy and astrophysics workshops and conferences held in Cefalú, Sicily, and devoted to hot topics over the whole field of modern astrophysics.

Motivation and Goals of this Conference
Modern ground-based and space telescopes are fundamental tools for the study of cosmos. However, without a deep understanding of the physical processes underneath, telescopes alone cannot yield the whole comprehension of the physical universe that is the main topic of astrophysics. Due to the complexity of involved physical phenomena, from the atomic and molecular scales up to the large scales of the cosmic structures, and due to the pervasive presence of gravity as fundamental engine acting on every space length, this physical understanding comes, nowadays, mainly by the proper use of massive simulations. This is made suitable by the concurrent progress of computing machines and software.

Given this context, this conference is a little different from many others where the accent was put on the computational part of scientific work related to astrophysics. Actually, more than dealing with deep numerical and computational aspects in a specific subfield of astrophysics or cosmology, we intended to gather scientists who are contemporarily at top of their fields on both the scientific side and that of numerical and computational methods and techniques, showing also expertise in the use of modern hardware and software resources. These invited speakers were explicitely asked to give presentations at a level to be understood by the, expectedly vast, audience. They give 45 minutes reviews of the state of the art in various representative topics, which are followed by both invited talks (30 minutes), examining in more detail some of the topics presented, and talks (20 minutes) presented by people selected by the Scientific Organizing Committee upon evaluation of the abstracts presented. The Scientific Committee privileged the scientific quality and, after, tried to favor presentations by young researchers. Some of them had here the first chance to present to an international audience the results of their research, always in connection with the discussion of methods and tools which conducted to the results. To help the participation of young researchers, a wide number of posters were presented covering the whole set of relevant topics.

The conference is organized in various Sessions, covering the study of astrophysics over the various scales from stars up to galaxies and large scale structure of the universe. There are also two specific Sessions dedicated to Advanced tools in computational astrophysics and to New Technologies in computational astrophysics. The Sessions are on:
• Stars: formation; • Stars: Fundamental Physics; • Stars: Evolution; • Supernovae and Progenitors; • Compact Interacting Objects and Gravitational Waves; • Stellar Systems: N-body problems; • Galaxy Formation and Large Scale Structure; • Advanced tools in computational astrophysics; • New Technologies in computational astrophysics.

Awards and prizes

We like to mention here the names of the five young researchers (less than 33 years old) that were awarded a prize for the quality of the Abstract of their submitted talk, in a competition preceding the workshop. They were allowed to present their oral contributions and received a Diploma and a money prize on the last day of the Workshop. Their names are:

– Ke-Jung Chen, Univ. of Minnesota, Twin Cities, Minneapolis, U.S.A.,
– Benoit Commerçon, MPIA, Heidelberg, Germany,
– Alessandra Mastrobuono-Battisti, Dep. of Physics, Sapienza, Univ. of Roma, Italy,
– Franco Vazza, Jacobs University, Bremen, Germany,
– Annop Wongwathanarat, MPA, Garching, Germany.

The "City of Cefalú" Prize for Astronomy was awarded in 2011 to prof. David Arnett for his career. For personal reasons, prof. Arnett could not come to the conference to receive the prize in person. As a consequence, the prize will be awarded during the next Cefalú Workshop.

Acknowledgements

The success of this conference was possible thanks to the help of a large number of people and Organizations. First of all we cite the Scientific Organizing Committee for the selection of scientific contributions and the Local Organizing Committee for the practical organization. Particular thanks are due to M. Castellani and A. Mastrobuono-Battisti for their assistance during the talks and for the interaction with participants, helping to solve the, unavoidable, many practical problems occurring during the presentations. G. Giobbi and F. Lupinacci gave an invaluable assistance with handling with all secretary tasks.

The organization warmly thanks the Major of the City, dr. Giuseppe Guercio and the vice-Major, avv. Roberto Corsello, for the hospitality in the City Hall and for their support before and during the meeting. We thank prof. Giuseppe Barracato and his secretary mrs. Enza Aquia for use of the beautiful "Sala delle Capriate", where the lectures were held.

Special thanks are also due to the President and Vice-president of the "Fondazione Mandralisca", dr. Angelo Piscitello and dr. Manlio Peri, for the support given by the Fondazione to the logistics and the organization at large, for their help in the outreach events, and the set-up of the secretarial offices and the internet connections. In this respect, we want to cite the huge effort made by Antonino Gugliuzza as leader of the local operations staff. We cite also the "Cefalu' and Astronomy" Association and its President and vice-President, prof. Luciano Burderi and dr. Tiziana Di Salvo, for the work done for the success of this conference.

Finally, we warmly thank the European Science Foundation for the financial support given, as well as prof. Giancarlo Ruocco and dr. Emanuele Giallongo, respectively directors of the Dep. of Physics of Sapienza, Univ. of Roma and of the Observatory of Roma (INAF), for both financial and logistic support.

Some of the pictures taken during the meeting can be found at the web site:
http://www.oa-roma.inaf.it/meetings/cefalu/2011/Photos.html

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Roberto Capuzzo-Dolcetta (conference chair)
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