NUMERICAL MODELING OF SPACE PLASMA FLOWS
ASTRONUM--2008

COVER ILLUSTRATION:

Density of the baryon gas in the Horizon Galaxy Formation simulation.

From the paper of D. Pomarède, Y. Fidaali, and R. Teyssier (see p. 320 of this volume).

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NUMERICAL MODELING OF SPACE PLASMA FLOWS ASTRONUM–2008

Proceedings of the 3rd International Conference held at
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Preface

The systemwide Institute of Geophysics and Planetary Physics (IGPP) at the University of California and the Institute for the Investigation of the Fundamental Laws of the Universe of the French Commissariat of Atomic Energy (CEA/Saclay – IRFU) organized the 3rd annual International Conference on Numerical Modeling of Space Plasma Flows (ASTRONUM-2008) on June 8–13, 2008 at the Westin Hotel, St. John, U.S. Virgin Islans. The Program Committee consisted of Edouard Audit (CEA/Saclay – IRFU, co-chair), Phillip Colella (Lawrence Berkeley National Laboratory), Tomoyuki Hanawa (Chiba University, Japan), James Stone (Princeton University), Nikolai Pogorelov (currently in the University of Alabama in Huntsville, chair), H. C. Yee (NASA Ames Research Center), and G. P. Zank (currently in the University of Alabama in Huntsville).

The conference attracted 64 scientists representing many different branches of the space physics and astrophysics simulation communities. The distinctive feature of this conference is a combination of diverse research topics, all of which are essential for performing high-resolution, continuum mechanics and particle, simulations of physical phenomena in space physics and astrophysics. Among such topics were software packages for modeling and analyzing plasma flows; advanced numerical methods for space, astrophysical and geophysical flows; large-scale fluid-based, kinetic, and hybrid simulations; turbulence and cosmic ray transport; magnetohydrodynamics. The applications included cosmology and galaxy formation, physics of the Sun-heliosphere-magnetosphere environments, interstellar medium and star formation, stellar physics, hypersonic turbulence, MHD modeling of plasma flows around space vehicles, etc. The proceedings volume is structured so that it covers all these topics. The conference allowed modelers working in seemingly distant fields to share their scientific achievements with the broad community of computational scientists doing numerical experiment.

As during previous conferences of this series, we were interested in such systems that are coupled across a multiplicity of spatial and temporal scales via collision-like integral terms that incorporate processes as diverse as chemical kinetics, charge-exchange, coagulation, etc. Numerical modeling of such systems usually generates extremely large data sets (hundreds of gigabytes), which require efficient analysis via parallel visualization techniques. For this reason, we invited experts in space physics, astrophysics, applied mathematics, and computer science, especially data handling and visualization, to share their experience in producing scientific insight into physical processes represented by abstract data.

The volume describes both the application of numerical methods and the algorithms themselves. This allows us to discuss the challenges theory imposes on numerical schemes for solving partial differential equations describing plasma in different physical environments.

We would like to thank the participants who submitted their papers for Proceedings of ASTRONUM-2008 and especially those who agreed to review the manuscripts thus ensuring a high quality of this publication. We also are grateful

to Adele Corona from the International Conferencing and Networking Solutions (www.icnsmeetings.com) for the excellent management of the conference.

The book will be useful to graduate and postgraduate students majoring in space physics, astrophysics, numerical, engineering, and applied mathematics. It is also aimed at the attention of specialists in applied mathematics and various fields of physics involving flows of partially ionized plasma both on the collisional and collisionless level.

Nikolai V. Pogorelov, Edouard Audit, Phillip Colella, and Gary P. Zank

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