

Preface

Magnetized plasmas in the universe exhibit complex dynamical behavior over a huge range of scales. The fundamental mechanisms of energy transport, redistribution, and conversion almost always occur in a multi-scale manner, while the driving mechanisms often include energy accumulation, free energy excited relaxation processes, dissipation and self-organization. The plasma processes associated with energy conversion, transport, and self-organization, such as magnetic reconnection, instabilities, linear and nonlinear waves, wave-particle interactions, dynamo processes, turbulence, heating, diffusion, or convection, represent fundamental physical ingredients of similar dynamical behavior occurring in the near-Earth space, at the Sun, in the heliosphere, or in astrophysical environments.

The International Astrophysics Forum (IAFA 2011) held in “Europe’s most beautiful flower village,” in the Tyrolean Alpbach in June 2011, reviewed the state of the art of space and astrophysical plasma research and identified the key problems to be addressed in the coming years. Merging new ideas in an interdisciplinary manner, the IAFA 2011 conference also provided a forum for promoting future international collaboration and research programs in theory, experiment, and numerical simulations with regard to space and astrophysical environments. Science topics addressed included the following:

- Magnetic field topology and reconnection
- Scaling and turbulence
- Wave-particle interactions
- Statistical physics and entropy approaches
- Shocks and nonlinear structures
- Multi-scale complexity, self-organization and relaxation
- Heliogeophysics

The scientific sessions were organized into a few consecutive reviews of related principal topics, followed by a 15-min long informal forum discussion. The result of these enthusiastic discussions is the IAFA 2011 Proceedings book. We warmly thank all the participants of IAFA 2011 who contributed to the Proceedings or presented their talks during the meeting.

Finally, we appreciate the support provided by the International Advisory Committee, the Local Organizing Committee, the numerous referees, and the Management of Congress Center Alpbach for their valuable help.

Innsbruck, Austria

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Multi-scale Dynamical Processes in Space and
Astrophysical Plasmas

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2012, XVI, 232 p., Hardcover

ISBN: 978-3-642-30441-5