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Nonlinear Processes in Geophysics

Preface

"Nonlinear plasma waves in space and laboratories"

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Plasma waves, turbulence and chaos have similar nonlinear processes to those in oceans, and successful understanding of them have benefited from multidisciplinary interactions between space plasma physicists, laboratory plasma physicists, fusion physicists, astrophysicists, mathematicians, and oceanographers. The Eighth International Nonlinear Wave Workshop (NWW8) was held in La Jolla, California, 1–5 March 2010 to foster such interactions. The Workshop gathered nonlinear plasma and water wave experts from the US, France, Czech Republic, Germany, Greece, Holland, India and Japan for a week-long series of informal and interactive discussions of nonlinear waves and chaos. This special issue contains 7 reviews on selected topics given at the Workshop. At the 2010 Workshop, special focus was given on nonlinear waves and turbulence in the terrestrial environment as well as in the interstellar medium from observational, laboratory and theoretical perspectives. Detailed discussions were held on the role of temperature anisotropies and related instabilities, on the properties and origin of the so-called dissipation range, and on various coherent structures of electromagnetic and electrostatic character. Other topics of attention included magnetic reconnection, collisionless shocks, and the properties of magnetospheric whistler and chorus waves. Examples and analysis techniques for superdiffusion and subdiffusion processes were identified. The location of this workshop series is moved around the world to allow local graduate students to attend. The format of the NWW workshops is quite different from that of a scientific meeting, or the usual workshop. All speakers are allocated an equal amount of time for their talks (graduate students may opt for half time) and thus there are no "principal speakers". All audience members may interrupt the speaker with questions of clarification or physics at any time during their talks (the session chairs have to cut-off overly lengthy questions if they occur). All attendees must give talks. The number of attendees is kept small (less than 35) to allow for adequate discussion and interaction. Attendance is by invitation only. Currently active, leading experts on a topic are chosen so that the level of discussion remains high. Finally, the workshop is kept flexible enough so that authors can change the topic of their talks (during the meeting) to present results more along the mainstream of the workshop. This unusual format for a workshop started out as an experiment in 1994. Previous workshops have been held in Kyoto Japan (1994), Köln Germany (1997), Carlsbad California (1999), Tromsø Norway (2001), Mumbai India (2003), Fukuoka Japan (2006), and Beaulieu-sur-Mer France (2008). It has worked out so well that we are planning for a ninth workshop in 2013. Along the way, it has been discovered that the mix of participants from different disciplines is crucial towards the successful dissemination of ideas and techniques. It is also obvious that the attendees must be friendly and communicative for substantial cross-fertilization to take place. All ideas are open for presentation and discussion. This special issue contains selected reviews on nonlinear wave-particle interactions (Tao and Bortnik, 2011), highly nonlinear mirror mode structures (Tsurutani et al., 2010), solitary electrostatic pulses generated by a suprathermal electron beam (Lefebre et al., 2011), a comparison of the turbulence in the Very Local Interstellar medium with that of the solar wind (Spangler et al., 2011), a means to use multispacecraft measurements to analyze turbulence in the wave vector domain (Narita et al., 2011), and a new technique to decipher the multifractal characteristics of intermittent structures called rank-ordered multifractal analyses: ROMA (Chang et al., 2011). The paper by del-Castillo-Negrete (2011) reviews nondiffusive transport in both fluids and plasmas. For the fluid case, nondiffusive chaotic transport by Rossby waves in zonal flows is studied following a Lagrangian approach. For plasmas, an analysis of test particle transport in pressure gradient driven turbulence is used.

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