Preface

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25 Years of Self-Organized Criticality

The theoretical concept of *self-organized criticality* (SOC) has revolutionized our understanding of complexity in nature, with applications in astrophysics, solar and stellar physics, geophysics, magnetospheric physics, laboratory plasma physics, condensed matter physics, biophysics, social sciences, and even financial physics. The SOC concept was originally pioneered by Per Bak in his seminal paper in 1987 with the paradigm of avalanching sandpiles, which became the prototype of nonlinear dissipative self-organizing systems with the ubiquitous powerlaw behavior, but there are much broader connections to nonlinear physics, statistics of extreme events, catastrophe theory, phase transitions, turbulence, percolation, chaotic systems, and network theory.

About 25 years later we organized two workshops at the *International Space Science Institute (ISSI)* in Bern, Switzerland, dedicated to the topics of “*Self-Organized Criticality and Turbulence*”, which took place during 2012 October 15–19 and 2013 September 16–22. The participants of this international ISSI meeting were (in alphabetical order); Markus Aschwanden (Lockheed Martin, Solar and Astrophysics Laboratory, USA), Sandra Chapman (University of Warwick, UK), Norma Crosby (Belgian Institute for Space Aeronomy, Belgium), Michaila Dimitropoulou (University of Athens, Greece), Manolis Georgoulis (Academy of Athens, Greece), Stefan Hergarten (University of Freiburg, Germany), Henrik Jeldtoft Jensen (Imperial College London, UK), James McAteer (New Mexico State University, USA), Alexander Milovanov (ENEA National Laboratory, Italy), Shin Mineshige (Kyoto University, Japan), Laura Morales (Canadian Space Agency, Canada), Naoto Nishizuka (ISAS/JAXA, Japan), Gunnar Pruessner (Imperial College London), Raul Sanchez (University of Madrid, Spain), Surjal Sharma (University of Maryland, USA), Antoine Strugarek (University of Montreal, Canada), Vadim Uritsky (NASA/GSFC, USA), and

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Nicolas Watkins (British Antarctic Survey, Cambridge, UK). The results of the discussions and research presented during the two weeks of these ISSI meetings is documented in the following four reviews in this volume that all cover different aspects related to the topic of *25 Years of Self-Organized Criticality*, such as concepts and controversies (Watkins et al.), solar and astrophysics (Aschwanden et al.), space and laboratory plasmas (Sharma et al.), and numerical detection methods (McAteer et al.). All members of this ISSI team contributed to the writing of these four reviews, additionally helped by the co-authors Alexander Klimas (NASA/GSFC, USA), Jack Ireland (NASA/GSFC, USA), and Valentyna Abramenko (Big Bear Observatory of NJIT, USA).

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