

# Prologue

This book contains the contributions of the invited speakers at the conference on *Similarities and Universality in Relativistic Flows* (SURF 2000), which took place from October 1st to 5th, 2000, on the island of Mykonos, Greece. A companion volume, including the contributed talks, has been published by Logos Verlag, Berlin, under the title “Similarities and Universality in Relativistic Flows”. The meeting was part of the European Union PhD Euroconference Program and aimed to give young European astrophysicists a platform to present and discuss recent developments in observation and theory of relativistic flows in astrophysical objects.

The topic of this book is the study of relativistic outflows such as those seen in gamma-ray bursts (GRBs), microquasars and active galactic nuclei (AGN). These flows are associated with compact objects ranging from neutron stars and stellar-mass black holes to supermassive black holes ( $10^6 - 10^9$  solar masses). The first three contributions in the book deal with the physical processes believed to be important in all families of systems exhibiting relativistic flows. The first one focuses on the relevant radiative processes and Doppler-boosting of the radiation from relativistically moving sources. Then particle acceleration via the first-order Fermi process in relativistic shock fronts is studied, as this mechanism is a good candidate for supplying accelerated electrons responsible for the highly non-thermal spectra being observed. After that, possible jet formation and collimation mechanisms are presented.

The next two contributions present an overview of our understanding of powerful AGN. First, the evolution of classical radio galaxies through studies of their large-scale structure is addressed, followed by a review of our understanding of blazars, which are AGN with jets almost aligned to our line of sight and observed luminosities dominated by a sub-parsec scale region close to the central black hole. Shifting to stellar-size systems, our current understanding of so-called microquasars, binary star systems resembling in many aspects scaled-down versions of AGN, is presented. The next contribution deals with observation and theory of GRBs. The study of the proper bursts and their afterglows suggests the existence of relativistic jets in these objects.

The fluid dynamics of relativistic astrophysical flows are quite complex, and one often has to resort to numerical simulations to describe them. Results of such numerical experiments are presented and compared to recent radio interferomet-

ric observations of jets. This is followed by an introduction to the development of modern numerical techniques for solving relativistic hydrodynamical problems.

The epilogue gives an overview of all the topics discussed at the SURF 2000 conference and offers an outlook over current and future research opportunities.

The meeting was attended by 39 participants from 16 different countries (Australia, Canada, France, Germany, Greece, The Netherlands, Ireland, Israel, Italy, Japan, Norway, Portugal, Russia, Spain, UK, USA). Funding for the conference was provided by the European Union programme on *High Level Scientific Conferences*, under contract HPCFCT-2000-00109. We wish to thank the company Starlab for funding the accommodation and travel expenses of some invited speakers and the administrative staff of the Max-Planck-Institut für Kernphysik for their help in organising the conference. We especially thank the authors of the articles included in this book for their contributions.

Heidelberg,  
October 2001

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Relativistic Flows in Astrophysics

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2002, XII, 246 p., Hardcover

ISBN: 978-3-540-43518-1