ASTROPHYSICS AND SPACE SCIENCE PROCEEDINGS

S.S. Hasan
R.T. Gangadhara
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Editors

Turbulence, Dynamos, Accretion Disks, Pulsars and Collective Plasma Processes

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TURBULENCE, DYNAMOS, ACCRETION DISKS, PULSARS AND COLLECTIVE PLASMA PROCESSES

FIRST KODAI-TRIESTE WORKSHOP ON PLASMA ASTROPHYSICS HELD AT THE KODAIKANAL OBSERVATORY KODAIKANAL, INDIA AUGUST 27 – SEPTEMBER 7, 2007

Edited by

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Preface

The Kodaikanal Observatory of the Indian Institute of Astrophysics traces its origins to the end of the nineteenth century when it was decided to relocate the Madras Observatory to a high altitude site with a view to initiate observations of the Sun. Many valuable observations were made here including the discovery of outflowing material in sunspots discovered by John Evershed in 1909. The Observatory continues to provide useful solar data as well as serve as a centre for research and training programmes. Moreover, with its serene and beautiful environment, and good infrastructure it is an ideal location for the pursuit of intellectual and pedagogical activity.

In 2006 an initiative was taken to begin a series of schools and workshops in different areas of astronomy and astrophysics with a view to attract students to this field as well as to enhance excellence and greater interaction among researchers working in these areas. The first Kodai-Trieste Workshop on Plasma Astrophysics, which was held at the Kodaikanal Observatory, Kodaikanal during August 27 - September 7, 2007, was a continuation of this effort. Organized jointly by the Indian Institute of Astrophysics, Bangalore and the Abdus Salam International Centre for Theoretical Physics (ASICTP), Trieste, its aim was to provide a strong conceptual foundation in plasma astrophysics. The Workshop was conceived when Prof. K. R. Sreenivasan, Director, ICTP, visited the Indian Institute of Astrophysics in October, 2006.

It is well established that more than 99% of the baryonic matter in the universe is in the plasma state. Most astrophysical systems could be approximated as conducting fluids in a gravitational field. It is the combined effect of these two that gives rise to the rich variety of configurations in the form of filaments, loops, jets and arches. The plasma structures that cannot last for more than a second or less in the laboratory remain intact on astronomical time and spatial scales. High energy radiation sources such as active galactic nuclei involve coherent plasma radiation processes for their exceptionally large output from regions of relatively small physical sizes. The generation of magnetic field, anomalous transport of angular momentum with decisive bearing on star formation processes, the ubiquitous MHD turbulence under

conditions not reproducible in terrestrial laboratories are some of the generic issues still awaiting a concerted effort to be properly understood. Quantum plasmas, pair plasmas and pair-ion plasmas exist under extreme conditions in planetary interiors and exotic stars.

This monograph, consisting of 22 contributions, is organized in six parts dealing with astrophysical turbulence, dynamos, pulsar radiation mechanisms, quantum plasmas, accretion disks, and solar and space plasmas. The workshop brought together several international scientists and young researchers working in plasma astrophysics.

The workshop owes its success to the efforts of a large number of persons, including V. Krishan, the course director, K. E. Rangarajan, the convener, and R. T. Gangadhara, the coordinator. In addition, I am grateful to all the speakers for readily accepting to participate in the workshop and for a timely submission of their manuscripts. I am thankful to the scientific and administrative staff of the Indian Institute of Astrophysics at the Bangalore and Kodaikanal campuses for providing local support.

Bangalore
April 2008

S. S. Hasan

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Part VI Solar and Space Plasmas

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