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Lectures on Solar Physics

Springer

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Preface

The idea for these lecture series arose at a Workshop on solar physics which was held at the Inter University Centre for Astronomy and Astrophysics (IUCAA), Pune/India in December 2000. This Workshop aimed to present a comprehensive and up-to-date overview of solar physics for interested students and faculty in other branches of astrophysics. It was intended to show that this field, concentrating on our closest star, is a vital and exciting field of research. For this purpose a number of comprehensive reviews were organised which assumed that the audience would have only a basic physics background but had no prior knowledge about solar physics. The set of lectures covered topics ranging from the solar core to the convection zone, the photosphere, chromosphere, and corona and extending to the solar wind in the interplanetary medium

During and after the Workshop there was much enthusiasm for this form of presentation and it was felt that these lectures, augmented by including the latest research findings in the field, would be beneficial to a much larger audience. Thus the plan for this book originated which could then be realised thanks to the publishers, Springer-Verlag.

There are 9 articles based on the lectures given at the Workshop. The article by Chitre on "Overview of Solar Physics" gives an introduction to the whole variety of phenomena of solar physics, the problems and their solutions and salient results. The article on "Instrumentation and Observational techniques related to Solar Physics" by Bhatnagar describes in detail the principles of solar instrumentation normally used to take simple white light, monochromatic and spectroscopic observations. Practical methods to measure important basic parameters, like area, position and the classification of sunspots are described in detail. Antia's article on "Solar Interior and Seismology" describes the solar interior, the technique of helioseismology and how this new technique allows a determination of the internal structure and dynamics of the Sun and constrains theories of stellar structure, evolution and angular momentum transport. Ambastha's article on "The Active and Explosive Sun" gives an overview of highly time-dependent phenomena in the photosphere, chromosphere and corona of the Sun and provides some theoretical models of the solar flares. Hasan's article on "Magnetic Flux Tubes and Activity on the Sun" discusses the generation, storage and emergence of magnetic fields in the form of small-scale flux tubes and examines their role in heating of the chromosphere. Ventakrishan's article on "Solar Magnetic Fields" gives a theoretical overview of the generation

of magnetic fields by the dynamo mechanism, the general magnetic field topology and how the magnetic fields are measured. Ulmschneider's contribution on "The Physics of Chromospheres and Coronae" discusses why all stars like the Sun have hot outer chromospheric and coronal layers. It identifies the heating mechanisms and dynamical processes which take place both in the presence and absence of magnetic fields. The article by Dwivedi on "The Solar Corona" gives a general overview of the solar corona, how it is observed and what the physical processes leading to its formation are. Finally Manoharan's contribution on "The Solar Wind" describes the generation and measurement of the solar wind derived from in situ observations by spacecraft and interplanetary scintillation studies.

We hope that by reading these lectures, interested people, amateurs, graduate and postgraduate students will be motivated to take up solar physics as an area of research, and share our excitement about the wonders of our nearest star – the Sun.

We are thankful to T. Padmanabhan and the Inter University Centre for Astronomy and Astrophysics, Pune for organising and hosting this Workshop on Solar Physics.

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