PREFACE

This IAU-symposium was the first which was entirely dedicated to dynamo processes, which are fundamental on all cosmical scales.

Dynamo theory concerns one of the few truly key questions of recent cosmic physics. There is increasing evidence for the magnetic character of most short-term activity phenomena in astrophysics. Obviously, the triangle "gravity, nuclear power, magnetism" dictates cosmic evolution over a very broad scale of magnitudes. A complicated interplay of rotation, magnetism and turbulence, that is hard to resolve, determines stellar and galactic activity for almost all the short and medium time-scales. Behind these multiform phenomena, the cosmic dynamo works in various guises, all involving inductive and dissipative equilibria in rotating turbulent cosmic plasmas.

The Sun, representing the cosmic dynamo par excellence, stands from the beginning at the centre of interest for those who followed the dynamo idea. Even the first models were able to present an explanation of the typical structural appearance of the solar magnetic field, i.e. a 22 year cycle, activity belts and their zonal migration, antisymmetry of the magnetic polarity. However, the solar dynamo still provides topics of further discussions, since confrontation with recent observational data raised and still raises new questions, non of which have yet found a plausible answer. These questions represent a challenge for the development of the basic theories: Understanding of turbulence, especially using methods of modern nonlinear physics. Numerical simulations are promising in the near future.

The discovery of magnetic cycles in late-type stars opened the possibility of testing dynamo theory with a larger set of objects. Basically, the dependence on characteristic stellar parameters (especially the rotation period) of the excited magnetic field can be studied and compared with the theoretical models. Observations today of the magnetic activity of solar type stars that are younger than the Sun can provide useful insights into the behaviour of the early Sun.

The strongest impulse for developing dynamo theory during the last ten years came from the discovery of global magnetic fields in a number of nearby galaxies. Whereas for our own galaxy we, as the insiders, have only a rather limited insight into the global structure of the Galactic magnetic field, observations of certain galaxies revealed in an impressive way well-ordered large scale fields. Special aspects made disc dynamo theory a fascinating matter: Galaxies generate magnetic fields of different symmetry types. There are some with magnetic fields of axisymmetric structure and others with a non-axisymmetric (bisymmetric) structure. Further, in contrast to other cosmical objects in which dynamo action occurs, galaxies are transparent. Hence the magnetic field inside a galaxy can be observed and certain parameters that influence the generation process, e.g. the rotation law, can be measured. And, last but not least, disc dynamo theory meets with much more severe mathematical difficulties in comparison with the well-developed theory of spherical models.

It was the idea of the organizers of this symposium to gather together all those who pursued the dynamo idea for explaining the appearance of magnetic fields in

any kind of cosmical objects. Review papers as well as papers concerning up-to-date work were presented. Since new observational results are always an important stimulant for developing theory we also included papers concerning the detection of magnetic fields and of phenomena related to magnetic fields in various cosmical contexts.

It turned out that papers on magnetic fields in galaxies dominated this symposium. In order to acquire more information on dynamo theory, it is recommended that notice be taken of the proceedings of two relevant conferences, which took place at almost the same time: The IAU-colloquium 141 "The Magnetic and Velocity Fields of Solar Active Regions" in Beijing, which was held during exactly the same week as our symposium, and the NATO-Advanced Study Institute "Theory of Solar and Planetary Dynamos" at the University of Cambridge (UK) at the end of September. Together, these may provide a complete insight into what is going on in the exploration of cosmical magnetism and its theoretical explanation.

Members of the Scientific Organization Committee of this IAU-symposium were U. Frisch (France), F. Krause (Germany, Chair), D. Loper (USA), K.H. Moffatt (UK), N.F. Ness (USA), A. Nordlund (Denmark), E.N. Parker (USA), E. Priest (UK), K.-H. Rädler (Germany), P.H. Roberts (USA), M. Stix (Germany), M. Tosa (Japan), I. Tuominen (Finland), R. Wielebinski (Germany), and H. Yoshimura (Japan).

We are indebted to the SOC-members and many other individuals who contributed to the success of the symposium. The editors especially wish to thank Andrea Trettin and Ljudmila Kurth for their energetic efforts before and during the meeting as well as for their continuous assistance in editing this volume.

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