

JD15 – Magnetic Fields in Diffuse Media

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Preface

Most of the baryonic matter in the Universe is permeated by magnetic fields which affect many, if not most, of astrophysical phenomena both, in compact sources and in diffuse gas.

Recent years have been marked by a worldwide surge of interest in the astrophysical magnetic fields, their origin, and their influence on the formation and evolution of astrophysical objects (stars, galaxies, cooling flows). This growing interest is in part due to the fact that it has become possible to trace magnetic fields in molecular clouds, over vast extensions of the Milky Way and to study extragalactic magnetic fields, including fields in clusters of galaxies. With the combination of various techniques, such as Zeeman and Faraday rotation measurements with synchrotron and aligned grain polarimetry, it is now possible to undertake quantitative observational studies of magnetic fields, the results of which can be compared with high resolution dynamo and MHD turbulence simulations. This brings the field to a new stage and, at the same time, calls for addressing fundamental questions, such as the correspondence of basic processes in astrophysical media with computer simulations, and our real understanding of the processes that we rely to infer magnetic fields from observations.

We thus felt that it was time to invite researchers of magnetic fields to debate the vital questions related to the origin of astrophysical magnetic fields in diffuse gas, their effects on transport processes in the interstellar medium of spiral galaxies and in the intracluster medium in order to get better insight into key astrophysical processes like star formation, acceleration of cosmic rays, and transfer of matter and energy between the diffuse and dense gas.

This two-day Joint Discussion on “Magnetic Fields in Diffuse Media” held at the IAU General Assembly, in Rio de Janeiro, provided an excellent forum for this timely undertaking. Because of the cross-disciplinary nature of the subject it was able to catch the attention and interest of a wide range of astrophysicists, including specialists in space and Solar physics.

The meeting counted with about 100 participants from 28 countries including 20 invited contributions, 6 oral contributions and 63 poster presentations. All the sessions ended with discussion panels of the related topics. We have also awarded prizes for the five most outstanding posters which were nominated by an anonymous competent referee. In the closure, a Summary Panel highlighted what might be the most relevant questions for continuing the study in the field:

- What is the role of turbulent magnetic reconnection and ambipolar diffusion on star formation triggering?
- What is the role of MHD turbulence on clouds formation?
- What is the dominant mechanism in the galactic dynamo: is it driven by turbulence and/or magnetic helicity?
 - To what extent is the kinetic-MHD turbulence dominant in the intergalactic medium?
 - What is the nature of the cosmic ray and MHD turbulence coupling in the intergalactic and intracluster medium?
- What is the role of supernovae, AGNs and mergers on turbulence and magnetic field feeding at the cores and outskirts of galaxy clusters?
- What will the coming new generation of instruments (SKA Pathfinders, LSST, SOFIA, PLANCK, LOFAR, ALMA, SKA) unveil about large scale cosmic field origin and structure?

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Rio de Janeiro, Brazil, August 2009*