Preface: Special Session SpS4
New era for studying interstellar and intergalactic magnetic fields

Magnetic fields dominate the universal energy balance on a wide variety of spatial scales; preserving life on Earth from extinction by cosmic rays, regulating star formation in giant molecular clouds, regulating the enrichment of the intergalactic medium by galactic winds and possibly regulating the growth of individual galaxies and filaments of galaxies. The structure of magnetic fields is determined by ubiquitous astrophysical turbulence and critically affects transport processes, including propagation and acceleration of cosmic rays and transfer of heat. Turbulent magnetic fields play an important role in magnetic field generation via dynamo processes, and must be understood to separate galactic foregrounds from the Cosmic Microwave Background signal.

Despite their importance and ubiquity, magnetic fields remain one of the most poorly understood components of the cosmos due to the challenges involved in both their measurement and theoretical description.

Recent years have been marked by two significant developments. First of all, advances in instrumentation, both in the more traditional radio frequency portion of the spectrum, and in the sub-mm and even the near-IR and optical, are dramatically advancing our knowledge of the incidence, strength and topology of magnetic fields in astrophysics. For the first time, there is clear evidence for an all-pervasive intergalactic magnetic fields according to HESS/FERMI observations. Second, but equally important, significant advances in numerical techniques provided possibilities to simulate magnetized plasmas with realistic turbulent structure and to test theoretical models of how turbulent magnetic fields interact with fully and partially ionized gases and cosmic rays. Combined with progress in the development of techniques to compare numerical and observational data, this makes the field ripe for a breakthrough in understanding of astrophysical magnetic fields, their properties and effects on key astrophysical processes.

At the same time, advances in numerical simulations are providing a greatly improved context in the interpretation of the observations and testing theoretical predictions. The tremendous increase of computational power helps to describe the complex processes of magnetic field generation, evolution and its effects on astrophysical processes.

Recent insights emerging from studies addressing magnetism on a wide range of specific scales and employing a wide range of techniques call for closer synergetic interactions of observers and theorists in order to synthesize a deeper understanding of the astrophysical magnetic phenomenon. Observers from various different wavelength ranges, theorists and computational astrophysicists converge to discuss the results in hand and plan for a new epoch of observing interstellar and intergalactic magnetic fields.

Given the very wide range of new data and results to present and discuss, there have been a lot of interest presentattions, including 31 invited talks, 21 talks and 23 posters in 8 sessions. All these sessions were well attended by assmebly participants, because the meeting room of 150 seats is always very full.

We would like to thank the IAU for supporting this Special Session and all the members of the Scientific Organizing Committee:

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