SYGP 1: Invited Talks

Time: Monday 10:30–13:00 Location: V55.22

Invited Talk SYGP 1.1 Mon 10:30 V55.22

Gemeinsame Forschungsprojekte in Fusions- und astrophysikalischen Plasmen — •Sibylle Günter[1] und Sami K. Solanki[2] — [1]Max-Planck-Institut für Plasmaphysik, Garching — [2]Max-Planck-Institut für Sonnensystemforschung, Katlenburg-Lindau

Es gibt viele Gemeinsamkeiten zwischen Fusions- und astrophysikalischen Plasmen, vor allem die Tatsache, dass es sich meist um sehr stoßarme Plasmen handelt. Daher finden sich wesentliche Effekte wie beispielsweise schnelle Rekonnexion, resonante Wechselwirkung zwischen Teilchen und Wellen, das Auftreten suprathermischer Teilchen und turbulenter Transport in beiden Gebieten. In astrophysikalischen Plasmen gibt es ein viel breiteres Spektrum solcher Phänomene, aber Laborplasmen erlauben meist bessere Diagnostik und aktive Beeinflussung der Plasmen. Eine engere Zusammenarbeit, wie es sie früher zwischen diesen beiden Gebieten gab, wäre daher sehr wünschenswert. Im Vortrag wird ein Überblick über Ergebnisse einer gemeinsamen Forschungsinitiative zwischen den Max-Planck-Instituten für Plasmaphysik und Sonnensystemforschung vorgestellt. Im nächsten Jahr wird eine neue Forschungsinitiative gemeinsam mit der Princeton University begonnen: das Max-Planck/Princeton research center for plasma physics (auf deutscher Seite zusätzlich das MPI für Astrophysik und aus Princeton die astrophysikalische Fakultät der Universität und das Plasma Physics Laboratory (PPPL)). Es wäre wünschenswert, wenn diese Initiative Keimzelle für eine engere Kooperation zwischen den beiden Gebieten auch in Deutschland würde. Im Vortrag werden die wesentlichen Themen für dieses Zentrum vorgestellt.

Invited Talk SYGP 1.2 Mon 10:55 V55.22

Liquid metal experiments on the creation and action of cosmic magnetic fields — •Frank Stefani[1], Gunter Gerbeth[1], Andre Giesecke[1], Thomas Gundrum[1], Martin Seilmayer[1], Agris Gailitis[2], Marcus Gellert[3], and Günther Rüdiger[3] — [1]Helmholtz-Zentrum Dresden-Rossendorf, Germany — [2]Institute of Physics, Salaspils, Latvia — [3]Leibniz-Institut für Astrophysik, Potsdam, Germany

The success of the large-scale dynamo experiments in Riga and Karlsruhe at the end of 1999 has boosted strong worldwide activity to simulate the creation and action of cosmic magnetic fields in the liquid metal laboratory. With some focus on our own projects, we review the recent efforts to study hydromagnetic dynamo action and related magnetic instabilities, such as the magnetorotational instability (MRI) and the Tayler instability (TI). We sketch our plans to set-up the new liquid sodium facility DRESDYN that will include a dynamo experiment based on precession, and a Taylor-Couette experiment for the combined investigation of MRI and TI.

Invited Talk SYGP 1.3 Mon 11:20 V55.22

The thermal noise of the universe — •Reinhard Schlickeiser[1] and Peter H. Yoon[2] — [1]Institut für Theoretische Physik, Lehrstuhl IV: Weltraum- und Astrophysik, and Research Department Plasmas with Complex Interactions, Ruhr-Universität Bochum, D-44780 Bochum, Germany — [2]Institute for Physical Science and Technology, University of Maryland, College Park, MD 20742, USA, and School of Space Research, Kyung Hee University, Yongin-Si, Gyeonggi-Do, 446-701, Korea

Fluctuations occur in all laboratory and space plasmas, including unmagnetized and those in thermal equilibrium, Using the system of the Klimontovich and Maxwell equations for collision-poor unmagnetized plasmas, general expressions for the electromagnetic fluctuation spectra (electromagnetic field, charge and current densities) from uncorrelated plasma particles are derived, which are correct within the theory of special relativity. The general expressions hold for collective and non-collective fluctuations, and for weakly amplified and weakly propagating (including aperiodic) fluctuations. Earlier claimed mathematical divergencies, when calculating the fluctuations from growing modes do not occur.

Probably the most important unmagnetized space plasma is the early intergalactic medium, ionized from the earliest generation of stars at redshift about 20, which transformed the Universe from darkness after recombination to light. We determine the thermal noise of the universe in weakly amplified and aperiodic modes, where the latter might be the source of electromagnetic dark forces.

Invited Talk SYGP 1.4 Mon 11:45 V55.22

The role of magnetic fields in core collapse supernovae — •Ewald Mueller — Max-Planck-Institut fuer Astrophysik, 85748 Garching, Deutschland

Simulations of core collapse supernovae pose a true challenge as they require a proper treatment of multi-dimensional neutrino radiation hydrodynamics, and possibly magneto-hydrodynamic processes. In my talk I will address the current status of core collapse supernova modeling, discuss magneto-hydrodynamic processes that can amplify a magnetic seed field during a core collapse supernova explosion, and present recent results from MHD core collapse simulations.

Invited Talk SYGP 1.5 Mon 12:10 V55.22

Magnetic instabilities in stars — •Rainer Arlt — Leibniz-Institut für Astrophysik Potsdam, Germany

MHD instabilities are ubiquitous phenomena in astrophysics. In many cases they are the key to understanding the enhanced viscosity and transport observed in stars, accretion disks and the interstellar medium. Here we address kink-type instabilities and the magnetorotational instability in the context of stars, look for enhanced transport of angular momentum and possible dynamo effect from the instabilities.

Invited Talk SYGP 1.6 Mon 12:35 V55.22

Small-scale vortices and shocks in the solar atmosphere — •Manfred Schüssler, Robert H. Cameron, and Rainer Moll — Max-Planck-Institut für Sonnensystemforschung, Katlenburg-Lindau, Germany

We report on the occurrence of vortices and shocks in realistic simulations of solar surface convection. In regions of weak magnetic field, the top layers of the photosphere are dominated by shocks driven by convective upflows. A completely different mechanism for local heating occurs in areas threaded by a sizeable vertical magnetic field: viscous dissipation associated with vortex flows extending high into the photosphere. These results are relevant for understanding the different temperature structure in weakly and strongly magnetized regions of the solar atmosphere.