SYPS 1: Symposium Fundamental Physics in Space

Zeit: Mittwoch 14:00–16:00 Raum: SFG 0140

Hauptvortrag SYPS 1.1 Mi 14:00 SFG 0140

Magnetospheric Physics – Basic Processes and Open Questions — •Antonius Otto — Geophysical Institute, Univ. of Alaska, Fairbanks

The terrestrial magnetosphere is a unique laboratory to study fundamental plasma physics because it allows the in-situ study of basic processes that are important in many astrophysical plasma environments. Although basic magnetospheric configuration is very simple – a magnetic dipole with an inner boundary at the upper atmosphere and an outer boundary subjected to the solar wind – the detailed physics is extremely rich. Magnetospheres allow the study of different types of shock physics, various macro- and microscopic boundary layer processes, plasma transport across boundaries, wave propagation, energy storage and release, current sheet formation, and magnetic reconnection. This presentation will address several selected topics motivated by the enormous progress that has been achieved in magnetospheric physics during the past decades. We have now a much better understanding of the role of Kelvin-Helmholtz waves and magnetic reconnection for the plasma transport at magnetospheric boundaries and the nature of transient events at the bow shock. Observations have provided a new framework for the energy storage and release during geomagnetic substorms. New evidence suggests that reconnection occurs almost always in bursty individual events. However, there are still basic open questions including fundamental topics such as the cause for the auroral acceleration, the physics of non-adiabatic plasma heating, and the micro-physics of magnetic reconnection.

Hauptvortrag SYPS 1.2 Mi 14:30 SFG 0140

GRACE/GRACE-FO and LAGEOS/LARES in Geodesy, Earth Observation and Relativity — •Rolf König[1], Ignazio Ciufolini[2], Frank Flechtner[1], and Antonio Paolozzi[3] — [1]Deutsches GeoForschungsZentrum GFZ, Telegrafenberg, 14473 Potsdam — [2]University Salento and Centro Fermi, Italien — [3]Sapienza Universita Roma and Centro Fermi, Italien

GRACE, launched in 2002, and its continuation GRACE-FO, to be launched end of 2017, are dedicated missions for the measurement of the time variable gravity field. We will briefly summarize the major achievements of GRACE in Earth observation so far. In 2004 the early GRACE static gravity field models firstly allowed to measure frame-dragging or the Lense-Thirring (LT) effect by Satellite Laser Ranging (SLR) observations to the LAGEOS satellites with an accuracy of 10%. In 2012 the LARES satellite was launched to complement the LAGEOS constellation, goal of the mission is to improve the accuracy of the LT measurement by one order of magnitude. We will briefly summarize the impact of LARES into geodesy before we focus on the relativity aspect. First results on the LT measurements with LARES are published reporting an accuracy of about 5%. We will independently repeat the LT analysis with a longer data span based on a suite of new gravity field models.

Hauptvortrag SYPS 1.3 Mi 15:00 SFG 0140

LISA and LISA Pathfinder — •Gerhard Heinzel — Max-Planck-Institut fuer Gravitationsphysik (Albert-Einstein-Inst.) Hannover

This presentation will summarize the status of the planned gravitational wave observatory LISA, and the latest results from its precursor mission LISA Pathfinder which is in orbit now.

Hauptvortrag SYPS 1.4 Mi 15:30 SFG 0140

Promises and challenges of Gaia astrometry — •Sergei Klioner — Lohrmann-Observatory, Technische Universität Dresden, 01062 Dresden, Germany

ESA's second space astrometry mission Gaia was launched in December 2013 and after an extended commissioning period started its scientific operations in July 2014. During its routine science operations Gaia has already delivered an immense data set of high-accuracy positional observations. In spite of some unexpected difficulties with the instrument, Gaia Data Processing and Analysis Consortium published the first Gaia Data Release in September 2016 and is working towards the second Gaia Data Release in the first half of 2018.

High-accuracy astrometric survey being made by Gaia opens a new window for specific research in the field of fundamental physics. This research window ranges from weak-field tests of General Relativity and its foundations in the gravitational field of the solar system to estimates of energy flux for gravitational wave background in certain frequency domains. These promises of space astrometry will be critically reviewed. The interrelation between astrometric solution, the resulting reference frame and the assumptions on fundamental physical laws made during data processing will be discussed.