EP 10: Planeten und kleine Körper I

Zeit: Donnerstag 8:30–10:15 Raum: GW2 B2880

Hauptvortrag EP 10.1 Do 8:30 GW2 B2880

Sounding the interior of Jupiter's moons through observations of their atmospheric emissions — •Lorenz Roth — KTH Royal Institute of Technology, Stockholm, Sweden

Magnetic field measurements by the Galileo spacecraft were used to probe the subsurface water oceans on Jupiter's moons Europa and Callisto through electromagnetic induction. In addition to in-situ spacecraft measurements, electromagnetic induction at Jupiter's moons can also be investigated through observations of auroral emission from the tenuous moon atmospheres. This is possible, because the morphology of the aurora, excited by the interaction of magnetospheric plasma with the atmospheres, is controlled by the magnetic field. In the case of Ganymede, magnetic fields induced in the subsurface ocean effectively suppress oscillations of the moon's auroral ovals, which was observed by the Hubble Space Telescope (HST). Magnetic induction in Europa's ocean might similarly affect its auroral emissions, but the effects could not be measured or determined yet, although the aurora has been extensively studied by HST. Observations of strongly oscillating auroral spots at the volcanic moon Io contradict the existence of a conductive magma ocean, postulated earlier based on in-situ measurements. I present an overview on our groups recent work on the aurora observations of Jupiter's moons Io, Europa and Ganymede and their interpretation with respect to electromagnetic induction inside the moons.

EP 10.2 Do 9:00 GW2 B2880

Io's plasma interaction with Jupiter's magnetosphere: Influence of global asymmetries in Io's atmosphere and volcanic plumes on the plasma environment — •Aljona Blöcker[1], Joachim Saur[1], and Lorenz Roth[2] — [1]Institut für Geophysik und Meteorologie, Universität zu Köln — [2]KTH Royal Institute of Technology, Stockholm, Sweden

Io's atmosphere is supported by sublimation of SO2 surface frost and by direct volcanic outgassing of SO2, where the detailed longitudinal and latitudinal structure is not fully known. We apply a 3D MHD model to analyze the effects of an asymmetric atmosphere and the role of volcanic plumes on the plasma interaction. Therefore, we use different atmosphere models with longitudinal and latitudinal dependencies. We compare our model results with Io's magnetic field environment measured with the Magnetometer of the Galileo spacecraft. We demonstrate that significant parts of the magnetic field perturbations, associated with the induction signals by Khurana et al. (Science 2011) can alternatively be explained by considering global asymmetries of the atmosphere without induced fields from a subsurface magma ocean.

EP 10.3 Do 9:15 GW2 B2880

A Fluid-Kinetic Model of Callisto's Ionospheric Electrons — •Oliver Hartkorn[1], Joachim Saur[1], and Darrell F. Strobel[2] — [1]Institute of Geophysics and Meteorology, University of Cologne, Pohligstr. 3, 50969 Cologne, Germany — [2]Department of Earth and Planetary Sciences, Johns Hopkins University, MD 21210, Baltimore, USA

We develop a model of the ionospheric electron population of Jupiter's moon Callisto using a prescribed neutral atmosphere composed of O2, CO2 and H2O. A kinetic description of ionospheric suprathermal electrons coupled with a fluid description of ionospheric thermal electrons is well suited to jointly analyze and interpret observations of electron density and atmospheric UV emission. Accordingly, we calculate the electron energy distribution function at each point in the ionosphere by solving the Boltzmann equation for suprathermal electrons and the continuity and energy equation for thermal electrons. We assume a stationary balance between local sources and sinks of electrons and electron energy neglecting electron transport. We consider photoionization, which is the dominant ionospheric electron source, and secondary ionization processes. Our calculations yield electron densities and electron impact generated UV emissions from Callisto's atmosphere. Comparisons between our modeled UV emission intensities and Hubble Space Telescope observations allow to draw conclusions on the atmospheric density of Callisto. Moreover, a joint comparison with HST observations and radio occultation observations of the Galileo spacecraft shows that Callisto's atmosphere possesses a day night asymmetry.

EP 10.4 Do 9:30 GW2 B2880

Cassinibeobachtungen der äußeren Saturnmonde — •Tilmann Denk[1] und Stefano Mottola[2] — [1]FU Berlin — [2]DLR Berlin

Mit der ISS-Kamera an Bord der internationalen Raumsondenmission Cassini-Huygens haben wir insgesamt 25 der 38 bekannten äußeren Saturnmonde beobachtet und über die Messung von Lichtkurven die Rotationsperioden bestimmt. Die schnellste Periode beträgt 5,5 h (Mond Hati), die langsamste 76,24 h (Tarqeq). Die Abwesenheit von schnellen Rotatoren deutet darauf hin, dass die mittleren Dichten der äußeren Saturnmonde deutlich geringer sind als diejenigen von Planetoiden, deren Perioden zum Teil unter 2,5 h liegen. Möglicherweise liegen viele Werte im Bereich von 0,5 g/ccm oder noch darunter, was den Dichten von Kometenkernen entspricht. Die mittlere Periode beträgt 11,0 h.

Elf Monde wurden anhand von Lichtkurvenmerkmalen als Kandidaten für "contact binaries" identifiziert, vier davon könnten sogar echte Doppelobjekte sein. Alle 13 bekannten Monde, deren Bahnen mehr als 27° gegen die Saturnbahn geneigt sind, rotieren langsamer als 10 h, während 3/4 aller gemessenen Objekte mit kleineren Bahnneigungen schneller rotieren. Ebenso gilt, dass alle Objekte, die größer als ~7 km sind, langsamer als 10 h rotieren (mit Ausnahme des großen Mondes Phoebe). Die physikalische Ursache hierfür ist bislang unbekannt.

Die letzte Cassini-Beobachtung eines äußeren Mondes erfolgt am 6.9.2017. Die Cassini-Mission soll am 15.9.2017 enden, wenn die Raumsonde in der Saturnatmosphäre verglüht. T.D. dankt dem Deutschen Zentrum für Luft- und Raumfahrt (DLR) in Bonn für die Unterstützung dieser Forschungsarbeiten (Förderkennzeichen: 50 OH 1503).

EP 10.5 Do 9:45 GW2 B2880

Multi-instrument overview of the 1-hour pulsations in Saturn's magnetosphere — •Benjamin Palmaerts[1,2], Elias Roussos[1], Aikaterini Radioti[2], Norbert Krupp[1], and Denis Grodent[2] — [1]Max-Planck-Institute für Sonnensystemforschung, Göttingen, Germany — [2]Laboratoire de Physique Atmosphérique et Planétaire, Université de Liège, Liège, Belgium

The in-situ exploration of the magnetosphere of Saturn has revealed different periodic processes. Several studies have reported periodicities of about 1 hour in the charged particle fluxes, plasma wave, magnetic field and auroral emission brightness. We made a 10-year survey of the quasi-periodic (QP) 1-hour energetic electron injections observed in the Saturn's outer magnetosphere by the MIMI/LEMMS instrument on board Cassini. These injections appear as pulsations in the electron fluxes at energies between 100 keV up to several MeV. We investigated also the concomitant signatures of the electron pulsations in the radio emissions and the magnetic field measured by Cassini. The results of the multi-instrument study suggest a high-latitude source for the pulsed electrons. Observations of QP 1-hour brightening of a high-latitude auroral spot associated with the magnetospheric cusp support this scenario. Pulsed dayside magnetopause reconnection is a likely common triggering process for the cusp auroral brightening and the QP pulsations in the high-latitude electron fluxes. Finally, the presence of electron pulsations in the vicinity of the magnetopause is another indication of the involvement of magnetopause reconnection as a triggering process for the QP electron injections.

EP 10.6 Do 10:00 GW2 B2880

In-Situ Staubmessungen im Saturnsystem mit dem Cosmic Dust Analyzer an Bord von Cassini — Thomas Albin[1,2], Jonas Simolka[1], Rachel Soja[1], Björn Poppe[2] und •Ralf Srama[1] — [1]Institut für Raumfahrtsysteme, University of Stuttgart, Stuttgart, Germany — [2]Universitätssternwarte Oldenburg, Institute of Physics and Department of Medical Physics and Acoustics, Carl von Ossietzky University, Oldenburg, Germany

Seit 2004 befindet sich der Cassini Orbiter im Saturnsystem und erfasst verschiedene Eigenschaften des Planetensystems. Mit Hilfe des am Max-Planck-Institutes für Kernphysik entwickelten Cosmic-Dust-Analyzer (CDA) erfolgen in-situ Messungen von saturn-gebundenem, interplanetarem und interstellarem Staub. Das Instrument ist aus zwei Teilen aufgebaut: dem High-Rate-Detector (HRD), bestehend aus zwei PVDF-Folien zur Messung von hohen Einschlagsraten und dem Dust Analyzer (DA) mit dem die Ladung, Geschwindigkeit, Masse und Massenspektrum der Staubteilchen gemessen werden können. In diesem Übersichtsvortrag geht es um die Beschreibung des Instruments, wis-

senschaftliche Resultate aus den chemischen Analysen des Staubes und der Vorstellung eines neuen Monte-Carlo basierten Codes zur Bestimmung der astro-dynamischen Eigenschaften der gut 2 Millionen Staubteilchen, die bislang erfasst wurden.