EP 9: Planets and Small Bodies II

Zeit: Mittwoch 8:30–10:15 Raum: AKM

Hauptvortrag EP 9.1 Mi 8:30 AKM

Frisch gezapft: Die Zusammensetzung der Eisteilchen in den Eisfontänen des Enceladus — •Frank Postberg[1,2], Sascha Kempf[1,3], Jürgen Schmidt[4], Jon Hillier[5] und Ralf Srama[1] — [1]Max-Planck-Institut für Kernphysik, 69117 Heidelberg, Germany — [2]Institut für Geowissenschaften, Ruprecht-Karls-Universität Heidelberg, 69120 Heidelberg — [3]IGEP TU - Braunschweig, 38106 Braunschweig — [4]Nichtlineare Dynamik, Universität Potsdam, 14469 Potsdam, Germany — [5]Planetary and Space Sciences Research Institute, The Open University, Milton Keynes, MK7 6AA, UK

Es werden neueste Daten von den nahen Enceladus-Vorbeiflügen der Raumsonde Cassini präsentiert. 2005 entdeckte Cassini aktiven Eisvulkanismus auf dem Saturnmond Enceladus. Beständig schießen aus warmen Spalten an dessen Südpol Jets aus Gas und Eisteilchen empor. Ein Teil der Materie entkommt der Anziehungskraft des kleinen Mondes und bildet Saturns äußeren Ring, den E-Ring.

In-situ Messungen der chemischen Zusammensetzung von Partikeln des E-Ringes mit Cassini's Staub Detektor (CDA) legen unter der Eiskruste lagerndes flüssiges Salzwasser als Quellen der Eisfontänen nahe (Postberg et al., Nature Vol.459, 2009). 2008 und 2009 tauchte Cassini bei engen Vorbeiflügen direkt in die Eisjets ein. Dadurch ist für das CDA-Team nun erstmals die Beschaffenheit frisch ausgestoßener Teilchen zugänglich. Die Zusammensetzung der Fontänen unterscheidet sich signifikant von denen des E-Ringes. Der Befund erlaubt weitergehende Rückschlüsse auf die Vorgänge unterhalb des Eispanzers dieses rätselhaften Himmelskörpers.

EP 9.2 Mi 9:00 AKM

The internal structure of Phobos derived from Radio Science measurements — •Thomas Andert[1], Martin Pätzold[2], and Bernd Häusler[1] — [1]Institut für Raumfahrttechnik, Universität der Bundeswehr, München — [2]Rheinisches Institut für Umweltforschung an der Universität zu Köln

The Mars Express spacecraft was successfully launched on 2 June 2003 and injected into orbit around Mars on 25 December 2003. The elliptical polar orbit of Mars Express allows close flybys at the Mars moon Phobos, the first close flybys since the flybys of Viking and Phobos 2 twenty years ago.

Mars Express performed two close flybys at Phobos in 2006 at 460 km and in 2008 at 275 km which resulted in a change of the orbit of Mars Express. The mass of Phobos was estimated from both flybys using the radio tracking data by evaluating the residual Doppler effect. The data of the second flyby provides a very small uncertainty of 0.3 % for the mass solution.

Mars Express will change its orbit in February 2010 which will allow a very close flyby at 62 km in March 2010. Here we report the results from the mass estimates of the flybys in 2006 and 2008 and the geophysical consequences for the internal structure of Phobos. In addition, simulation results about the feasibility of the low order coefficient J_2 of the gravity field of Phobos at the very close flyby in March 2010 are shown.

EP 9.3 Mi 9:15 AKM

Untersuchungen der Mars Neutralatmosphäre durch das Radio Science Experiment MaRS auf Mars Express — •Silvia Tellmann[1], Martin Pätzold[1], Bernd Häusler[2], G. Leonard Tyler[3] und David P. Hinson[3] — [1]Rheinisches Institut für Umweltforschung, Abteilung Planetenforschung, Universität zu Köln, Köln, Deutschland — [2]Institut für Raumfahrttechnik, Universität der Bundeswehr München, Neubiberg, Deutschland — [3]Department of Electrical Engineering, Stanford University, Stanford, CA, USA

Das auf Mars Express befindliche Radio Science Experiment MaRS sondiert die Atmosphäre und Ionosphäre des Planeten durch Verwendung zweier kohärenter Radiosignale. Vertikalprofile des Drucks, der Temperatur und der Neutralteilchendichte können somit von der Planetenoberfläche bis ca. 50 km Höhe mit einer Vertikalauflösung von wenigen hundert Metern gewonnen werden. Der hochelliptische Orbit von Mars Express erlaubt es, einen großen Bereich von Lokalzeiten und Geolokationen zu untersuchen. Bisher konnten bereits mehr als 500 Atmosphärenprofile gesammelt werden. Die hohe vertikale Auslösung der Profile gestattet es, die bodennahe Grenzschicht des Planeten hinsichtlich ihrer vertikalen Ausdehnung zu untersuchen. Darüber hinaus ist es möglich, atmosphärische Wellenstrukturen zu analysieren. Viele der bisher aufgenommenen Profile befinden sich in den hohen polaren Breiten beider Hemisphären. Vergleiche der gemessenen Temperaturen mit den Sättigungskurven des Kohlendioxids erlauben es, Rückschlüsse über CO2-Kondensation und eine eventuelle temporäre Übersättigung der Atmosphäre zu ziehen.

EP 9.4 Mi 9:30 AKM

Meteor layers in the Martian ionosphere: Observations and Modelling — •Kerstin Peter[1], Gregorio Molina Cuberos[2], Olivier Witasse[3], and Martin Pätzold[1] — [1]Rhenish Institute for Environmental Research, Dept. Planetary Research, Cologne, Germany — [2]Universidad de Murcia, Dep. Física, Facultad de Quimica, Murcia, Spain — [3]Research and Scientific Support Division of ESA, ESTEC, Noordwijk, The Netherlands

There are two main sources of the meteoric flux into planetary atmospheres: the meteoroid stream component and the sporadic meteoroid component. Models of the evolution of meteoroid streams show that they can be created by parent comets, when particles are removed from the comet's surface by nongravitational forces. The gravity influence of the sun and planets acts as a forming factor over long periods of time. The sporadic meteoroid component is the dominant source of the meteoric flux into planetary atmospheres. Interplanetary dust, i.e. from collisions in the Kuiper belt or the asteroid belt, contributes most to this component.

Observations by the radio science experiments MaRS and VeRa on Mars Express and Venus Express revealed the sporadic as well as the expected (from cometary orbit plane crossings) appearance of meteor layers in the Martian and Venusian ionosphere below the common secondary layers.

This paper will present the status of the detection of the Martian meteor layer in MaRS electron density profiles and the first steps towards the modelling of these meteor layers.

EP 9.5 Mi 9:45 AKM

Simulation of Io's auroral emission in Eclipse — •Lorenz Roth[1], Joachim Saur[1], Kurt Retherford[2], Darrell Strobel[3], and John Spencer[4] — [1]Institut für Geophysik und Meteorologie, Universität zu Köln — [2]Southwest Research Institute, San Antonio, Texas, USA — [3]Johns Hopkins University, Baltimore, Maryland, USA — [4]Southwest Reseach Institute, Boulder, Colorado, USA

Jupiter's moon Io is embedded in a dense plasma environment. Due to Jupiter's fast rotation the corotating plasma particles constantly flow past the moon. This flow of electrons and ions causes a complex plasma interaction and triggers auroral emission in the moon's atmosphere. With a three-dimensional two-fluid plasma model we simulate the plasma interaction of Io and its atmosphere-ionosphere with the Jovian magnetosphere. By using the simulated electron density and temperature profiles we are able to calculate the auroral radiation, which is generated in the moons atmosphere by collisions with magnetospheric electrons.

During the Jupiter flyby of the New Horizons spacecraft in February 2007 Io's aurora has been observed by the on board long-range visible-spectrum camera (LORRI) and simultaneously by the Hubble Space Telescope. The observations revealed a complex emission pattern, where local volcanic plumes appear in the ultraviolet and visible radiation. By comparison of the observed intensity and morphology with our simulated emission we derive constraints for the distribution and density of Io's atmosphere and some abundant elements.

EP 9.6 Mi 10:00 AKM

Multifrequency Electromagnetic Sounding of the Galilean Satellites' Interiors — •Mario Seufert, Joachim Saur, and Fritz M. Neubauer — Institut für Geophysik, Universität zu Köln

We investigate the temporal variations of the Jovian magnetospheric field at the Galilean satellites' positions and analyze possible inductive responses from the moons' interiors on the basis of classical electromagnetic theory. By using a magnetospheric model that includes contributions of Jupiter's internal field, the current sheet field and fields due to the magnetopause boundary currents, we deduce the corresponding amplitude spectra at each satellite. These spectra provide the strength of inducing signals at different periods for all magnetic components.

Short excitation periods (~10 hours) occur due to the fast rotation of Jupiter with respect to the moons' orbital motion. Longer periods (~40 to 400 hours) arise from contributions of the magnetopause field and due to the eccentricity and inclination of the satellites' orbits. Further we analyze various established interior models for all moons and determine answering functions for multiple subsurface conducting layers. We examine the possibility to measure signals of conductive cores in the presence of conductive subsurface liquid water and lava oceans. We also discuss suitable flyby configurations for future missions that could lead to a better understanding of the moons' interiors.