EP 13: Cassini bei Saturn

Time: Thursday 13:30–15:30 Location: H46

Invited Talk EP 13.1 Thu 13:30 H46

Die Atmosphäre am Südpol des Saturnmondes Enceladus — •Joachim Saur — Institut für Geophysik und Meteorologie, Universität zu Köln

Im Jahr 2005 erfolgten die ersten je geflogenen nahen Vorbeiflüge einer Raumsonde am Saturnmond Enceladus durch die Raumsonde Cassini. Bei diesen Vorbeiflügen wurde mit einer Reihe von Instrumenten eine Neutralgaswolke am Südpol des Saturnmondes Enceladus entdeckt. Diese Gaswolke entweicht aus Verwerfungen in der Eisoberfläche, den so genannten Tiger Stripes, in denen anomal hohe Temperaturen beobachtet wurden. Unter anderem maß das Cassini Raumfahrzeug in der Nähe von Enceladus auch eine unerwartet große Magnetfeldstörung von ungefähr 5-10 nT. In unserem Vortrag stellen wir eine Analyse dieser gemessenen Magnetfelder mittels drei-dimensionaler Plasmasimulationen vor. Unsere Untersuchungen geben Aufschluss über Eigenschaften der Gaswolke, wie deren räumliche Ausdehnung und Masseinhalt, aber auch Einblick in eine interessante plasmaphysikalische Wechselwirkung mit der Saturnmagnetosphäre.

EP 13.2 Thu 14:00 H46

Signatures of Enceladus in the elemental composition of E-ring particles — •Frank Postberg[1], Sascha Kempf[1,2], John Hillier[3], Ralf Srama[1], Uwe Beckmann[1], Simon Green[3], Neil McBride[3], and Eberhard Gruen[1] — [1]MPI für Kernphysik, Heidelberg — [2]Institut für Geophysik und extraterrestrische Physik, Universität Braunschweig — [3]Planetary and Space Sciences Research Institute, The Open University, Milton Keynes, UK

The population of Saturn's outermost tenuous E-ring, is known to be dominated by tiny water ice particles. Active volcanism on the moon Enceladus, embedded in the E-ring, has been known since late 2005 to be a major source of particles replenishing the ring. Therefore particles in the vicinity of Enceladus may provide crucial information about dynamical and chemical processes occuring below its icy surface.
We present a statistical evaluation of more than 2000 impact ionisation mass spectra of Saturn's E-ring particles, with sizes predominantly below 1 μm, detected by the Cosmic Dust Analyser onboard the Cassini spacecraft. We focus on the identification of non-water features in spectra dominated by water ice signatures. We specify the categorisation of two different spectrum types, which probably represent two particle populations. Silicate minerals and/or organic compounds are identified as the most abundant impurities within the icy particles. This finding hints at dynamic interaction of Enceladus' rocky core with liquid water.

EP 13.3 Thu 14:15 H46

Dynamics of Enceladus' plume particles — •Uwe Beckmann, Sascha Kempf, Ralf Srama, Georg Moragas-Klostermeyer, Stefan Helfert, and Eberhard Grün — Max-Planck-Institut für Kernphysik, Heidelberg, Deutschland

Since July 1st 2004, the Cassini spacecraft has been exploring the Saturnian system, which is distinguished by a pronounced ring system. Knowledge of the dynamical properties of the ring particles is essential for understanding the ring formation. The Cosmic Dust Analyser (CDA) on Cassini measures the mass, speed, charge, and elemental composition of individual dust particles hitting the detector. On July 14th 2005, Cassini performed a close encounter at the icy moon Enceladus - the dominant E ring dust source. The CDA data obtained during this flyby can only be explained by a collimated dust source at the south pole area of the moon. This finding finally led to the discovery of a strong cryo-volcanism in this region replenishing the ring with fresh dust.

Here, we present model calculations for dust grains ejected at Enceladus' south pole into the ring. We show that only grains 14 m/s faster than the moon's three-body escape speed do not re-collide with Enceladus during their first orbit and thus be able to populate the ring. Our numerical results match the CDA data reasonably well. In particular, our findings explain the vertical extent of the ring as derived from the in-situ observations.

EP 13.4 Thu 14:30 H46

Zur Topographie der Saturnmonde: Ergebnisse aus der Cassini-Mission — •Bernd Giese[1], Tilmann Denk[2], Thomas Roatsch[1] und Gerhard Neukum[2] — [1]DLR-Institut für Planetenforschung, Rutherfordstr. 2, 12489 Berlin — [2]Institut für Geologische Wissenschaften, Freie Universität Berlin, Malteserstr. 74-100, 12249 Berlin

Seit ihrer Ankunft im Saturnsystem hat die Cassini-Sonde tausende, zum Teil sehr hochauflösende Bilder der Monde zur Erde gefunkt. Diese Bilder sind nicht nur für die photogeologische Interpretation wertvoll, sondern gestatten auch wichtige Informationen über die Topographie der Oberflächen abzuleiten. Kenntnis der Topographie ist einerseits notwendig, um genaue Bildkarten der Monde zu erstellen, andererseits lassen sich aus der Topographie Rückschlüsse auf die Mächtigkeiten der Lithosphäre ziehen, was mit zusätzlicher Kenntnis der Alter der Oberflächen Randbedingungen für Modelle der thermischen Entwicklung liefert. Die Analyse der bisher abgeleiteten Topographien der Monde Iapetus, Dione, Tethys und Enceladus zeigt gewaltige Unterschiede in den Höhenbereichen und impliziert damit sehr unterschieliche thermische Entwicklungen, die mit unterschiedlichen Gesteinsanteilen (radiogene Heizung) und Abständen zu Saturn (Gezeitenwechselwirkung) erklärbar sind. Während Iapetus schon sehr früh (> 4 My) eine mächtige Lithosphäre von 50-100 km besaß, hat Enceladus wahrscheinlich noch heute eine vergleichsweise sehr dünne Lithosphäre.

Invited Talk EP 13.5 Thu 14:45 H46

Saturnian Dust: Rings, Ice Volcanoes, and Streams — •Sascha Kempf — Max-Planck-Institut f{\"u}r Kernphysik, Saupfercheckweg 1, Heidelberg, Germany

Starting in 2004, the Cassini spacecraft drastically changed our picture of the Saturnian dust. In the Saturnian system most of the dust particles are found within the diffuse E ring - the largest known ring in the Solar system. Since Cassini is equipped with a dust detector it became possible for the first time to investigate the evolution cycle of the Saturnian dust. There are two processes feeding the ring with fresh dust: collisions of micrometeoroids with the surfaces of icy moons and dust injection by the recently discovered ice volcanoes on the moon Enceladus. After injection into the ring the particles spend most of their lifespan as ring particles. Finally, the grains get lost by collisions with the main rings or with the moons. More interesting, some of the ring particles interact strongly with Saturn's magnetic field and will finally form fast dust streams which were discovered by Cassini during her approach to Saturn.

We are still at the beginning of our understanding of the physical processes relevant for the dust life cycle. However, Cassini already provided us with some of the major pieces to accomplish a comprehensive picture. Here, I will give an overview about the major findings by the Cassini dust detector and discuss the implications of these findings.

EP 13.6 Thu 15:15 H46

The Cosmic Dust Analyser: Calibration revisited — •Ralf Srama[2], Sascha Kempf[1], Georg Moragas-Klostermeyer[1], Frank Postberg[1], and Eberhard Grün[3] — [1]Max-Planck-Institut Kernphysik, Heidelberg, Germany — [2]MPI Kernphysik, Heidelberg and IRS, Univ. Stuttgart, Germany — [3]MPI Kernphysik, Heidelberg, Germany and Univ. of Colorado, Boulder, USA

The Cosmic Dust Analyser (CDA) onbaord the spacecraft Cassini was switched in 1999 and is gathering data successfully until today. The detector monitored particles with sizes between 0.01 and 50 micrometer and with speeds between one and 300 km/s. Impacts of iron nickel particles, silicates and water ice particles were characterised by the incorporated time-of-fliight mass spectrometer. Here, we revisit the calibration of the CDA instrument, which is based on ground based measurements at the dust accelerator facility in Heidelberg. The laboratory results are applied to and compared with in-flight measurements in the saturnian system. The well known properties of Saturn's E-ring particles allow for an in-flight calibration.