



Preface

Special issue on the “Surfaces and atmospheres of the outer planets, their satellites and ring systems”

This special issue of PSS represents select articles based on research presented during the PS9 and PS10 sessions of the 28th European Geophysical Union (EGU) meeting in Nice, France from 22 to 26 April 2002, as well as two articles from the session PS4.2 of the 2004 EGU meeting in Nice, France (6–11 April). The aim of these sessions was to discuss recent observational and modeling work on the atmospheres and surfaces of the giant planets and their satellites, as well as the ring systems. A number of papers in this issue also review the current state of knowledge about some of these bodies.

In this issue we have one article on the rings by *Griv and Gedalin* who explore in detail the linear regime of growing of Jeans instabilities in Saturn’s rings by means of a 2D local N-body shearing-boxes model. They interestingly test numerically a modified criterion for instability established analytically.

C. Russell reviews the interactions of Io, Europa, Ganymede and Callisto with the Jovian magnetosphere and ionosphere, focusing on how the mass-loading process at each satellite affects them.

A key outstanding question in the dynamics of the Jovian atmosphere, namely the super-rotation of the rapid equatorial jet, is discussed in the paper by *Yamazaki, Read and Skeet*. Using 2D and 3D simulation models. The authors examine the feasibility of a dynamical mechanism that can explain the prograde equatorial winds on Jupiter and Saturn reasonably well.

The mystery of Jupiter’s ammonia clouds is discussed in a paper by *Atreya and colleagues*. This paper interprets the Voyager and Galileo imaging observations with the help of thermochemical and photochemical models, and proposes that hydrocarbon hazes combined with hydrazine particles can effectively mask the spectral signature of the upper cloud deck of ammonia, so that only fresh, localized plumes can be identified spectrally as ammonia ice.

The article by *S. Lebonnois* offers a sensitivity study for the production of aerosols and benzene in the atmospheres of Jupiter and Saturn’s moon, Titan —

representing extension of previous photochemical models.

Titan is the focus of several other papers in this issue. This is expected in view of the arrival of the Cassini-Huygens spacecraft at Saturn on 1 July 2004, followed by several remote sensing observations of Titan, and the detailed exploration of Titan by in situ measurements by the Huygens descent probe anticipated on 14 January 2005. The Titan haze is the subject of an article by *Negrao et al.*, where Voyager limb data are analyzed in an attempt to constrain the haze parameters (such as the production rate and the imaginary refractive index) in the latitudinal distribution of Titan’s main haze layer.

The study of the surface and certain aspects of Titan’s lower atmosphere are discussed in two papers in this issue. The review article by *Lorenz and Lunine* is a significant undertaking that integrates last 8 years of work related to Titan’s surface. The critical investigation presented here will be valuable in interpreting both the spacecraft and ground-based observations. In the *Hirtzig et al.* article, spectro-imaging data of Titan are analyzed in the 0.8–1 μm region with results pertaining both to the surface as observed in the 0.94 μm windows, as well as to the satellite’s atmospheric spatial and temporal changes.

Two articles are related to the retrieval of surface properties of Titan from certain experiments on the Huygens probe. As a tribute to the pioneer in this field, the late Dr. Alvin Seiff, his colleagues, Stoker, Young, Mihalov, McKay and Lorenz, discuss in the paper by *Sieff et al.* laboratory experiments that show how mechanical properties of Titan’s surface, especially if liquid, can be retrieved with an impact accelerometer. This paper also is a valuable addition to the sparse data set available for impact loads on liquid-impacting spacecraft. The contribution by *B. Grieger* deals with the important problem of recovering information on Titan surface topography from optical images, taking into account the strong scattering of light in hazy atmosphere. The paper by *Atkinson et al.* presents plans for reconstruction of the Huygens descent trajectory

through Titan's atmosphere, using available observations as this information is essential for the interpretation of the Huygens observations.

In two articles presented in our EGU 2004 session, we find informative, easily understandable introductions to the problems associated with aerocapture. The papers by *T. Spilker* and *Justus et al.* present the advantages and limitations of the missions considered in these studies. They set limits that may prove beneficial to long-term planning.

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