Planetary and Space Science 77 (2013) 1–2

Contents lists available at SciVerse ScienceDirect

Planetary and Space Science

journal homepage: www.elsevier.com/locate/pss

Preface

Surfaces, atmospheres and magnetospheres of the outer planets and their satellites and ring systems: Part VIII

This issue includes research presented during the past year in sessions organized at several international meetings and congresses including the European Geosciences Union (EGU), the Asia Oceania Geosciences Society (AOGS), and the European Planetary Science Congress (EPSC) focused on recent observations and models of the atmospheres, magnetospheres and surfaces of the giant planets and their satellites, as well as on their ring systems. Special emphasis was placed on results from space missions such as the Cassini–Huygens mission in the Kronian System which has been continuously returning a wealth of data since 2004, revealing an astonishingly complex and dynamic system around Saturn. Galileo and even Voyager data are still used in some of the studies presented here, while complementary observations of the giant planets and their satellites were obtained from the ground, but also by the new space observatory Herschel, launched in 2009. Besides the observations, a paper in this issue discusses results from laboratory experiments and several from models.

In their paper ‘‘*Periodic bursts of Jovian non-Io decametric radio emission*’’, Panchenko and co-authors report on the analysis of a recently discovered type of Jovian periodic radio bursts in the decametric frequency range, between 4 and 12 MHz. Their occurrence appears strongly correlated with solar wind ram pressure at Jupiter and tends to occur in groups every $\sim$25 days. The bursts are right hand polarized radio emission associated with the Northern magnetic hemisphere of Jupiter. The authors suggest the bursts to be linked with the interchange instability in Io's plasma torus triggered by the solar wind.

Lipatov et al. in their study entitled ‘‘Jovian plasma torus interaction with Europa. Plasma wake structure and effect of inductive magnetic field: 3D Hybrid kinetic simulation’’ investigate the dependence of the plasma wake structure on upstream conditions and Europa's and assess the possible effects of an induced magnetic field arising from oceanic shell conductivity. Their hybrid model fully accounts for finite gyroradius effects, electron pressure and improved estimates of ion velocity distribution and the fluxes and includes processes such as photoionization, electron-impact ionization, charge exchange and collisions between the ions and neutrals. These calculations allow for an improved analysis of existing Europa flyby measurements from the Galileo Orbiter and help plan future observations and missions.

In ‘‘*The Temporal Evolution of the July 2009 Jupiter Impact Cloud*’’ Baines and coauthors discuss the time evolution of the debris cloud following the impact of Jupiter on July 19, 2009 that was first observed by amateur astronomer Anthony Wesley. While many different telescopes observed the cloud sporadically, only the IRTF monitored it on several different occasions over a seven week period. This paper discusses the findings from those data. In particular, the cloud evolved rapidly in the first four weeks, while less so over the next three. The cloud particle size evolution was derived. They also conclude that meridional shear is the dominant cloud shear component.

In their study ‘‘*A study on Ganymede's surface topography: perspectives for radar sounding*’’ Berquin et al. use topographic data from the Voyager and Galileo missions to try to constrain the surface structure and to quantify the geometry (in terms of slopes and RMS heights) of the satellite. The authors follow up on a previous study by Schenk et al. applied to Europa, and look at different Digital Elevation models of Ganymede. Their findings indicate that terrains on Ganymede are rather rough in comparison to what has been observed on Mars while smoother areas are located within sulcii which display obvious topographic differences from the rest. This study aims to offer constraints on the design of a possible future radar, i.e. by showing that important lateral surface echoes and surface diffusion of the radar signal are very likely to occur during radar sounding experiments.

The article ‘‘*Exogenic controls on sulfuric acid hydrate production at the surface of Europa*’’, by Dalton et al., seeks to assess the relative influence of electron energy, ion energy, sulfur ion number flux, and the total combined electron and ion energy flux at the surface of Europa to estimate the influence of each one of these sources on the abundance of sulfuric acid hydrate on the surface of the satellite. This depth analysis of spectral observations of several regions of the leading and trailing hemispheres of Europa displays exciting results: the new obtained spectra are fitted by models of chemical composition that evidence a variegated surface composition. Different locations have in common a very high abundance of hydrated sulfuric acid. The results are then analyzed along with those already available in the literature and relative to other surface regions, which have a full range of hydrated sulfuric acid abundances. These abundances are then compared with the prediction of models concerning the fluxes of energetic particles, electrons and sulfur ions.

In their study ‘‘*Magnetospheric ion sputtering and water ice grain size at Europa*’’ Cassidy et al. present the first calculation of Europa's ion erosion rate as a function of position on Europa's surface. This paper describes a theoretical calculation of the ion flux impacting Europa, of the induced sputtered flux of water products from Europa surface and underlines a potential correlation between calculated sputtering rates and observed grain size. It is an original paper providing new insights on this topic that would clearly stay for long as a very useful contribution to our

0032-0633/$ - see front matter © 2013 Published by Elsevier Ltd.
http://dx.doi.org/10.1016/j.pss.2013.01.002

understandings of the sputtering processes occurring on icy satellites.

The manuscript presented by Kereszturi et al. entitled "*Astrobiological implications of chaos terrains on Europa to help targeting future missions*" is a research devoted to the analysis of information available on the Conamara Chaos terrain, from which they infer pressure and depth characteristics of the ice crust and depth of the possible liquid water ocean hidden underneath. The research focuses on the gas bubbles that could be trapped in the ice or the clathrates and the means for detecting them on Europa with future space missions while floating upward in the warm rising plume in chaos terrains.

In the paper "*Can laboratory tholins mimic the chemistry producing Titan's aerosols? A review in light of ACP experimental results*", Coll et al. use laboratory measurements made more than 10 years ago to help experimentalists to select laboratory analogs chemically relevant of Titan's aerosols. Indeed they ran in the framework of Huygens preflight-calibration chemical analyses of a large set of Titan's analogs produced worldwide, and compared obtained results with the ones recovered by the ACP experiment on-board Huygens probe. This comparison shows that Titan's aerosols laboratory analogs produced using a cold plasma energy deposit mimic quite well the major chemical composition observed in the light of Huygens probe exploration of Titan's environment.

In "*Morphotectonic features on Titan and their possible origin*" Solomonidou and co-authors present a detailed review of morphological features observed at the surface of Titan by the radar and the visual and infra-red mapping spectrometer on-board the Cassini–Huygens spacecraft. This study emphasizes evidence of tectonic features, such as mountains, ridges, and faults. The authors propose a mechanism for the origin of these features involving compressive tectonism but point out the role of atmospheric processes in degrading the overall morphology of these features. This, combined with the lack of high spatial resolution imaging, poses limits to the interpretation. In order to support their analysis, the authors carry out comparisons with terrestrial tectonic systems. Qualifying and quantifying tectonic activity on Titan is necessary to constrain the role of that process in the global atmospheric activity and methane cycle, as it is important to understand the carbon cycle on Earth.

Updated atlases of some of Saturn's medium-sized satellites are presented in "*Recent improvements of the Saturnian Satellites Atlases: Mimas, Enceladus, and Dione*" by Roatsch et al. High-resolution images returned by the Imaging Science Subsystem for the first three years of extension of the Cassini mission were used to improve the resolution of existing mosaics, and especially fill in the gaps of regions that were not illuminated during the nominal mission (e.g., Northern parts). These new atlases supersede the previous versions from 2006 (Enceladus) and 2008 (Mimas and Dione), and include the official names of additional features approved by the International Astronomical Union. The entire atlases are available to the public through the Imaging Team's website 〈http://ciclops.org/maps〉.

Tseng et al. present a study entitled "*Modeling the Seasonal Variability of the Plasma Environment in Saturn's Magnetosphere between Main Rings and Mimas*" and investigate the time variation of plasma populations between 2.5 and 3.5 R_S in Saturn's magnetosphere. Their simulations aim to understand the highly variable plasma environment observed by the Cassini CAPS instrument. Two sources of plasma are considered in the calculations, a seasonally varying source from the ring atmosphere and a seasonally invariant source from Enceladus. Observations are best reproduced by the ring atmosphere as main source of material.

The manuscript presented by Tiscareno entitled "*A modified "Type I migration" model for propeller moons in Saturn's rings*" discusses a possible mechanism to explain the observed non-keplerian motion of small moons embedded in Saturn's rings that create propeller-shaped disturbances in the ring disk. The author suggests that radial variations in ring surface density result in Type I angular momentum exchange between the moons and the ring disk. This mechanism, combined with occasional "kicks" to the moon's semi-major axis result in migration of the embedded moon.

In their paper, *Evidence for a Dichotomy in the Interior Structure of Uranus and Neptune*, Nettelmann et al. present theoretical arguments for significant and observable differences in the heavy element abundances (10% by mass) in the atmosphere of Uranus compared to Neptune (up to 60% by mass), while the non-dimensional moment of inertia are found to be rather similar (0.22 and 0.25, respectively). They use for constraints the revised rotation periods for Uranus (40 min faster than that from Voyager in 1986) and Neptune (1 h 20 min slower than Voyager in 1989) and a modified equation of state for the interior. The conclusions of the paper have important implications for the formation of these icy giants.

To conclude this special issue let's go further joining investigation of extrasolar bodies etc. Helling et al. address the "*Dust cloud lightning in extraterrestrial atmospheres*", in a paper where they argue for the existence of lightning in clouds of mineral dust in the atmospheres of some extrasolar planets, or in brown dwarf stars which appear to be similar. An astrophysical approach is then used to argue for such likelihood of dust cloud formation, charging and then lightning.

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