Geophysical Research Abstracts
Vol. 21, EGU2019-5684-1, 2019
EGU General Assembly 2019

Callisto's surface-sputtered exosphere: what does it teach us about the building blocks of the Jupiter system?

Audrey Vorburger (1), Peter Wurz (1), Martin Pfleger (2), Jesper Lindkvist (3), Helmut Lammer (2), Herbert Lichtenegger (2), André Galli (1), Mats Holmström (3), and Stas Barabash (3)

(1) Space Research and Planetary Sciences, University of Bern, Bern, Switzerland (vorburger@space.unibe.ch), (2) Institute for Chemical Engineering and Environmental Technology, Graz University of Technology, Graz, Austria, (3) Swedish Institute of Space Physics, Kiruna, Sweden

The core accretion model is the favoured concept to explain the formation of the giant planets in the Solar System. In this scenario, five steps lead to the formation of a giant planet from the proto-planetary disc: (i) cloud collapse and star-disk formation, (ii) dust growth and planetesimal formation, (iii) planetary embryo growth, (iv) gas capture and gap opening, and (v) long term gravitational evolution of the planet. The last phase also comprises the formation of regular satellites, which occurs within the giant planet's sub-nebula. Analysis of the chemical composition of such a regular satellite thus sheds light onto the thermodynamic conditions encountered within the sub-nebula and onto its formation epoch.

The JUpiter ICy moons Explorer mission of ESA is intended for the detailed investigations of Jupiter and its system including all inter-relations and complexities. In-orbit exospheric measurements of Europa, Ganymede, and Callisto will allow the inference of their surface compositions, and thus offer the unique opportunity to measure the full spectrum of building blocks of the Jupiter system. Being undifferentiated, i.e. the least processed of Jupiter's icy moons, Callisto is probably in its 'most original' form with respect to its formation from the sub-nebula.

We present here a detailed 3D model of Callisto's surface-sputtered exosphere. The model includes a surface composition model based on planetary formation theory, plasma conditions based on observations, and sputter yields based on laboratory measurements. In addition, we demonstrate the capabilities of the mass spectrometer NIM/PEP on JUICE at various fly-by altitudes and show how these measurements will help us distinguish between different formation scenarios.