Geophysical Research Abstracts
Vol. 17, EGU2015-12799-1, 2015
EGU General Assembly 2015

Characterization of signatures from organic compounds in CDA mass spectra of ice particles in Saturn's E-ring

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The major source of ice particles in Saturn's E-ring is Enceladus – a geological active moon of Saturn. Enceladus is emanating ice particles from its fractured south polar terrain (SPT), the so-called "Tiger Stripes". The source of Enceladus activity and many of the ice particles is a subsurface ocean. The Cosmic Dust Analyzer (CDA) onboard the Cassini spacecraft is sampling these icy particles and producing TOF mass spectra of cations of impinging particles [1]. Three compositional types of ice particles have been identified from CDA-mass spectra: (i) pure water ice (Type-1) (ii) organic rich (Type-2) (iii) salt rich (Type-3) [2][3]. These organic rich (Type-2) spectra are particularly abundant in the icy jets of Enceladus as we found out during the Cassini's Enceladus flybys (E17 and E18) in 2012 [4].

We present a compositional analysis of the CDA spectra of these organic rich icy grains sampled in the E ring. We have characterized hundreds of Type-2 spectra of impinging ice particles. These were recorded at different impact velocities causing different molecular fragmentation patterns observed in the mass spectra. We defined 3 typical impact speed intervals: (i) 4-7 km/s (ii) 8-11 km/s and (iii) 12-16km/s. Organic features best observed at slow (4-7 km/s) or at intermediate (8-11 km/s) impact velocity ranges. Several classes of organic rich spectra are identified. Classifying Type-2 spectra are according to their characteristic mass lines of possible organic species.

We try to infer the composition of each class of organic rich spectra is inferred by using an experimental setup (IR-FL-MALDI) to simulate the CDA spectra of different compositional types. In the laboratory we have used infrared laser to disperse a micro-beam of a water solution [5]. The laser energy is adjusted to simulate different impact velocities of ice particles on the CDA. Four families of organic compounds including alcohols, fatty acids, amines and aromatic, with varying number of carbon atoms, have been measured and compared with the CDA Type-2 spectra.

References

[1] Srama, R. et.al.: The Cassini Cosmic Dust Analyzer, SSR, Vol. 114, 465—518, 2004.

[2] Postberg, F. et.al.: The E-ring in the vicinity of Enceladus II. Probing the moon's interior—The composition of E-ring particles, Icarus, Vol. 193, 438—454, 2008.

[3] Postberg, F. et.al.: Sodium salts in E-ring ice grains from an ocean below the surface of Enceladus, Nature, Vol. 459, 1098 - 1101, 2009.

[4] Khawaja, N. et.al.: Compositional differentiation of Enceladus' plume, EPSC, Vol. 9, 2014.

[5] Reviol, R. et.al.: Simulation of TOF spectra from cosmic ice particles in the Laboratory by IR-FL-MALDI, EPSC, Vol. 7, 2012.