

Enceladus/E ring 周辺でのダスティプラズマの発見

諸岡 倫子 [1]
[1] 東北大学 PPARC

Discovery of Dusty Plasma near the Kronian moon Enceladus and the E ring

Michiko Morooka[1]
[1] Tohoku Univ., PPARC

<http://pparc.gp.tohoku.ac.jp/>

One of the Cassini's most exciting findings is that the Kronian moon Enceladus expels water vapor and ice grains from its south pole and forms a plume that becomes the major source for the E ring and the surrounding neutral gas. The Enceladus' plume and dispersed neutral gas produces a large amount of ionized gas, which become a dominant plasma source for Saturn's magnetosphere. Using the data from the Cassini Radio and Plasma Wave Science (RPWS) measurements of the cold plasma properties, It is shown that Enceladus' southern exhaust plume and surrounding plasma disc environment are associated with a large amount of negatively charged submicron- and micron-sized dust that is strongly coupled by dust-plasma interactions, i.e., a dusty plasma. A large ion and electron density difference ($N_e/N_i < 0.01-0.5$) that is associated with the micrometer sized dust grains is observed near Enceladus plume and the E ring region. This is due to the electron attachment to the dust grains and thus the dust is negatively charged. In addition, the bulk ion speed was significantly slower than the co-rotation speed and close to the gravitational speed. An interpretation to this slow ion is that the cold ions are trapped in the electric potential of the charged dust and moves in a same speed as the dust, i.e. the dust-plasma interaction is collective. The dust and plasma properties estimated from the observations clearly show the strong dusty plasma characteristics. Dusty plasma have not been observed in space except a few rocket based observations in the Earth's atmosphere. In the presentation, the Cassini observations of the dusty plasma near the Enceladus and the E ring shall be summarized.

土星衛星 Enceladus のサウスポールから吹き出す氷の plume は、カッシーニ衛星が齎した最大の発見の一つと言える。Enceladus plume の氷の塵は衛星周辺だけに留まらず、土星磁気圏へと広がり、E ring ダスト及び中性大気的主要な起源となる。太陽紫外線等によってこれらの中性大気は電離され、土星磁気圏にプラズマを供給する。興味深い事に Enceladus plume の塵はネガティブにチャージし、背景プラズマと電氣的に強く相互作用している事がわかった。この状態はダスティプラズマと呼ばれるが、これまで宇宙空間での観測はあまりない。ダスティプラズマは Enceladus 周辺だけでなく、広く E ring 領域に分布し、土星磁気圏に強く影響を与えていると考えられる。講演では Enceladus 及び E ring 付近のダスティプラズマ観測結果をレビューを交えて報告する。