

## Density trends of negative ions at Titan

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### Abstract

The Electron Spectrometer part of the Cassini Plasma Spectrometer (CAPS-ELS) has revealed the existence of negative ions in Titan's ionosphere (Coates et al, 2007, Waite et al, 2007). These are observed during every encounter when the instrument points in the ram direction at altitudes between 950 and 1400 km. The heaviest ions observed so far have masses up to 13 800 amu/q. This indicates that complex hydrocarbon and nitrile chemical processes take place in Titan's upper atmosphere, probably playing a role in haze formation. Even heavier particles such as tholins can form which fall to lower altitudes and build up on Titan's surface (Coates et al, 2009). Coates et al. (2009) discussed trends in the highest masses observed with solar zenith angle (SZA), altitude and latitude. We are extending this study to density trends of different masses. With data from over 34 encounters and taking advantage of an increase in the duty cycle of measurements during recent flybys we have accumulated a large negative ion database. Groups of masses can be identified because recurrent peaks are observed in the "mass" spectra of different encounters. We have updated these mass groups according to the spectra including the most recent flybys. This includes a heavy group of 625 amu and above. We investigate the effects of different controlling parameters such as altitude, solar zenith angle, latitude and the angle between magnetospheric co-rotation and solar ionisation sources. The aim of this study is to help constrain the chemical formation and destruction processes of negative ions in Titan's ionosphere. By studying SZA trends we can for example learn about whether nightside reactions or photochemical reactions yield higher densities for the different groups. We present the results and discuss their implications. For instance, the heaviest mass group (625 amu +) negative ions are only present at altitudes below 1100

km. Densities of this mass group are highest on the night side however there are some moderate densities on the dayside, too. The lower mass group densities are highest on the dayside. The densities of all mass groups are mostly very low near the terminator compared to day and night side densities, especially the highest mass groups.