Energetic Fe Ions In And Near The Magnetospheres Of Earth, Jupiter, And Saturn

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Abstract

We examine long-term energetic heavy ion measurements including three planets' magnetospheres, focusing on Fe ions (specifically, but not exclusively, Fe+) in and near Earth's magnetosphere. We compare Fe data to that of other energetic ion species with masses greater than C (carbon) and consider the relationship(s) of energetic Fe ion measurements at the three planets to internal (ionospheres, exospheres, moons, rings, and trapped radiation) and external (solar wind and interplanetary dust) source candidates. Fe+ has been observed at Earth and Saturn, but not yet at Jupiter, as our observations there were brief. The measurements are from two functionally identical charge-energy-mass ion spectrometers: one on Geotail (˜87-212 keV/e), orbiting Earth at ˜9-30 Re; and the other on Cassini (˜83-167 keV/e), in interplanetary space, during Jupiter flyby, and at ˜4-20 Rs on its constantly varying orbits around Saturn. These ion spectrometers efficiently separate energetic light and heavy ions by mass, as well as lower charge state ions from higher charge state ions by mass-per-charge. Energetic low charge state ions often derive from magnetospheric sources, while energetic high charge state ions most often derive from the solar wind. We also enlist heavy ion measurements closer to the Earth from AMPTE/CCE which are used for C and Fe radiation-belt-modeling content, consideration, and estimation.

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