Geophysical Research Abstracts
Vol. 21, EGU2019-16019, 2019
EGU General Assembly 2019

Solar wind suprathermal particle populations

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Suprathermal populations are an ubiquitous and still intriguing component of plasma particles (electrons, protons and heavier ions) present in the solar wind and planetary atmospheres. The enhanced suprathermal tails of the observed velocity (or energy) distributions deviate significantly from a standard Maxwellian specific to thermal equilibrium, but are well reproduced by the Kappa power-laws. Recent advances of Kappa modeling have revealed essential properties of suprathermal populations suggesting major implications from micro- to macroscopic scales. We discuss a series of new results which enhance the interpretation of the existing and forthcoming observational data to understand key features of the solar wind dynamics, e.g., the origin of the observed wave fluctuations and their role on differential heating and acceleration.