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Recent Progress in Understanding the Origin and Acceleration of Suprathermal Ions and Electrons

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Ions and electrons with energies that lie above (i.e., ∼2 keV) that of the core or bulk solar wind protons and electrons are known as suprathermal particles. Observations over the last decade have shown that such suprathermal particles are an important constituent of the overall seed population that is accelerated in solar and interplanetary events. Despite their increased level of importance, where these populations originate from and how they are accelerated remains highly controversial. This is partly due to the fact that these particles exist in the so-called tail regions of the corresponding solar wind distributions where high temporal and sensitivity measurements are sparse. Moreover, observations comprising long-term averages (between ∼hours to more than a day) have shown conflicting results. For instance, below ∼40 keV/nucleon the ion differential intensities in the solar wind frame appear to exhibit a near-constant power-law spectral slope of ∼1.5, perhaps indicating a universal acceleration mechanism. In contrast, at energies greater than ∼40 keV/nucleon, the ion composition changes with solar activity and the energy spectra are significantly steeper, perhaps indicating that the suprathermal pool of material also comprises lower-energy particle populations accelerated in corotating interaction regions, interplanetary shocks, and solar energetic particle events. This talk discusses recent observations of suprathermal ions and electrons in terms of state-of-the-art theories and models that have been put forward to account for their origins and acceleration.