



## **Non-thermal features of the electron velocity distribution functions in the solar wind: their origins, evolution, and constraints**

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Solar wind electrons, being quite tenuous but hot at once, suffer from lack of Coulomb collisions and these are not capable to maintain the thermal equilibrium disturbed by the continual unstable and turbulent expansion into the heliosphere. Indeed the observed electron velocity distributions deviate from the theoretical Maxwellian one and exhibit significant non-thermal features, like considerable temperature anisotropies, field-aligned beams, or enhanced supra-thermal tails. Here, we review the characteristic properties of these non-thermal features in terms of their plausible origins, radial variations along the solar wind expansion, and possible constraints imposed by kinetic mechanisms. Using real in situ data in comparison to numerical simulations, we show that still many of the observed features can be well addressed to the Coulomb collisions only but various wave-particle interactions provide effective constraints in case of extreme events.