

## **Kappa distributions: Theory and applications in plasmas**

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Classical particle systems reside at thermal equilibrium with their velocity distribution function stabilized into a Maxwell distribution. On the contrary, collisionless and correlated particle systems, such as space and astrophysical plasmas, are characterized by kappa distributions or combinations thereof [1-3]. Understanding the statistical origin of kappa distributions [4] was the cornerstone of further theoretical developments and applications, which, among others, are the following: (i) Connection to zero-th law of thermodynamics [5]; (ii) Physical meaning of temperature [1,4,5]; (iii) Multi-particle description of kappa distributions [6]; (iv) Phase-space kappa distributions for Hamiltonians with non-zero potential [7,8]; (v) Sackur-Tetrode entropy for kappa distributions [1,5], (vi) Generation of kappa distributions in plasmas [1,9], and (vii) Existence of a large-scale phase-space constant, about 12 orders larger than the one given by the Planck's constant [10,11].

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