

Abstract Submitted
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Kappa distributions in the presence of a potential energy

GEORGE LIVADIOTIS, Southwest Research Institute — 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 geophysical, space, and astrophysical plasmas, are characterized by a non-Maxwellian behavior, typically described by the so-called kappa distributions, or combinations thereof. Empirical kappa distributions have become increasingly widespread across plasma physics. A breakthrough in the field came with the connection of kappa distributions to non-extensive statistical mechanics. Understanding the statistical origin of kappa distributions was the cornerstone of further theoretical developments and applications, one of which is the generalization to the phase-space kappa distributions of a Hamiltonian with non-zero potentials. We present the theory behind the phase-space kappa distributions and discuss three important applications in collisionless plasmas: (i) origin of polytropic relation; (ii) gravitational field; (iii) barometric relation (i.e., pressure vs. altitude); and (iv) plasma magnetization.

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