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Kappa distributions: Founding statistical mechanics in space plasmas GEORGE LIVADIOTIS, Southwest Res Inst — Space plasmas are collisionless systems out of thermal equilibrium described by a single type or a more complex combination of kappa distributions. These distributions have recently received impetus, as they provide efficient modeling for observed distributions in numerous space plasmas throughout the heliosphere. Moreover, theoretical developments showed the connection of kappa distributions with non-extensive statistical mechanics, an unambiguous generalization of the classical Boltzmann-Gibbs statistics, revealing the robust physical meaning of temperature, pressure, and other thermodynamic parameters. The kappa distributions and the proven tools of non-extensive statistical mechanics have been successfully applied to a variety of space plasmas throughout the heliosphere, from the inner heliosphere, e.g., the solar wind and planetary magnetospheres, to the outer heliosphere, e.g., the inner heliosheath and beyond. These analyses led to the determination of the thermodynamic variables and the understanding of the underpinning physical processes of these plasmas, as well as to more fundamental findings, such as the new quantization constant that characterizes collisionless space plasmas.

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