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Transitions of solar wind in non-equilibrium states GEORGE LIVADIOTIS, DAVID MCCOMAS[1], Southwest Research Institute — The solar wind, like other space plasmas, is a system that exists in stationary states out of equilibrium. Empirical kappa distributions successfully describe these space plasmas, while the Tsallis formalism of non-extensive Statistical Mechanics offers a solid statistical foundation for generating and understanding these distributions. The Tsallis entropy can be expressed in terms of the kappa index that labels these distributions and characterizes each stationary state. In this talk, we show how following this entropy exposes the phenomenological paths by which space plasmas transit through stationary states toward, or away from, equilibrium. Starting near a fundamental stationary state with the minimum entropy, spontaneous procedures that can increase entropy, move the system toward equilibrium. On the other hand, external factors that decrease the entropy of the system, move it back into stationary states closer to the fundamental state. In the case of solar wind, newly formed pick-up ions may play just such a critical role because their motion is highly ordered. This motion is dictated by the relative orientation of the solar wind velocity and the interplanetary magnetic field, which become increasingly perpendicular on average as the solar wind moves out through the heliosphere.

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