RADIAL EVOLUTION OF INTERPLANETARY DENSITY INTERMITTENCY IN THE FAST SOLAR WIND

D. Telloni

National Institute for Astrophysics, Astrophysical Observatory of Torino, Via Osservatorio 20, 10025 Pino Torinese, Italy

The radial evolution of intermittency of density fluctuations in the fast solar wind is investigated. The study is performed by analyzing the proton density measurements obtained by Helios 2 in the inner heliosphere, within the same high-speed stream observed on the ecliptic plane at 0.3, 0.7, and 0.9 AU. The analysis is carried out by means of a complete set of diagnostic tools, comprising the study of the behavior of the flatness factor at different time scales, the Fourier transforms, the identification of the intermittent events via the Local Intermittency Measure method, and the Kolmogorov-Smirnov test. The results clearly indicate that density fluctuations within fast wind are rather intermittent and that their level of intermittency decreases with the distance from the Sun, in contrast with intermittency of magnetic field and plasma velocity fluctuations, which instead increases in the transition from 0.3 to 0.9 AU. Furthermore, the intermittent events are found to be strongly correlated, exhibiting temporal clustering, thus indicating that the mechanism underlying their generation departs from a time-varying Poisson process. Finally, both the amplitude and the occurrence rate of the intermittent events decreases with the heliocentric distance. The observed radial evolution of density intermittency in the fast solar wind and the statistical properties of the intermittent events can be interpreted in the light of the mechanism based on the parametric decay of the energy of the outward Alfvén waves. This interpretation is further suggested by numerical MHD simulations, which show that at the saturation of the instability, the intermittency of the density fluctuations decreases with time, thus in qualitative agreement with the observational results.