



The Kappa Index of Solar Wind Protons: Correlation with the Polytrropic Index and the Solar Activity

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The velocities of collisionless space plasma particles, often follow the kappa distribution function. The kappa index of such a distribution is essential for a full description of the plasma properties, and for understanding the physical mechanisms responsible for its dynamics. Previous studies provided evidence for correlations between kappa and polytropic indices in solar wind plasma. Such a correlation is expected in the presence of potential energy. In this study, we derive the kappa and polytropic indices of solar wind protons using WIND observations, covering the last two solar cycles. We examine the long term correlation between the kappa and polytropic indices and we perform a detailed, yearly based analysis to determine the relation of these two parameters, which can help identify the features of the potential energy of the plasma particles. Finally, we show that the long term variation of the kappa index follows the solar activity.