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Thermodynamics of the proton plasma in the inner heliosheath during the 24th solar cycle

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Space plasmas reside in non-equilibrium stationary states described by kappa distributions. The high-energy asymptotic behavior of kappa distributions leads to a power-law relationship of the energy-flux spectra; this relationship, when observed, can be analyzed for determining the thermodynamic parameters of the plasma. In the presented analysis, we use Energetic Neutral Atom (ENA) observations from the IBEX-Hi sensor, converted to the corresponding proton plasma spectra of the inner heliosheath, and timestamped with the ENA creation time. We, then, model the proton spectra with kappa distributions and derive the sky maps of the (radially averaged) values of temperature, density, kappa, and other thermodynamic parameters of the proton plasma in the inner heliosheath. We examine the variations of the determined thermodynamics and whether a correlation exists with solar activity during the 24th solar cycle.