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Plasma beta control of scaling of solar wind turbulent structures

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The high-time resolution of Spektr-R plasma measurements allows us to make direct observations of solar wind turbulence below ion kinetic length scales. The paper analyzes solar wind power spectra of bulk and thermal speeds that are computed with a time resolution of 32 ms in the frequency range of 0.001–2 Hz. The statistics based on more than 5000 of individual spectra shows that: (1) the spectra of bulk and thermal speeds can be fitted by two power-law segments; (2) despite their large variations, the parameters characterizing frequency spectra fits computed on each particular time interval are very similar for both quantities; (3) the median slopes of the segment attributed to the MHD scale are -1.43 and -1.38, respectively for the bulk and thermal speeds, whereas those in the kinetic scale are -3.08 and -2.43, respectively; (4) the break between both MHD and kinetic scales is controlled the ion beta; and (5) the power index corresponding to kinetic turbulence depends on a level of the density variations in the high beta solar wind, whereas the ion gyromotion determines it for low beta intervals.