Evolution of plasma turbulence across interplanetary shocks

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Dissipation of large scale variations of the solar wind kinetic energy into the thermal energy via turbulence cascades is thought to be an important source of the solar wind heating, although the exact mechanism is yet to be found. The frequency spectrum of magnetic field fluctuations can be divided into several domains differing by spectral indices – the lowest frequencies are controlled by the solar activity, MHD activity shapes the spectrum at higher (up to about 0.1 Hz) frequencies, whereas the ion and electron kinetic effects dominate at the high-frequency end.
Interplanetary shocks of various origins are a part of solar wind turbulence naturally occurring in the solar wind and the Spektr-R spacecraft detected tens of them in course of the 2011–2013 years. Based on its high-time resolution of the ion flux, density and velocity measurements, we study an evolution of the frequency spectra on MHD and kinetic scales across fast forward low Mach number shocks.
We found that the power of downstream fluctuations rises by an order of magnitude in a broad range of frequencies independently of its upstream value. The spectral slope in the MHD range remains close to -5/3 but the slope of the spectrum within the kinetic range (~3—8 Hz) is steeper downstream in a statistical sense. Moreover, the downstream spectra in the ion kinetic range exhibit frequently an exponential decay.