Turbulent Spectra of the Solar Wind near Interplanetary Shocks

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The solar wind is a supersonic and super-Alfvenic plasma flow of solar origin filling the whole heliosphere. It has a strong turbulent character with several energy cascades. Interplanetary (IP) shocks are characterized by abrupt changes of plasma parameters and the magnetic field strength. Primary drivers of IP shocks are transient phenomena such as coronal mass ejections and co-rotating interaction regions. We discuss an occurrence of large-amplitude low-frequency fluctuations of the magnetic field in upstream and downstream of IP shocks. We have used a newly developed automated algorithm for detection of IP shocks which is planned to be implemented on-board the future Solar Orbiter spacecraft. We used the fluxgate magnetometer on-board Wind with a sampling frequency of 10 Hz which allows us to analyze both inertial ranges and the beginning of the kinetic scale. For a time series analysis the Morlet wavelet transform was performed. We have identified 971 IP shocks in the Wind measurements between 1995 and 2014 with using the detection algorithm. We have analyzed four types of shocks: 488 Fast Forward (FF, panel a), 101 Fast Reverse (FR, panel b), 212 Slow Forward (SF, panel c), and 170 Slow Reverse (SR, panel d). Blue and red data points show statistical results of the density of magnetic field fluctuations for five minutes before and after the shock passage, respectively. We can identify the break of the power law spectra between the inertial and dissipation scales around 0.4 Hz. Generally, we observe larger fluctuations in the downstream when compared to the upstream as it can be expected.