Analysis of solar wind turbulence using interplanetary scintillation measurements

*Munetoshi Tokumaru[1]

1.Institute for Space-Earth Environmental Research, Nagoya University

The power spectrum of interplanetary scintillation (IPS) provides with crucial information on physical properties of the solar wind turbulence with a spatial scale of ~100--~10 km; so-called micro-turbulence. In this study, the spectral index and anisotropy of the solar wind turbulence are determined by fitting a theoretical model to IPS spectra observed for two strong sources 3C273 and 3C48 with the Solar Wind Imaging Facility Telescope (SWIFT) of the Institute for Space-Earth Environmental Research (ISEE), Nagoya University. In this fitting analysis, free parameters are the power-law index of the turbulence spectrum, the axial ratio of the anisotropy, and the turbulence level. The solar wind speed derived ISEE multi-station IPS observations is used as a fixed parameter to calculate the IPS spectrum model. The apparent size of IPS sources is another fixed parameter, and 60 mas and 100 mas are used for 3C273 and 3C48, respectively. The spectral indices obtained here (4.1+/-0.7) are close to but slightly higher than the Kolmogorov value (11/3), and the axial ratios (1.0+/-0.4) are nearly equal to a unity, suggesting that the turbulence is isotropic. The important point to note here is that there is a significant negative correlation between spectral indices and axial ratios; i.e. the turbulence spectrum becomes flatter, as it becomes more anisotropic. The spectral indices and axial ratios are also compared with solar wind speeds, and poor (positive) correlations are found between them. These results are unchanged when the solar wind speed is assumed to be a free parameter in the fitting analysis.

Keywords: solar wind, interplanetary scintillation, turbulence

