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A new view on the solar wind: What can we learn from fast measurements?

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The paper presents measurements of interplanetary (IP) shocks and solar wind parameters registered by the BMSW instrument onboard the Spektr–R project. The main advantage of these measurements is their speed that can reach 32 Hz. In this contribution, we concentrate our attention on (1) IP shock ramp thickness that is observed to be shorter than the ion gyroradius, even for low-Mach number shocks; (2) wave trains connected with the IP shock and evolution of the ion velocity distribution within these wave trains; and (3) finally, on solar wind properties like the plasma turbulence and helium abundance. The high-time resolution of BMSW allows us to make direct observations of solar wind turbulence below ion kinetic length scales. We present a short study of the frequency spectra of the density, velocity, and thermal velocity. Our study reveals that although these parameters exhibit the same behavior at the MHD scale, their spectra are remarkably different at the kinetic scale. Furthermore, the ratio of the alpha particle and proton densities is an indicator of the source of the currently observed solar wind stream. However, a preliminary analysis of the BMSW data acquired in the sweeping mode shows that the He abundance can rapidly vary over much shorter time scales. We analyze changes of the proton/helium ratio under different solar wind conditions and show a new direction in the investigation of this topic.