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Wavelet-based model of the heliospheric turbulent magnetic field

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We present a model of the heliospheric magnetic field that combines a large-scale component, represented by the Parker Spiral, with a small-scale turbulent component generated using a wavelet-based method. The turbulent fluctuations are designed to replicate key features of magnetic turbulence observed in the solar wind, including a varying correlation length and a radially decreasing amplitude. This wavelet-based approach is adapted from a previously developed [1] Cartesian method by introducing a new coordinate system, which ensures the correct radial scaling of the turbulence correlation length. Our algorithm enables the modeling of a broader spectral range of fluctuations than is typically accessible with magnetohydrodynamic simulations—an essential feature for accurately capturing gyroresonant scattering of energetic particles [2]. This model is intended for future applications in the study of energetic particle transport in the heliosphere.

References
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