OBSERVATIONS OF THE THREE DIMENSIONAL STRUCTURE OF MAGNETIC TURBULENCE IN FAST SOLAR WIND

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The complete spectral tensor of magnetic fluctuations measured by Ulysses in the high-latitude solar wind at solar minimum was determined by a novel wavelet method. In several intervals of about a month, large long-period fluctuations in the direction of the mean magnetic field allowed determination of the tensor components at high frequencies, as a function of frequency over 1.5 decades, and field direction over about of the sphere. Preliminary analysis of these data sets shows that the total power (trace of the tensor) varies considerably with direction of the local mean field, in a manner consistent with a slab + 2.5D model of power in k -space, in which power is present only at wave vectors exactly parallel, or exactly perpendicular, to the local mean field. Most of the power is at wave vectors perpendicular to the local mean field, and a small fraction of this 2D power is in (poloidal) fluctuations parallel to the local mean field. The dominant 2D part has a spectrum near f-5/3, but the slab part has a spectrum nearer f-2.

We emphasize that this analysis does NOT prove that the turbulence IS slab +2D. In fact, the anisotropy is also consistent with the critical balance model of MHD strong turbulence predicted by Goldreich and Sridar. Moreover, we show that the critical balance model also predicts an f-2 variation of the reduced spectrum parallel to the mean magnetic field.