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Stokes’ Parameters Compared to Astrophysical Magnetic Turbulence Parameters MIRIAM FORMAN, Stony Brook University, ROBERT WICKS, NASA/Goddard Space Flight Center, SEAN OUGHTON, Waikato University, NZ, TIMOTHY HORBURY, Imperial College, UK — Since the divergence of a magnetic field is zero, the Fourier transform of fluctuations $\delta B(k)$ must be perpendicular to $k$, so $\delta B(k)$ has components only in the plane perpendicular to $k$. When there is also a mean field $B$, the obvious choice of coordinates to describe $\delta B(k)$ are the unit vectors $t$ in the direction $B \times k$ and $p$ in the direction $(B \times k) \times k$, called the “toroidal” and “poloidal” directions, respectively. Oughton, et al. (1997) as elucidated by Wicks et al. (2012) showed that the power spectral tensor $P_{ij}(k)$ of magnetic fluctuations is described by four scalar functions of $k$, multiplying the tensors $t:t, p:p, t:p + p:t$, and $t:p - p:t$ so that the Hermitian $P_{ij}(k) = \text{Tor}(k) t:t + \text{Pol}(k) p:p + C(k) [t:p + p:t] + i k H(k) [t:p - p:t]$. Since the electromagnetic fluctuations $\delta B(k)$ and $\delta E(k)$ in a beam of light are also perpendicular to their $k$, the four scalar functions of magnetic turbulence in astrophysics which scatters cosmic rays and allows their acceleration, are analogs of the Stokes’ parameters. Using Chandrasekhar’s (1960) notation $[I, Q, U, V]$: $I = \text{Tor} + \text{Pol} = \text{Tr}(P_{ij}(k)); Q = \text{Tor-Pol}; U = C$; we speculate that $V$ corresponds to magnetic helicity $kH$ in turbulence. We are studying projections of $P_{ij}(k)$ observed by spacecraft in the solar wind.

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