Abstract Submitted
for the APR15 Meeting of
The American Physical Society

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 $\delta\mathbf{B(k)}$ must be perpendicular to $\mathbf{k}$, so $\delta\mathbf{B(k)}$ has components only in the plane perpendicular to $\mathbf{k}$. When there is also a mean field $\mathbf{B}$, the obvious choice of coordinates to describe $\delta\mathbf{B(k)}$ are the unit vectors **t** in the direction **B x k** and **p** in the direction **(Bxk) x 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 $P_{ij}(\mathbf{k})$ of magnetic fluctuations is described by four scalar functions of $\mathbf{k}$, multiplying the tensors **t:t**, **p:p**, **t:p**+**p:t**, and **t:p-p:t** so that the Hermitian Pij($\mathbf{k}$) =Tor($\mathbf{k}$) **t:t** + Pol($\mathbf{k}$) **p:p** + C($\mathbf{k}$) [**t:p**+**p:t**] +ikH($\mathbf{k}$) [**t:p-p:t**]. Since the electromagnetic fluctuations $\delta\mathbf{B(k)}$ and $\delta\mathbf{E(k)}$ in a beam of light are also perpendicular to their $\mathbf{k}$, 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= Tor + Pol =Tr($P_{ij}(\mathbf{k})$; Q=Tor-Pol; U=C; we speculate that V corresponds to magnetic helicity kH in turbulence. We are studying projections of $P_{ij}(\mathbf{k})$ observed by spacecraft in the solar wind.

Miriam Forman
Stony Brook University

Date submitted: 09 Jan 2015 Electronic form version 1.4