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Theory for the measurement of cascade rates of energy and cross-helicity in axisymmetric incompressible MHD turbulence MIRIAM FORMAN, Department of Physics and Astronomy, State University of New York, Stony Brook, New York, 11794, JOHN PODESTA, CHARLES SMITH, Space Science Center, University of New Hampshire, Durham, NH 03824 — A theory is presented for the experimental measurement of the turbulent cascade rates of energy and cross-helicity for incompressible MHD turbulence that is statistically homogeneous and axisymmetric about the mean magnetic field. Like Kolmogorov's four-fifths law for incompressible hydrodynamic turbulence, the theory is based on measurements of third order moments of the fluctuations at two points separated by a vector $\mathbf{r}$. In MHD the third order moments contain combinations of velocity and magnetic field fluctuations and are proportional to the distance r when r lies in the inertial range. For axisymmetric MHD turbulence the third order moments are also functions of the angle θ between the displacement vector $\mathbf{r}$ and the mean magnetic field and the dependence on the angle must be measured to determine the cascade rates from experimental data. Tensor forms for the third order moments in axisymmetric MHD turbulence are derived and the resulting theory reveals an interesting relationship between the cascade rates and the angular dependence of the third order moments.

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