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Reconstructing magnetic variance anisotropy, from fluid to kinetic scales, using a simple toy-model

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Solar wind magnetic turbulence is strongly anisotropic in the variance associated with the components. Understanding the properties of anisotropy is relevant to a better comprehension of turbulence phenomena. Studies performed within the kinetic range showed that this anisotropy is well enhanced at smaller and smaller scales. In particular, it has been shown that a) the eigenvalues of the variance matrix have a strong intermittent behavior, with very high localized fluctuations at scales smaller than the ion cyclotron scale; b) the minimum variance direction, which is almost parallel to the background magnetic field at fluid scales, tends to become nearly perpendicular at kinetic scales.
We show that some of these features, observed in different regions of space plasmas, can be reproduced to a good degree by a toy-model in which the tip of the magnetic vector randomly fluctuates on the surface of a sphere with its directional fluctuations following a double-lognormal distribution. In addition, we show that in our model magnetic compressive fluctuations play a key role in analogy with observations.