

## The fat tails of axion-photon mixing

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One of the most powerful probes of axion-like particles (ALPs) comes from considering their mixing with photons in large-scale astrophysical magnetic fields, e.g. in galaxy clusters. However, such searches requires modelling the magnetic field, which is only in part constrainable by observations. In this talk, I will address the questions of how sensitive the ALP predictions are to the magnetic field modelling. In particular, large coherent structures are expected from both magnetohydrodynamic simulations (MHD) and astronomical observations, but absent from the simpler models used so far in the literature. How do coherent structures affect the conversion probability of ALPs and photons? I will present new results based on the first systematic study of ALP-photon mixing in MHD magnetic fields, and compare these with other models used in the literature. An important finding is that the magnetic non-Gaussianity of MHD models leads to “fat tails” in the distribution of conversion probabilities. This result could improve the prospects of high-precision searches of ALPs, and suggests that limits placed using appropriate, simple models are conservative and robust.

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