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Axion-Photon Conversion in Magnetospheres: The Role of the Plasma

The most promising indirect search for the existence of axion dark matter uses radio telescopes to look for narrow spectral lines generated in the magnetospheres of neutron stars. Unfortunately, a large list of theoretical uncertainties has prevented this search strategy from being accepted as robust. In this talk I will present a novel end-to-end pipeline that traces individual photon trajectories from their point of genesis in the magnetosphere to asymptotic distances. This method allows one to assess many of the outstanding uncertainties, including: (1) do refraction and reflection induce strong inhomogeneous features in the flux, (2) can refraction induce premature axion-photon de-phasing, (3) what is the expected width of the line, (4) does the flux have a strong time-dependence, and (5) can these radio photons be efficiently absorbed.

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