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Axion Magnetic Resonance: A Novel Enhancement in Axion-Photon Conversion

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We identify a new resonance, axion magnetic resonance (AMR), that can greatly enhance the conversion rate between axions and photons. A series of axion search experiments rely on converting them into photons inside a constant magnetic field background. A common bottleneck of such experiments is the conversion amplitude being suppressed by the axion mass when m_a
$gtrsim10^{-4}$ eV. We point out that a spatial or temporal variation in the magnetic field can cancel the difference between the photon dispersion relation and that of the axion, hence greatly enhancing the conversion probability.
We demonstrate that the enhancement can be achieved by both a helical magnetic field profile and a harmonic oscillation of the magnitude. Our approach can extend the projected ALPS II reach in the axion-photon coupling ($g_{a\gamma}$) by two orders of magnitude at $m_a = 10^{-3}$ eV with moderate assumptions.

Mini Symposia (Invited Talks Only)

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