Contribution ID : **17** Type : **not specified**

Floquet and Sideband Dynamics of Photon–Axion Mixing in Coherent Axion Backgrounds

Coherent axion dark matter provides a periodically time-dependent background for electromagnetic propagation. In the presence of an external magnetic field, the oscillating axion field acts as a temporal pump and can drive photon–axion conversion beyond the conventional static or adiabatic level-crossing picture. A unified Floquet and sideband description of this dynamics will be presented.

Resonant photon–axion mixing can occur when the mismatch between photon and axion dispersion relations is compensated by integer harmonics of the axion oscillation frequency. This driven resonance enables efficient conversion away from the usual level-crossing regime and is missed after time averaging. It constitutes a unitary mode-conversion process, distinct from axion decay or parametric particle production, and can lead to characteristic polarization signatures relevant for astrophysical observations.

A Floquet–Bloch sideband formulation of axion electrodynamics will be discussed. The periodic axion background generates a ladder of photon and axion sidebands. Near folded degeneracies, the system reduces to universal two-mode crossings whose stability is determined by the symplectic, or Krein, signatures of the colliding modes. This framework unifies stable avoided crossings, parametric instabilities, forward conversion, stop bands, and distributed reflection within a single language.

Together, these results clarify how coherent axion backgrounds modify wave propagation and provide new theoretical tools for identifying observable signatures of axion dark matter.

Primary author(s) : YAO, Runmin (HIAS, UCAS); BI, Xiaojun (IHEP); YIN, Pengfei; HUANG, Qingguo

Presenter(s) : YAO, Runmin (HIAS, UCAS)