Quadratic Coupling of Axions to Photons

Tuesday 4 June 2024 14:30 (20 minutes)

Using chiral perturbation theory as a guideline, we show that the QCD axion couples to the electromagnetic (EM) kinetic term at one loop, generating a shift-breaking effective operator $a^2 F_{\mu\nu}F^{\mu\nu}$. If axions make up dark matter, they induce some temporal variation of the EM-fine structure constant α , which is severely constrained. Therefore, we can exploit the precision of upcoming quantum metrology experiments to probe the signal of axion dark matter. We recast these constraints on the QCD axion parameter space. Finally, we discuss how to generalise our finding to axion-like particles (ALPs), leading to more stringent constraints on the ALPs parameter space.

Reference: arXiv: 2307.10362 (https://arxiv.org/abs/2307.10362)

Authors: BEADLE, Carl (Universite de Geneve (CH)); VUONG, Hoa (DESY); QUEVILLON, Jeremie (LPSC, Grenoble (CNRS)); ELLIS, Sebastian (Universite de Geneve (CH))

Presenter: VUONG, Hoa (DESY)

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