

Proceedings of the Conference in Honour of Murray Gell-Mann's 80th Birthday: Quantum Mechanics, Elementary Particles, Quantum Cosmology and Complexity, 2011, pages 526-535

Pseudoscalar-photon interactions, axions, non-minimal extensions, and their empirical constraints from observations

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Abstract

Pseudoscalar-photon interactions were proposed in the study of the relations among equivalence principles. The interaction of pseudoscalar axion with gluons was proposed as a way to solve the strong CP problem. Subsequent proposal of axion as a dark matter candidate has been a focus of search. Motivation from superstring theories add to its importance. After a brief introduction and historical review, we present (i) the current status of our optical experiment using high-finesse Fabry-Perot resonant cavity - Q & A experiment - to detect pseudoscalar-photon interactions, (ii) the constraints on pseudoscalar-photon interactions from astrophysical and cosmological observations on cosmic polarization rotation, and (iii) theoretical models of non-minimal interactions of gravitational, electromagnetic and pseudoscalar (axion) fields, and their relevance to cosmology.

Keywords

Axions, Cosmic polarization rotation., Non-minimal extensions, Pseudoscalar-photon interactions