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Abstract

Generalized Heisenberg-Euler Formula and Its Application to Vacuum Magnetic Birefringence Experiment †

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The Heisenberg-Euler formula, describing the non-linear effective action of a photon, is generalized to include parity violating effects. Using the formula, how to probe the dark sector via the magnetic birefringence experiments is studied, in which a new scheme has emerged. The scheme uses a ring Fabry-Pérot resonator with a new setup for the initial polarization of a laser beam, which can measure the parity-violating effects directly without QED background. As an example, the sensitivity of the measurements (ellipticity and polarization rotation) is given, in the presence of a dark sector neutrino, as a function of a mixing parameter between visible and dark sectors and the mass of the dark sector neutrino.