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High-energy vacuum birefringence and dichroism in an ultra-strong laser field SEBASTIAN MEUREN[1], SERGEY BRAGIN, CHRISTOPH H. KEITEL, ANTONINO DI PIAZZA, Max Planck Institute for Nuclear Physics, Heidelberg, Germany — The interaction between real photons in vacuum is a long-standing prediction of quantum electrodynamics, which has never been observed experimentally. Upcoming 10 PW laser systems like the Extreme Light Infrastructure (ELI) will provide laser pulses with unprecedented intensities [1]. If combined with highly energetic gamma photons – obtainable via Compton backscattering from laser-wakefield accelerated electron beams – the QED critical field becomes accessible. In [2] we have derived how a generally polarized probe photon beam is influenced by both vacuum birefringence and dichroism in a strong linearly polarized plane-wave laser field. We put forward an experimental scheme to measure these effects in the nontrivial high-energy regime, where the QED critical field is reached and the Euler-Heisenberg approximation, valid for low-frequency electromagnetic fields, breaks down. Our results suggest the feasibility of verifying/rejecting the QED prediction for vacuum birefringence/dichroism at the 3σ confidence level on the time scale of a few days at several upcoming laser facilities.
[1] Di Piazza et al., Rev. Mod. Phys. **84**, 1177 (2012)
[2] S. Bragin, SM, C. H. Keitel, A. Di Piazza, arXiv:1704.05234 (2017)

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