Observing Light-By-Light Scattering in Vacuum with an Asymmetric Photon Collider

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The elastic scattering of two real photons in a vacuum is one of the most elusive of the fundamentally new processes predicted by quantum electrodynamics. This explains why, although it was first predicted more than eighty years ago, it has so far remained undetected. In our work [1], we show that in present-day facilities, the elastic scattering of two real photons can become detectable far off-axis in an asymmetric photon-photon collider setup. This may be obtained within one day of operation time by colliding 1 mJ extreme ultraviolet pulses with the broadband gamma-ray radiation generated in nonlinear Compton scattering of ultrarelativistic electron beams with terawatt-class optical laser pulses operating at a 10 Hz repetition rate. In addition to the investigation of elastic photon-photon scattering, this technique allows us to unveil or constrain new physics that could arise from the coupling of photons to yet undetected particles, therefore opening new avenues for searches of physics beyond the standard model.

References

[1] M Sangal, C H Keitel and M Tamburini, Phys. Rev. D **104**, L111101 (2021)