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Towards a vacuum birefringence experiment at the Helmholtz International Beamline for Extreme Fields

Thursday, October 9, 2025 4:40 PM (20 minutes)

Quantum field theory predicts a nonlinear response of the vacuum to strong electromagnetic fields of macroscopic extent. This fundamental tenet has remained experimentally challenging and is yet to be tested in the laboratory. A particularly distinct signature of the resulting optical activity of the quantum vacuum is vacuum birefringence manifesting itself in a polarization-flipped signal component. This offers an excellent opportunity for a precision test of nonlinear quantum electrodynamics (QED) in an uncharted parameter regime.
In this talk I will provide an update on the status of the dark-field approach devised to measure the leading (both polarization-flipped and unflipped) quantum vacuum signals in a dedicated experiment at the European X-ray Free Electron Laser (EuXFEL) within the Helmholtz International Beamline for Extreme Fields (HIBEF) User Consortium.

Primary author: KARBSTEIN, Felix

Presenter: KARBSTEIN, Felix

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