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Probing QED in the strong-field regime with LUXE

Tuesday, 24 March 2020 09:00 (20 minutes)

In this talk LUXE (Laser Und XFEL Experiment) is discussed. It is an experiment that aims to use the high-quality and high-energy electron beam of the European XFEL and a powerful laser. The scientific objective of the experiment is to study quantum electrodynamics processes in the regime of strong fields. High-energy electrons, accelerated by the European XFEL linear accelerator, and high-energy photons, produced via Bremsstrahlung of those beam electrons, colliding with a laser beam shall experience an electric field up to three times larger than the Schwinger critical field (the field at which the vacuum itself is expected to become unstable and spark with spontaneous creation of electron – positron pairs) and access a new regime of quantum physics. The processes to be investigated, which include nonlinear Compton scattering and nonlinear Breit-Wheeler pair production, are relevant to a variety of phenomena in Nature, e.g. in the areas of astrophysics and collider physics and complement recent results in atomic physics. The regime of multi-photon exchange is also of interest for QCD; it is similar to the color-glass condensate there.

The experimental setup requires in particular the extraction of a minute fraction of the electron bunches from the European XFEL accelerator, the installation of a powerful laser with sophisticated diagnostics, and an array of precision detectors optimised to measure electrons, positrons and photons. Physics sensitivity projections based on simulations are also shown.

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