8th MT Student Retreat



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Detection and Reconstruction of High-Flux Electron Energy Spectra in the Strong-Field QED Regime with LUXE

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Conventional QED, an incredibly accurate physical theory, breaks down and becomes divergent at extremely high energy scales, and also in the presence of an extremely intense external electromagnetic field. LUXE (LASER Und XFEL Experiment), an experiment in design and planning here in Hamburg, intends to collide a high-intensity LASER pulse with highly boosted electrons and photons, up to 17.5 GeV from the Eu.XFEL, creating assisted strong electric fields up to and greater than the Schwinger limit of ~1.32 × 10^18 Vm^-1.

This creates a non-negligible probability of non-linear Compton Scattering and Breit-Wheeler interactions, the latter of which represents a spontaneous boiling of the vacuum. The rates and kinematics of these interactions will be measured to high accuracy, with high-statistics runs for the first time at LUXE. Detection challenges of the results of these interactions include low-flux positron detection and tracking in a high-radiation environment, GeV-photon spectrometry, and high-flux, high-energy electron energy distribution reconstructions for a variety of spectral shapes and dynamic ranges.

A Scintillator Screen & Camera system is employed for the electron detection system, where scintillation light from the screen is measured by remote optical cameras, and magnetic deflection of the charged particles is used as magnetic spectrometer to reconstruct energy distributions of the electron flux.

The LUXE experiment and its goals are introduced, before the design, reconstruction methods and expected results for this Scintillation Screen & Camera detector and its consequences for LUXE are discussed.

Primary author: HALLFORD, John Andrew (FLC (Forschung an Lepton Collidern))

Presenter: HALLFORD, John Andrew (FLC (Forschung an Lepton Collidern))

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