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Strong field Quantum Electrodynamics: from amplitudes to physical effects

The presentation will begin with a concise introduction to Quantum Electrodynamics (QED) in the presence of external background fields, offering insights into the fundamental interactions between matter and electromagnetic fields. Following this, we will delve into the significance of light-by-light scattering in QED, examining ist amplitude (also known as the four-photon amplitude) with general kinematics. We will highlight its applications in accurately measured quantities, such as the electron's magnetic moment and the Lamb shift observed in atomic energy levels. Furthermore, we will explore the remarkable phenomena associated with light-by-light scattering, notably vacuum birefringence. Despite its long-standing prediction, experimental observation of this phenomenon remains challenging due to its tiny effects. We will provide an overview of the theoretical foundations behind vacuum birefringence and present our proposed experimental approaches and ongoing progress in this intriguing research area.

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Session Classification: Lectures