Spin-Dependent Electron Diffraction in X-Ray Laser Fields

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Spin effects for the case of electron diffraction in X-ray laser fields are predicted [1], which, in principle, can be used to infer the electron spin state before interaction [2,3], in the Kapitza-Dirac effect [4]. The experimental feasibility of the effect is coming into reach [5], as suggested in Fig. 1 and raises the question, whether a small longitudinal polarization component in focused Gaussian beams is affecting these spin dynamics [6]. Since this longitudinal component is anti-symmetric and averages to zero along the transverse direction with respect to the laser beam propagation, the emerging question of interest also requires for an extension of the quantum description beyond the one-dimensional plane wave modeling.

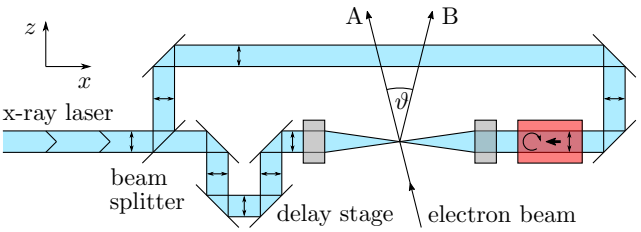

Figure 1: Considered experimental setup for observing spin-dependent electron diffraction, according a sketch in reference [5]

In our contribution, we shine light on this aspect and discuss an extension of the perturbative calculation from reference [6] with a more realistic and higher spacial resolution [7]. We also present further perspectives on the realization of the effect [8].

References

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