Abstract Submitted
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A novel design of coherent and efficient electron beam-splitter based on quantum interaction-free measurement[1] YUJIA YANG, CHUNG-SOO KIM, RICHARD HOBBS, AKSHAY AGARWAL, MIT, PIETER KRUIT, TU Delft, KARL K. BERGGREN, MIT — We propose the design and theoretical analysis of a novel coherent and efficient electron beam-splitter utilizing quantum interaction-free measurement. A coherent electron beam-splitter is a necessary component in electron interferometry, electron holography, and recently emerging quantum electron optics. For most of these applications, a coherent, highly efficient, lossless, and two-port beam-splitter is preferred, which currently available electron beam-splitters cannot readily provide. Our electron beam-splitter design combines a weak phase grating with a resonator. Beam-splitting is achieved by passing the electron beam through the weak phase grating multiple times in the resonator. The beam-splitting ratio is controlled by the number of passes through the grating. Higher-order diffractions can be suppressed by inserting an aperture in the diffraction plane. The loss introduced by the aperture can be arbitrarily low according to quantum interaction-free measurement, thus enabling a lossless, two-port electron beam-splitter. Moreover, this novel design is not limited to electron optics, and can be generalized to light, atom, and molecular optics.

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