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Towards Controlled Free-Electron Decoherence[1] WAYNE HUANG, Center for Fundamental Physics, Northwestern University, ZILIN CHEN, HERMAN BATELAAN, Department of Physics and Astronomy, University of Nebraska-Lincoln — We report on our preliminary results from an experiment that is designed for studying controlled free-electron decoherence. Using above band-gap or below band-gap photoexcitation, we created various charge patterns on the surface of an undoped GaAs plate. Through Coulomb interaction with the surface charges, a diffracted electron wavepacket is coupled to the plate in such a way that the resulting beam pattern is either displaced or deformed depending on the state of the light-induced surface charges. The low electron beam flux guarantees that only one electron is present in the vacuum chamber at any given time. As such, we devised an open quantum system that consists of single electrons coupled to a semiconductor plate. In this talk, I will discuss the observed contrast loss and broadening of the diffraction peaks. Possible mechanisms that may lead to such effects, including decoherence, will be reviewed.

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