In this work, we study perpendicular collisions between two voltage pulses traveling through a four-terminals mesoscopic quantum dot. In the central scattering region, the two pulses interact via the Coulomb field. The model is described by a tight-binding system with Hubbard-like interaction and we solve the time-dependent Schrödinger equation numerically using the methods discussed in [1] available in the future as a time-dependent extension of the KWANT package. The interaction is included by means of the time-dependent Hartree-Fock approximation.

We observe the time evolution of the local charge and current density after injecting two voltage pulses. The pulses are sufficiently weak and only cause slight perturbations to the system. However, when we compare the current variations due to relative time-delays between the injection of the voltage pulses, we observe changes in the direction of the propagation of the pulses due to the interaction. Counter-intuitively, the most effective collision-response has been observed after the first pulse has already passed over, when its remaining parts are left behind and modify the medium sufficiently to change the physics through the path for the second pulse.