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Fermi edge singularity and finite frequency spectral features in a semi-infinite 1D wire

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Abstract content
   (Max 300 words)

We theoretically study a charge qubit interacting with electrons in a semi-infinite 1D wire. The system displays the physics of the Fermi edge singularity, i.e. a singularity in the qubit tunneling rate due to a proliferation of long wavelength excitations in the wire. Our results generalize known results for the Fermi-edge system to the regime where excitations induced by the qubit can resolve the spatial structure of the scattering region. We find resonant features in the qubit tunneling rate as a function of the qubit level splitting. They occur at integer multiples of Planck's constant times the Fermi velocity divided by l. Here l is the distance from the tip of the wire to the point where it interacts with the qubit. These features are due to a single coherent charge fluctuation in the electron gas, with a half-wavelength that fits into l an integer number of times. As the coupling between the qubit and the wire is increased, the resonances are washed out. This is a clear signature of the increasingly violent Fermi-sea shake-up that accompanies strong coupling.

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