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Spin-Dipole Excitations Produced On-Demand in the Fermi Sea

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Abstract : The single-particle injection from the Andreev level and how such injection is simulated using a voltage pulse are discussed. Recently, high-speed quantum-coherent electron sources injecting one- to few-particle excitations into the Fermi sea have been experimentally realized. The main obstacle to using these excitations as flying qubits for quantum-information processing purposes is decoherence due to the long-range Coulomb interaction. An obvious way to get around this difficulty is to employ electrically neutral excitations. Here it is discussed how such excitations can be generated on-demand using the same injection principles as in existing electron sources. Namely, with the help of a voltage pulse of a certain shape applied to the Fermi sea or using a driven quantum dot with superconducting correlations. The advantage of the latter approach is the possibility of varying the electron-hole content in the excitation and the possibility of creating a charge-neutral but spin-dipole excitation.

Keywords : Andreev level, on-demand, single-electron, spin-dipole
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