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Spinful quantum dot junctions probed by superconductivity and thermoelectricity

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We investigate the properties of gate-tunable single quantum dot junctions, obtained by the electromigration technique, in the spin-1/2 Kondo regime with rather large U/Γ (U is the on-site interaction and Γ the tunnel coupling). In the first part we investigate the device response in the presence of superconductivity in the leads. We tune the ground state of the dot quantum spin from screened to unscreened, using the gate voltage, the temperature and the magnetic field. In the second part, we investigate the thermoelectric device response in the normal state of the leads, in the presence of a thermal gradient. We find a 2e-periodic response of the Seebeck coefficient with respect to the quantum dot charge state, which provides a characteristic signature of the spin degeneracy of the quantum dot levels. A sign change of the Seebeck coefficient with increasing temperature in the oddly occupied state provides a hallmark of Kondo correlations, in very good agreement with NRG calculations.

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