InSb Nanowire Double Quantum Dots Coupled to a Superconducting Microwave Cavity

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A microwave transmission line cavity can be used as a quantum bus allowing the coupling of different qubit systems on a single chip. Such coupling is already well established in superconducting qubits[1,2]. The coupling of the electron spin to the cavity field is theoretically suggested to be achieved through spin-orbit interaction or the use of a local slanting Zeeman field. InSb nanowires exhibit large g-factor and strong spin-orbit interaction[3,4], making them a promising candidate to construct the hybrid QD-cavity architecture to realize the potential strong spin coupling regime. Here we demonstrate a mechanical transfer technique to align single nanowires with micron accuracy onto prefabricated surface gates followed with one step lithography for the contact electrodes and the microwave cavity. This method ensures a high fabrication yield of hybrid device in which the nanowire interacts with the strongest microwave field. A double QD is formed in the InSb nanowire with predefined local electric gates. The charge state is read out from the amplitude and phase response of resonator as well as the dc transport measurement. The frequency shift and linewidth broadening of the resonator is compared when charge transits between dot-dot, or dot-lead.

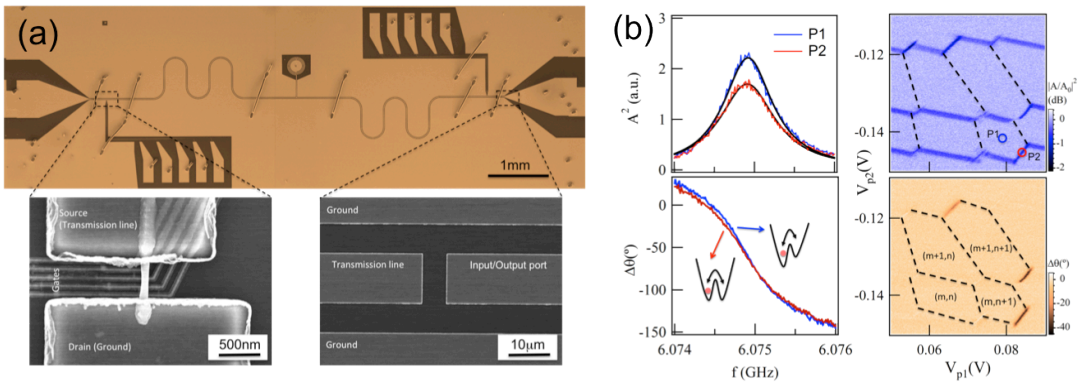

Fig. (a) SEM image of InSb double QD embedded in a superconducting resonator. (b) Resonator transmission spectrum and readout of charge stability diagram from the resonator amplitude and phase response.

Reference:

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[4] Deng *et al.*, Nano Lett. 12, 6414 (2012).