



Landau-Zener-Stuckelberg interferometry in superconducting qubits

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Superconducting persistent-current qubits are quantum-coherent artificial atoms with multiple energy levels. In the presence of large-amplitude harmonic excitation, the qubit state can be driven through one or more of the energy-level avoided crossings. The resulting Landau-Zener transitions mediate a rich array of quantum-coherent phenomena as a function of the driving amplitude and frequency, as experimentally demonstrated using a niobium persistent-current qubit.

In this talk, we will discuss the observation of Mach-Zehnder-type interferometry, for which quantum interference fringes for 1-50 photon transitions are identified, and microwave-induced cooling, for which effective qubit temperatures < 3 mK are achieved, a factor 10x-100x lower than the dilution refrigerator ambient temperature.

We will also introduce a novel spectroscopy technique, where spectroscopic information is obtained from the dependence of the system response on the driving amplitude, rather than on the driving frequency. This approach surmounts many of the limitations of the conventional frequency-based approach, whose application is not universally straightforward and becomes challenging for frequencies in the range of tens and hundreds of gigahertz.