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**Cavity QED and magnetic field modulated coupling between two-level resonators and a Josephson junction** LIN TIAN, RAYMOND SIMMONDS, National Institute of Standards and Technology — A superconducting Josephson junction can be explored as a novel probe of the amorphous two-level systems (TLSs) inside the junction. In recent experiments, TLSs have been demonstrated in the energy splittings of the superconducting phase qubits. However, the mechanism of the coupling between the TLSs and the junction remains unresolved. Possible mechanisms include coupling of the TLSs with the critical current and coupling of the TLSs with the dielectric field in the junction. In this talk, we present a scheme that can distinguish the two mechanisms. The key idea is to apply a magnetic field inside the junction, which is treated as a high-Q cavity, and study the cavity transmission in the presence of the TLS. When the TLS couples with the critical current, the magnitude of the coupling will be strongly modulated by the magnetic field; when the TLS couples with the dielectric field, the magnitude of the coupling will not be affected. The change of the coupling can be observed through the cavity transmission. We calculate the cavity transmission under the magnetic field and show that the dependence of the coupling on the field can be extracted from the amplitude and the spectrum of the transmission. We also show that spatial location of the TLS can be resolved by this scheme.

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