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Optomechanical effects of two-level states in electromechanical devices JUNHO SUH, AARON WEINSTEIN, KEITH SCHWAB, Applied Physics, California Institute of Technology — It is now clearly established that the presence of two-level states can act as a power-dependent dielectric and lead to non-linear response of lithographic superconducting circuits. We observe these effects in a parametrically coupled, superconducting electro-mechanical system. In this case, the driven two-level states shift the microwave resonance frequency, and modulate the mechanical resonance through the optical spring effect. When pumping with two tones to realize a back-action evading measurement, these effects produce mechanical frequency modulation at twice the mechanical resonance, leading to a parametric instability for strong drives sufficient to produce a single quadrature measurement near the zero-point level. We also discuss schemes to avoid these effects in future devices.

Junho Suh
California Institute of Technology

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