

Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Level attraction in circuit electromechanics NATHAN R. BERNIER, LASZLO D. TOTH, ALEXEY K. FEOFANOV, TOBIAS J. KIPPENBERG, EPFL (Ecole polytechnique fdrale de Lausanne) — Level repulsion, with a coupling lifting an initial degeneracy between two modes, is a well-known phenomenon that appears anywhere from solid state band theory to quantum chemistry. In fact, a second phenomenon can occur when two modes cross in frequency. Level attraction, although less recognized, can be as relevant in many fields. The interaction between the two modes yields an instability, as the two frequencies become degenerate and develop an imaginary component. The difference originates from one of the mode having negative energy. Level attraction lies at the crossroads where many exciting topics intersect, as it is linked to synchronization, PT symmetry breaking and exceptional points. Here we realize experimentally level attraction in optomechanics. The parametric instability, with a blue-detuned pump, can be seen as a consequence of level attraction. Our system is a electromechanical circuit, with two microwave cavities coupled to the same mechanical oscillator. The latter is damped with the auxiliary microwave mode, in order to have a dissipation rate commensurate with that of the main microwave mode. Only in this regime can one observe level attraction between the microwave and mechanical modes, which we contrast with previously demonstrated level repulsion.

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Date submitted: 02 Nov 2016

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