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Direct observation of coherent energy transfer in nonlinear micromechanical oscillators CHANGYAO CHEN, Argonne National Lab, DAMIAN ZANETTE, Centro Atmico Bariloche e Instituto Balseiro , DAVID CZAPLEWSKI, JEFFREY GUEST, Argonne National Lab, STEVE SHAW, MARK DYKMAN, Michigan State University, DANIEL LOPEZ, Argonne National Lab — Energy dissipation is an unavoidable phenomenon of physical systems that are directly coupled to an external environmental bath. The ability to engineer the processes responsible for dissipation and coupling is fundamental to manipulate the state of the systems. This is particularly important in oscillatory states whose dynamic response is crucial for many applications, e.g., micro and nano mechanical resonators for sensing and timing, qubits for quantum engineering, and vibrational modes for optomechanical devices. In situations where stable oscillations are required, the energy dissipated by the vibrational modes is usually compensated by replenishment from external energy sources. Consequently, if the external energy supply is removed, the amplitude of oscillations start to decay immediately since there is no means to counteract the energy dissipated. Here, we experimentally demonstrate a novel strategy to maintain stable oscillations, i.e. constant amplitude and frequency, without supplying external energy to compensate losses. The fundamental intrinsic mechanism of mode coupling is used to redistribute and store mechanical energy among vibrational modes and coherently transfer it back to the principal mode when the external excitation is off.

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