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Phasonic spectroscopy of tunable quantum quasicrystals[1] RUWAN SENARATNE, SHANKARI RAJAGOPAL, TOSHIHIKO SHIMASAKI, PETER DOTTI, DAVID WELD, Univ of California - Santa Barbara — We report on experiments studying excitations in a tunable quantum quasicrystal consisting of cold strontium atoms in a bichromatic optical lattice. The phasonic degree(s) of freedom of solid-state quasicrystals (analogues of phonon modes in a regular crystal) are typically not dynamically accessible, and yet are believed to have significant effects on thermal and electronic transport. We directly drive this phason mode and observe the excitation of the lattice-bound atoms, which are analogous to the electrons in a real quasicrystal. We discuss both the familiar phononically driven excitations of ground band atoms and the results of this novel coherent phasonic spectroscopy. We identify fundamental resonances and higher-order processes, study their dependence on tunneling and modulation strength, and compare spectroscopic results for phasonic and phononic modes of excitation.

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