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Vibrational states and Kondo physics in single-molecule transistors[1]

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It is now possible to fabricate a transistor with a channel consisting of a single small molecule. While electronic transport through such a device resembles that seen in metal and semiconductor single-electron transistors, single-molecule transistors (SMTs) can tie together concepts from chemical electron transfer theory and many-body physics. I will describe our recent observations of inelastic cotunneling features in SMTs that correspond with vibrational excitations of the molecule, as determined by Raman and infrared spectroscopy. These vibrational features evolve in a nontrivial manner as a function of gate voltage when electronic levels are nearly resonant with the vibrational energies. When the molecule contains an unpaired electron, we also see vibrational satellite features around the Kondo resonance. This demonstrates that SMTs are rich systems for studying the interplay of electronic correlations and vibrational motion. This work was supported by NSF DMR-0347253, the Packard Foundation, the Research Corporation, and the Welch Foundation.

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