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High-resolution Josephson spectroscopy with a scanning tunneling microscope MALLIKA T. RANDERIA, BENJAMIN E. FELDMAN, ILYA K. DROZDOV, ALI YAZDANI, Princeton University — Conventional scanning tunneling microscopy (STM) measurements use a normal metal tip to probe local quasi-particle density of states with atomic resolution. Using a superconducting tip to conduct spectroscopy significantly boosts the energy resolution of the measurements, thus expanding the STM capabilities. Moreover, superconducting tips make it possible to probe superconductivity via the Josephson effect, which provides a direct measure of the local superconducting order parameter. Therefore, scanning Josephson spectroscopy measurements have the potential to characterize of a wide variety of superconducting materials on the atomic scale. I will present superconducting Pb tip measurements performed at temperatures below 250mK in a dilution refrigerator STM. By controlling the junction resistance, we are able to explore a wide range of tunneling regimes. Josephson measurements on Pb samples exhibit features including multiple Andreev reflections, and I will discuss the extension of these techniques to study atomic scale variations in Josephson current.

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