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A Feedback-Stabilized Platform for the Study of the Electrical and Mechanical Properties of Atomic Point Contacts DOUGLAS SMITH, JON PRATT, FRANCESCA TAVAZZA, LYLE LEVINE, ANNE CHAKA, NIST, NIST TEAM — The ability to create and maintain contacts of atomic dimensions between a probe tip and a surface enables the study of a wide range of electronic and mechanical properties of nanowires, single-atom chains and single molecules. Such experiments require that the relative tip-surface position be held stable to better than atomic dimensions for extended periods of time. In this work, we describe recent experimental results from a feedback-stabilized break junction (FSBJ) instrument that uses high-resolution Fabry-Perot interferometry to measure and control tip-surface position with better than 5 pm long-term stability in vacuum at 4 K. Experiments with gold contacts reveal complex electron transport behavior through gold nanowires and single-atom chains, including the observation of stable integer and non-integer quantum conduction states and variations in non-ballistic transport as a function of atomic chain length. Correlations are observed between measured experimental conduction states and calculated density-functional-theory-based results for one- and two-dimensional structures. Extension of the FSBJ to the measurement of atomic bond strength and stiffness will also be discussed.

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