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Active current-noise cancellation for Scanning Tunneling Microscopy¹ LAVISH PABBI, CONNER SHOOP, RIJU BANERJEE, BILL DUSCH, E.W. HUDSON, The Pennsylvania State University — The high sensitivity of the scanning tunneling microscope (STM) poses a barrier to its use in a noisy environment. Vibrational noise, whether structural or acoustic in source, manifests as relative motion between the probe tip and the sample, then appearing in the Z feedback that tries to cancel it. Here we describe an active noise cancellation process that nullifies this motion by adding a drive signal into the existing Z feedback loop. The drive is digitally calculated by actively monitoring vibrations measured by an accelerometer placed *in-situ* close to the STM head. By transferring the vibration cancellation effort to this drive signal, vibration-created noise in the Z-feedback (during topography) or current (during spectroscopy) is significantly reduced. This inexpensive and easy solution, requiring no major instrumental modifications, is ideal for those looking to place their STM in a noisier environment, for example in the presence of active refrigeration systems (e.g. pulse tube cryocoolers) or coupled to high-vibration instrumentation.

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