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Development of low temperature scanning probe microscope[1]
YONGHO SEO, PAUL CADDEN-ZIMANSKY, VENKAT CHANDRASEKHAR, Department of Physics and Astronomy, Northwestern University, MESOSCOPIC PHYSICS TEAM — We have built a low temperature scanning probe microscope using a quartz crystal tuning fork. This microscope can be used for STM, AFM, EFM, and MFM at temperatures ranging from room temperature to millikelvin temperatures. The tuning fork, a self- actuating and self-sensing sensor, has a 32 kHz resonance frequency, 10^5 quality factor, and 1300 N/m spring constant. Due to the small vibration ($\sim$ 0.1 nm) of the tuning fork, it is an ideal tool for ultra-high resolution imaging. Also, the tuning fork is particularly suited for millikevin temperature range SPM due to its low dissipation power ($\sim$ 1 pW). We present low temperature EFM images of boron nano wires, low temperature MFM images of magnetic dot arrays embedded in a superconducting matrix, and high resolution topographic and EFM images of carbon nanotubes.

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