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Synchrotron X-ray Enhanced Scanning Tunneling Microscopy[1]
VOLKER ROSE, JOHN FREELAND, Argonne National Laboratory — Proper understanding of complex phenomena occurring in nanostructures requires tools with both the ability to resolve the nanometer scale as well as provide detailed information about chemical, electronic, and magnetic structure. Scanning tunneling microscopy (STM) achieves the requisite high spatial resolution; however, direct elemental determination is not easily accomplished. X-ray microscopies, on the other hand, provide elemental selectivity, but currently have spatial resolution only of tens of nanometers. We present a novel and radically different concept that employs detection of local synchrotron x-ray interactions utilizing a STM that provides spatial resolution, and x-ray absorption directly yields chemical, electronic, and magnetic sensitivity. If during tunneling the sample is simultaneously illuminated with monochromatic x-rays, characteristic absorption will arise. Electrons that are excited into unoccupied levels close to the Fermi level modulate the tunneling current giving rise to elemental contrast.

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