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The Virtual Scanning Tunneling Microscope: Induced Tunneling in Bilayer Two-Dimensional Electron Systems ADAM SCIAMBI, MATTHEW PELLICCIONE, DAVID GOLDHABER-GORDON, Stanford University, SETH BANK[1], ARTHUR GOSSARD, University of Santa Barbara, MICHAEL LILLY, JOHN RENO, Sandia National Laboratory — We propose a novel probe technique, the virtual scanning tunneling microscope (VSTM), which will spatially and spectroscopically map two-dimensional electron systems (2DESs) in semiconductor heterostructures. The probe overcomes the typical inaccessibility of a buried 2DES by having a second parallel "probe" 2DES grown nearby. A biased tip overhead can then induce local tunneling from the probe 2DES into the original by adjusting the interlayer potential barrier. Prior bilayer studies have shown that a tunneling signal is dominated by the overlap of the layers' Fermi surfaces, hindering VSTM-induced tunneling and obscuring any spectroscopy. We show, however, in widely-space bilayers systems where interlayer inelastic scattering is more prominent that the previous energy-momentum constraints are relaxed. In GaAs/AlGaAs samples grown by two different sources, we show we can increase interlayer tunneling by an order of magnitude with gating, setting the stage for spectroscopy.

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