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Low Temperature Scanning Force Microscopy for Probing the Edge of Quantum Hall Systems JAMES HEDBERG, ASHWIN LAL, YOICHI MIYAHARA, GUILLAUME GERVAIS, PETER GRUTTER, MICHAEL HILKE, Department of Physics, McGill University, Montreal, Canada, L.N. PFEIFFER, K.W. WEST, Department of Electrical Engineering, Princeton University, Princeton, NJ — Using our recently implemented ultra-low temperature, high magnetic field scanning force microscope, we have further developed methods to probe charge transport in semiconductor materials, specifically edge states of a 2-dimensional electron gas (2DEG) in the quantum hall regime. Among other techniques, we apply an AC excitation signal to a buried two-dimensional electron gas and monitor the electrostatic potential distribution via the oscillation dynamics of a piezoelectric quartz tuning fork with an etched metallic probe attached to one tine. The quartz tuning fork allows for ultrasensitive detection of electric forces as a consequence of its small oscillation amplitude. Additionally, the 2DEG sample is prepared with a cleaved edge overgrowth structure offering an extra electrode separated from the 2DEG by a atomically defined tunneling barrier, resulting in an addressable edge.

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