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Microscopic conductivity imaging of the quantum Hall edge states by a microwave impedance microscope KEJI LAI, WORASOM KUNDHIKANJANA, MICHAEL KELLY, ZHI-XUN SHEN, Stanford University, JAVAD SHABANI, MANSOUR SHAYEGAN, Princeton University — Spatially resolved studies of the quantum Hall edge channels are usually challenging because most high mobility two-dimensional electron gas (2DEG) systems are buried underneath the surface. Using a cryogenic microwave impedance microscope, we demonstrate the conductivity mapping of the bulk and edge states in a GaAs/AlGaAs 2DEG. Narrow strips with either metallic or insulating screening properties are observed along edges of the 2DEG. The sizes and positions of these strips as a function of the magnetic fields agree with the self-consistent electrostatic picture. The quantitative local conductivity information provides a complete microscopic description of the evolution through the bulk filling factor $\nu = 2$. The imaging was performed without DC electrodes, vividly manifesting that the quantum Hall edges are equilibrium states and do not depend on externally supplied currents.

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