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An investigation of orienting mechanisms of the quantum Hall stripe phases J. POLLANEN, S. BRANDSEN, J.P. EISENSTEIN, Institute for Quantum Information and Matter and Department of Physics, California Institute of Technology, Pasadena, California 91125, USA, L.N. PFEIFFER, K.W. WEST, Department of Electrical Engineering, Princeton University, Princeton, New Jersey 08544, USA — At high magnetic field, two-dimensional electron systems (2DES) exhibit collective states possessing broken rotational symmetry. These states, known as the quantum Hall stripe phases (QHSP), are examples of electronic nematic liquid crystals. Experiments consistently show that the stripes are oriented relative to the GaAs crystal axes, but the exact nature of the native symmetry-breaking field remains unknown. We report here on an extensive study of the QHSPs in a series of high mobility single quantum well samples. These samples all have the same electron density, but differ systematically in the symmetry of the 2DES confinement potential and the distance between the 2DES and the sample surface. Tilted field magneto-transport measurements are used to observe the stripe phases and to assess the strength of the native symmetry-breaking field. We find that the stripes remain oriented in the same way in all our samples. Furthermore, our measurements show that the strength of the orienting potential does not depend on the distance to the sample surface but does exhibit an intriguing dependence on the symmetry of the 2DES confinement potential. We discuss these results in the light of recent suggestions that strain and/or spin-orbit effects may determine the stripe orientation.

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