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The role of MBE in observing coherence in a quantum Hall interferometer

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The integer Quantum Hall Effect was discovered in 1980 in Silicon MOSFETs. Two years later the Fractional Quantum Hall Effect was discovered in GaAs-AlGaAs heterostructures. Now, recent experiments[1] suggest the existence of a third Quantum Hall variety, the Quantum Hall Effect of Quasiparticles obeying Non-abelian Statistics. This apparent discovery of non-abelian quasiparticles makes possible a potential application of the Quantum Hall Effect, that may lead to an elegant topological lock against decoherence of entangled quantum states, and thus would point the way toward building a quantum computer with built-in error correction. We will review how the sequential discoveries of the various levels of the Quantum Hall effect have depended on the gradually improving quality of the semiconductor samples, and how semiconductor perfection still limits current experiments that are exploring the properties of non-abelian quasiparticles.

[1]R. L. Willett, L. N. Pfeiffer, and K. W. West, "Alternating e/4 and e/2 period interference oscillations consistent with filling factor 5/2 non-abelian quasiparticles," arXiv:0911.0345.