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Electron-hole asymmetric fractional quantum Hall effect in bilayer graphene BEN FELDMAN, ANGELA KOU, ANDREI LEVIN, BERTRAND HALPERIN, Harvard University, KENJI WATANABE, TAKASHI TANIGUCHI, National Institute for Materials Science, Japan, AMIR YACOBY, Harvard University — At zero magnetic field, the electronic spectrum of bilayer graphene is electron-hole symmetric to first order. In a magnetic field, the lowest two orbital states occur at zero energy, and they combine with the spin and valley degrees of freedom to yield an eightfold degenerate lowest Landau level. Both external fields and electron-electron interactions can break these symmetries, leading to a uniquely rich and tunable phase diagram of many-body states. In this talk, I will present local electronic compressibility measurements of high quality bilayer graphene performed using a scanning single-electron transistor. We observe clear fractional quantum Hall states at filling factors ν = -10/3, -4/3, 2/3 and 8/3, with additional states appearing at ν = -17/5, -7/5, 3/5 and 13/5. Remarkably, this sequence breaks electron-hole symmetry and instead follows an even-odd pattern between integer quantum Hall states. Our results highlight the key role played by the orbital degree of freedom in the many-body physics of bilayer graphene.

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