Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Proliferation of upstream neutral modes in the fractional quantum Hall regime HIROYUKI INOUE, ANNA GRIVNIN, YUVAL RONEN, MOTY HEIBLUM, VLADIMIR UMANSKY, DIANA MAHALU, Braun Center for Submicron Research, Department of Condensed Matter Physics, Weizmann Institute of Science — The fractional quantum Hall effects (FQHE) are canonical examples of topological phases, resulting from correlations among planar electrons under strong perpendicular magnetic field. Chargeless energy transport, in the form of upstream (anti-chiral) neutral edge modes, were recently observed in the *hole-conjugate* FQHEs (filling ν of the n^{th} Landau level in the range $n+1/2>\nu>n+1$, with n =0, 1, 2) as well as ν =5/2. These modes had been predicted to appear due to edge reconstructions by Coulomb interaction and random tunneling among multiple channels. Here we report highly sensitive shot noise measurements that reveal, unexpected theoretically, the presence of such upstream neutral modes in *electron-like* FQHEs such as ν =1/3, 2/5, etc. Furthermore, we also found neutral bulk modes that propagate through the incompressible bulk; though weaker than the edge modes. The proliferation of such neutral modes detected only in FQHEs drastically changes the accepted picture of the transport therein. Moreover, our observation may shed new light on a source of decoherence, which prevented thus far a definite observation of quantum interference of fractional quasiparticles.

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Date submitted: 13 Nov 2013 Electronic form version 1.4