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Magnetic Flux Quanta (Fluxons) as Elementary Fermions
SHEGEJI FUJITA, YUNUS KUMEK, LUBNA PEERZADA, University@Buffalo, SUNY, SALVADOR GODOY, UNAM, Mexico — The electric (magnetic) field is a vector (pseudo- vector). The quanta for the electric (magnetic) fields are called the photons (fluxons). The photons can be created or annihilated, and hence they are bosons. The magnetic flux lines cannot terminate at sinks, and hence the corresponding fluxons are fermionic. The basic particle property (count- ability) of the fluxons is known as Onsager's flux quantization. We assume that the fluxons are half-spin fermions with no mass and no charge. In the presence of a magnetic field the classical electron spirals about the field. Quantum mechanically a transition from the momentum state at a zero field to the circulating Landau state at a finite field requires a perturbation. In a 2D solid such as GaAs/AlGaAs there are phonons arising from the longitudinal ionic-lattice vibrations. We assume the phonon exchange between the electron and the fluxons for the perturbation. The composite (c-) particle made of an electron and Q fluxons moves as a boson (fermion) if Q is odd (even). The quantum Hall effect can be interpreted as a manifestation of the condensation of the c-bosons. The plateau in the Hall resistivity with zero resistance is viewed as the Meissner effect.

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