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Origin of composite particle "mass" in the fractional quantum Hall effect[1] F.D.M. HALDANE, Princeton University — Composite particles in a partially-filled 2D Landau level are formed by "flux attachment" of q empty orbitals to p particles to form either a "composite boson" or a "composite fermion". The geometry of "flux attachment" (the shape of the q-orbital correlation hole that contains the p particles) is the principal degree of freedom of the composite particle, and can adjust to the local environment. An additional independent degree of freedom is the electric polarization of the composite particle by deformation of its inversion-symmetric charge profile to produce an electric dipole moment. In a magnetic field, the momentum is the magnetic flux density B times the electric dipole, rotated through 90 degrees. The energy increase of the composite boson as a function of its electric dipole moment is thus also its dispersion as a function of momentum. This then gives the quadratic dispersion that defines the analog of inertial "mass" of the composite particle. This gives both the stiffness constant of the Ginzburg-Landau term in the FQHE composite boson picture, and the dispersion of composite fermions in the $\nu = 1/2$ composite Fermi liquid state.

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