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Geometry of the fractional quantum Hall effect[1] F.D.M. HALDANE, Princeton University — Unlike the integer effect, the incompressible electron fluid that exhibits the fractional effect is *not* invariant under "area-preserving diffeomorphisms" of the guiding-center degrees of freedom. Instead (F. D. M. Haldane, Phys. Rev. Lett. 108, 116801 (2011)), it has a shear modulus that characterizes the energy cost of distortions of the correlation hole around the electrons, and a "guiding-center metric tensor" that exhibits quantum zero-point fluctuations around a preferred shape. In a simple (one-component) fluid, electronic charge-density fluctuations relative to the background set by the magnetic flux density are given by $\delta\rho = (e^*/2\pi)\bar{s}K$, where e^* is the elementary fractional charge, $\bar{s}$ is an integer or half-integer "guiding-center spin" that is topologically quantized by the Gauss-Bonnet theorem, and K is the local Gaussian curvature of the guiding-center metric. These results provide a simple explanation of the seminal 1985 results of Girvin, MacDonald and Platzman on the FQH structure factor and collective mode, which remained unexplained in previous proposed narrative explanations of FQH incompressibility (Ginzburg-Landau Chern-Simons theory, composite fermions, and non-commutative Chern-Simons field theory).

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