Abstract Submitted
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**Anomalous Hall effect and the "quantum geometry" of the Fermi surface of metals in Fermi liquid theory.**[1] F.D.M. HALDANE, Princeton University — The "anomalous Hall effect" in ferromagnetic metals was recently found to be a previously-unrecognized fundamental Fermi liquid property (FDMH, Phys. Rev. Lett. **96**, 203602 (2004)), arising from the Berry curvature of the quasiparticle Bloch state at the Fermi surface, when time-reversal symmetry is broken. This turns out to be a fundamental property of metallic Fermi liquids that survives the "switching on" of interactions, protected by Ward identities. The Fermi surface is not just a 2-manifold embedded in k-space, but also a 2-manifold embedded in the Hilbert space describing the periodic factor in the quasiparticle Bloch state. Both embeddings induce geometry: the second embedding not only induces a U(1) or SU(2) gauge (Berry) connection, but also a second Riemannian structure. The new realization that the periodic Bloch factor (plus the spin state) induces an extra "quantum geometry" of the Fermi surface points towards a new topological description of Fermi liquid theory. Explicit formulas for the anomalous Hall conductivity, Drude tensor, and other properties of arbitary-shape Fermi surfaces will be reviewed. Separate adiabatic conservation laws are associated with each distinct Fermi surface manifold: this generalizes the separate conservation laws at each Fermi point in 1D Luttinger liquids.

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