Abstract Submitted
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Cancellation of intrinsic "spin-Hall" conductivity in absence of broken time-reversal symmetry[1] ALEXANDER BAYTIN, F.D.M. HALDANE, Princeton Univ. — A Streda-type argument is used to obtain the intrinsic dissipationless "spin-Hall" conductivity of electronic systems with spin-orbit coupling (SOC). Instead of directly calculating the "spin-current" response to an electric field, we calculate the *spin-density* response to a magnetic flux density B (from orbital, rather than Zeeman coupling), and transform to a moving frame in which an electric field is present. This is consistent when used to compute the "anomalous" and "quantized" (electrical) Hall conductivities, and appears to also be so for the "spin-Hall" conductivity: the induced "spin-current" in the moving frame is interpreted as the induced spin density in the static frame, times the boost velocity. In the 2D model with "Rashba" spin-orbit coupling, the spin density induced by linear response to B is cancelled by an "anomalous" term from the lowest Landau level, which is "special" because it alone is spin-unpaired. Similar unpaired "special" Landau levels also occur in the 3D "Luttinger" model for SOC of holes in p-type semiconductors. We also argue that a *quantized* spin-Hall effect cannot occur in the absence of broken time-reversal symmetry, and conjecture that this is also true for the metallic (non-quantized) spin-Hall effect.

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