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Hall coefficient signals orbital differentiation in the Hund's metal Sr_2RuO_4

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The Hall coefficient R_H of Sr_2RuO_4 exhibits a non-monotonic temperature dependence with two sign reversals. We show that this puzzling behavior is the signature of two crossovers, which are key to the physics of this material. The increase of RH and the first sign change upon cooling are associated with a crossover into a regime of coherent quasiparticles with strong orbital differentiation of the inelastic scattering rates. The eventual decrease and the second sign change at lower temperature are driven by the crossover from inelastic to impurity-dominated scattering. This qualitative picture is supported by quantitative calculations of $R_H(T)$ using the Boltzmann transport theory in combination with dynamical mean-field theory, taking into account the effect of spin–orbit coupling. Our insights shed new light on the temperature dependence of the Hall coefficient in materials with strong orbital differentiation, as observed in Hund's metals.

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