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Is The Intrinsic Spin Hall Effect Measurable? ZHAOYANG YANG, SHUFENG ZHANG, University of Missouri-Columbia — Despite of the large intrinsic spin Hall conductivity in a spin- orbit coupled material predicted theoretically, we show that the intrinsic spin Hall effect in any diffusive sample is not measurable via conventional transport methods, thus the research on the intrinsic spin Hall effect is limited at the pure theoretical content. After generally defining the intrinsic and extrinsic transport coefficients, we show that the intrinsic magnetization Hall current, which is the sum of the intrinsic spin and intrinsic orbit-angular-momentum Hall currents, is identically zero. More importantly, we demonstrate that the equation of motion for the spin density does not depend on the intrinsic spin Hall current, therefore the transverse spin accumulation is solely determined by the extrinsic spin Hall current. The zero intrinsic magnetization Hall current and the independence of the spin accumulation on the intrinsic spin Hall effect lead us to conclude that the intrinsic spin Hall effect can not be assessed by conventional spin transport experiments based on the measurement of the magnetization current and the spin accumulation at the edge of the sample.

Zhaoyang Yang
Department of Physics and Astronomy, University of Missouri-Columbia

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