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Chirality of symmetry broken spin-orbit systems KYOUNG-WHAN KIM, HYUN-WOO LEE, Pohang Univ of Sci & Tech, KYUNG-JIN LEE, Korea University, MARK STILES, National Institute of Standards and Technology — Recently, structures consisting of an ultrathin magnetic layer adjacent to a heavy metal layer with strong atomic spin-orbit coupling have received a considerable attention. Their unexpected behavior not only stimulates scientific interest but also makes them promising candidates for spintronic devices. Strong spin-orbit coupling of two kinds, bulk spin Hall effect and interfacial spin-orbit coupling, play important roles on magnetization dynamics. In this work, we propose a unified theory of magnetic systems with interfacial spin-orbit coupling up to linear order starting from a two dimensional Rashba model which includes structural inversion symmetry breaking and time reversal symmetry breaking. The combination of both broken symmetries makes the system chiral. In our theory, conventional terms in the equation of motion each give rise to a linear chiral effect; this relationship is captured by replacing the usual spatial derivative with a chiral derivative. Introducing the chiral derivative not only captures previously reported results but also reveals previously unreported chiral aspects of the Rashba model such as the Dzyaloshinskii-Moriya interaction. It also clarifies the one-to-one correspondence between interfacial spin-orbit effects and conventional effects without spin-orbit coupling.

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