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Multi-orbital induced effective Rashba spin texture - the inequivalent contribution MING-CHIEN HSU, LIANG-ZI YAO, SENG GHEE TAN, MANSOOR B. A. JALIL, GENGCHIAU LIANG, Dept. Electrical Computer Engineering, Nat'l Uni. of Singapore — Many important methods controlling spin in solids have been realized by Rashba effect inheriting from the interaction between spin and orbitals. However, it is usually discussed on the spin part only, while there may be increasing need to understand the role of orbitals in fields like orbitronics and spin orbit torque. Recently it was demonstrated that the orbital angular momentum texture is the basis resulting in Rashba spin texture. To better understand how various quantities influence the spin texture, the effective Rashba splitting in multi-orbital systems is re-investigated. For systems with p orbitals, two pairs of Rashba splitting with opposite signs emerge and the last one remains near degenerate, consistent with previous works. However, it is found that the amplitudes of two pairs of Rashba texture differ, not as claimed to be equal previously. This explains why usually only one significant spin splitting was observed, obscuring the discovery of orbital contributions. Both the analytical derivation and ab initio simulation show consistent results. Physical parameters like the spin-orbit coupling strength, the inversion asymmetry, and the crystal field are tuned to see how all pairs of spin texture change, demonstrating ways to control them more diversely in the future.

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