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Quasi-Rashba Dispersion in Buckled Square Lattices

Intrinsic spin-orbit coupling in honey-comb two-dimensional materials generally leads to either band splitting, as in transition metal dichalcogenides, or to a gap opening at the K point of the Brillouin zone, as in silicene. In buckled square lattices, the effects of the spin-orbit interaction are quite different. Instead of a gap opening at the corner of the BZ, one obtains a Rashba-like dispersion even in the absence of an external electric field [1]. Moreover, the quasi-Rashba bands are found in mono-elemental and bi-elemental lattices. The magnitude of the splitting depends on the atomic spin-orbit coupling and can reach hundreds of meV for sufficiently heavy elements. In the case of bi-elemental lattices, the quasi-Rashba bands also possess the familiar chiral spin texture[2]. The robustness of this effect, as well as its existence in the absence of external fields makes these materials excellent candidates for spintronic applications.

References

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2. P. Z. Hanakata, A. S. Rodin, A. Carvalho, H. S. Park, D. K. Campbell, A. H. Castro Neto, “Two-dimensional Buckled Rashba Lead Chalcogenides with Tunable Spin Texture and Dirac Cones”, Submitted to PRL

Figures

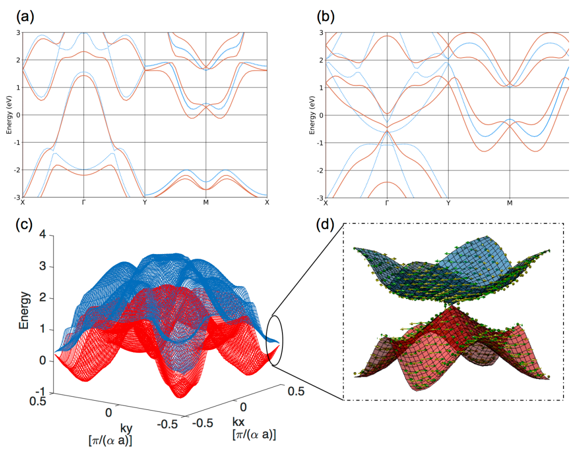

Figure 1: Band structures of Pb (a) and Bi (b). Fermi energy is set to be zero. Red lines indicate when spin-orbit interaction is included. (c) Energy surface over Brillouin zone of Pb monolayer and (d) its Dirac cone at M with spin texture.