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Magnetoanisotropic Josephson effect in superconductor/ferromagnet/superconductor (S/F/S) junctions[1] ANDREAS COSTA, PETRA HOEGL, JAROSLAV FABIAN, University of Regensburg — Heterostructures combining two nominally antagonistic states—superconductivity and ferromagnetism—are promising systems for future spintronic devices. Perhaps most striking in S/F/S Josephson junctions is the existence of π-states, in which an additional π-shift to the superconducting phase difference reverses the Josephson current flow compared to the usual (0-) state. Due to structure inversion asymmetry, interfacial spin-orbit fields invariably emerge in heterojunctions. By performing numerical calculations on S/F/S model junctions in the presence of interfacial Rashba and Dresselhaus spin-orbit fields, we study the unique signatures of the interplay of ferromagnetism and the spin-orbit fields in the Josephson current flow.[2] We find that the Rashba fields can not only significantly enhance the Josephson current, but even induce transitions from 0- to π-states. As a clear indication for the spin-orbit fields, we predict marked magnetoanisotropies in the Josephson current. These anisotropies are huge compared to tunneling anisotropic magnetoresistance in normal-state junctions, particularly close to 0-π transitions. Finally, we show that 0-π transitions can also be manipulated by solely rotating the magnetization in the F layer.

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[2]arXiv:1608.01218

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