Asymmetric Josephson effect at the interface of non-centrosymmetric superconductors

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We calculate the Andreev bound states and the corresponding Josephson current for an asymmetric 2-dimensional Josephson junction by solving Bogoliubov-de-Gennes equations. The junction consists of a non-centrosymmetric superconductor (NCS) separated by a tunnel barrier with variable height to a conventional s-wave superconductor. In addition to the antisymmetric spin-orbit coupling in the NCS on the one side, this asymmetric junction gives rise to a Rashba spin-orbit coupling at the interface. We explore the rich parameter space and recover various limiting cases such as s-wave/p-wave junction and the recently studied asymmetric s-wave junctions. In addition, we report a transition from a 0-junction to a $\pi/2$-junction with increasing triplet-singlet pairing ratio of the NCS, which serves as a novel mechanism to determine the unknown ratio in a variety of NCS's.