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Impurity-induced bound states in superconductors with spin-orbit coupling[1] YOUNGHYUN KIM, University of California - Santa Barbara, JUNHUA ZHANG, E. ROSSI, College of William and Mary, ROMAN LUTCHYN, Microsoft Research Station Q — We study the effect of strong spin-orbit coupling on bound states induced by impurities in superconductors. The presence of spin-orbit coupling breaks the $SU(2)$-spin symmetry and causes the superconducting order parameter to have generically both singlet (s-wave) and triplet (p-wave) components. As a result, impurity-induced bound states corresponding to different angular momentum channels hybridize and display a number of qualitatively different features from that of the well-known Yu-Shiba-Rusinov states in conventional s-wave superconductors. In particular, we find that in the presence of spin-orbit coupling the spectrum of the impurity-induced bound states depends on the orientation of the magnetic moment of the impurity. Our predictions can be used to distinguish the symmetry of the order parameter and have implications for the Majorana proposals based on chains of magnetic atoms placed on the surface of superconductors with strong spin-orbit coupling [1].

[1] S. Nadj-Perge, I. K. Drozdov, J. Li, H. Chen, S. Jeon, J. Seo, A. H. MacDonald, B. A. Bernevig, Ali Yazdani, Science 346, 602 (2014).

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