# Unconventional superconductivity from magnetism in transition metal dichalcogenides

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**Abstract**

Understanding possible mechanisms for the coexistence and interplay of superconductivity with magnetism has been one of the most long-standing and intensely studied questions in condensed-matter physics [1]. We investigate proximity-induced superconductivity in monolayers of transition metal dichalcogenides (TMDs) that are tunnel-coupled to a conventional singlet s-wave superconductor and subject to an external exchange field generated by a ferromagnetic substrate or an applied magnetic field [2]. A variety of superconducting order parameters is found to emerge from the interplay of magnetism and superconductivity, covering the entire spectrum of possibilities to be symmetric or antisymmetric with respect to the valley and spin degrees of freedom, as well as even or odd in frequency. As a key finding, we reveal the existence of an exotic even-frequency triplet pairing between equal-spin electrons from different valleys, which arises whenever the spin orientations in the two valleys are noncollinear. The opposite-spin-pairing component of this exotic superconducting correlation is a realization of the previously discussed phenomenon of Ising superconductivity. Among the different order parameters, we also identify the existence of induced intra-valley pairings, which are particular instances of the generic pair-density-wave order associated with Cooper pairing at finite momentum. Finally, all types of induced superconducting order parameters turn out to be tunable via manipulations of the external exchange field. [1] L. N. Bulaevskii, A. I. Buzdin, M. L. Kulic , and S. V. Panjukov, Adv. Phys. 34, 175 (1985).

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