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Two Dimensional Ising Superconductivity in Gated MoS NOAH YUAN, Hong Kong Univ of Sci Tech, JIANMING LU, Zernike Institute for Advanced Materials, KAM TUEN LAW, Hong Kong Univ of Sci Tech, OLEKSANDR ZHELIUK, Zernike Institute for Advanced Materials, INGE LEERMAKERS, ULRICH ZEITLER, Radboud University, JIANTING YE, Zernike Institute for Advanced Materials — The Zeeman effect, which is usually considered to be detrimental to superconductivity, can surprisingly protect the superconducting states created by gating a layered transition metal dichalcogenide. This effective Zeeman field, which is originated from intrinsic spin orbit coupling induced by breaking in-plane inversion symmetry, can reach nearly a hundred Tesla in magnitude. It strongly pins the spin orientation of the electrons to the out-of-plane directions and protects the superconductivity from being destroyed by an in-plane external magnetic field. In magnetotransport experiments of ionic-gate MoS_2 transistors, where gating prepares individual superconducting state with different carrier doping, we indeed observe a spin-protected superconductivity by measuring an in-plane critical field B_{c2} far beyond the Pauli paramagnetic limit. The gating-enhanced B_{c2} is more than an order of magnitude larger compared to the bulk superconducting phases where the effective Zeeman field is weakened by interlayer coupling. Our study gives the first experimental evidence of an Ising superconductor, in which spins of the pairing electrons are strongly pinned by an effective Zeeman field.

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