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Ferromagnetism in platinum induced by field effect gating using paramagnetic ionic liquid LEI LIANG, QIHONG CHEN, JIANMING LU, WYTSE TALSMA, JUAN SHAN, GRAEME BLAKE, THOMAS PALSTRA, JIANTING YE, Zernike Institute for Advanced Materials, University of Groningen — Field induced and controlled magnetism has attracted growing interest in spintronics, which requires the field effect manipulation of both charge and spin degrees of freedom. In this work, we report the reversible field effect switching of ferromagnetic states in a platinum (Pt) thin film by applying only a few volts. This highly effective control of ferromagnetic state is based on ionic gating using paramagnetic ionic liquids (MIL), a group of ionic media containing magnetic anions especially developed for gating in spintronics. Because of the magnetic anion, the field effect control of the ion transport in the MILs associates the ion movement with both electric charges and magnetic moments, which leads to emergent ferromagnetism with large coercivity in the Pt film with perpendicular anisotropy. While the induced itinerant ferromagnetic state extends to room temperature, a co-existing Kondo effect at low temperature sheds light on understanding the itinerant-localized duality of the gate-induced carriers. The present result reveals that MIL gating can serve as a versatile and highly efficient protocol to control electric and magnetic properties simultaneously, which is promising for the spintronics.

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