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Spin gated transistors for reprogrammable logic CHIARA CICCARELLI, University of Cambridge, FERNANDO GONZALEZ-ZALBA, Hitachi Cambridge Laboratory, ANDREW IRVINE, University of Cambridge, RICHARD CAMPION, University of Nottingham, LIVIU ZARBO, Institute of Physics ASCR, BRIAN GALLAGHER, University of Nottingham, ANDREW FERGUSON, University of Cambridge, TOMAS JUNGWIRTH, Institute of Physics ASCR, JOERG WUNDERLICH, Hitachi Cambridge Laboratory, HITACHI CAMBRIDGE LABORATORY TEAM, INSTITUTE OF PHYSICS ASCR COLLABORATION, UNIVERSITY OF NOTTINGHAM COLLABORATION, UNIVERSITY OF CAMBRIDGE TEAM — In spin-orbit coupled magnetic materials the chemical potential depends on the orientation of the magnetisation [1,2]. By making the gate of a field effect transistor magnetic, it is possible to tune the channel conductance not only electrically but also magnetically. We show that these magnetic transistor can be used to realise non-volatile reprogrammable Boolean logic. The non-volatile reconfigurable capability resides in the magnetization-dependent band structure of the magnetic stack. A change in magnetization orientation produces a change in the electrochemical potential, which induces a charge accumulation in the correspondent gate electrode. This is readily sensed by a field-effect device such as standard field-effect transistors or more exotic single-electron transistors. We propose circuits for low power consumption applications that can be magnetically switched between NAND and OR logic functions and between NOR and AND logic functions. [1] J. Wunderlich et al., PRL 97, 077201 (2006) [2] C. Ciccarelli, et al., Appl. Phys. Lett. 101, 122411(2012)

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