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Electric field control of spins in a silicon two-dimensional electron gas. R. JANSEN, B.C. MIN, S. P. DASH, R. S. PATEL, M. P. DE JONG, University of Twente, MESA+ Institute for Nanotechnology, The Netherlands — A key objective in the development of semiconductor spintronics is the active control of spins in semiconductors. The manipulation by electric rather than magnetic fields is preferred as this is more efficient for nanoscale high frequency devices. Proposals for electric spin control, for example for use in a spin transistor, have so far focused on mechanisms that require spin-orbit interaction. Unfortunately, in silicon, the mainstream semiconductor, the weak spin-orbit interaction renders these mechanisms unsuited. Hence, alternative approaches are paramount to the success of semiconductor spintronics. Here we demonstrate spin control by electric fields in a silicon two-dimensional electron gas (2DEG), exploiting the discrete electronic structure of the 2DEG. This, in combination with an electric field, allows spin manipulation without the need for spin-orbit interaction. The spin control is manifested as resonances in the tunnel magnetoresistance between the Si 2DEG and a ferromagnetic tunnel contact, with amplitude of up to 8%.

Ron Jansen
University of Twente, MESA+ Institute for Nanotechnology

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