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Reconfigurable magnetic logic combined with non-volatile memory in silicon. ZHAOCHU LUO, XIAOZHONG ZHANG, Tsinghua Univ — Silicon-based complementary metal-oxide-semiconductor (CMOS) transistors have achieved great success and become the mainstream of integrated logic circuits. However, the traditional pathway to enhance computational performance and decrease cost by continuous miniaturization is approaching its fundamental limits. The recent emergence of magnetic logic devices, especially magnetic-field-based semiconductor logic devices, shows promise for surpassing the development limits of CMOS logic and arouses profound attentions. Based on our Si based magnetoresistance (MR) device [1], we proposed a Si based reconfigurable magnetic logic device by coupling nonlinear transport effect and Hall effect in Si [2], which could do all four basic Boolean logic operations including AND, OR, NOR and NAND combined with non-volatile memory. Further, we developed a Si based current-mode magnetic logic device, which allowed direct communication between different logic devices by current-induced magnetization switch effect without external intermediate magnetic-electric converters. This may result in a memory-logic integrated system leading to a non von Neumann computer. [1] CH Wan, et al, Nature 477, 304, (2011). [2] ZC Luo et al. Adv. Funct. Mater. 25, 158, (2015)..

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