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Extremely large magnetoresistance and magnetic logic by coupling semiconductor nonlinear transport effect and anomalous Hall Effect. XIAOZHONG ZHANG, ZHAOCHU LUO, Tsinghua University — Size limitation of silicon FET hinders the further scaling down of silicon based CPU. To solve this problem, spin based magnetic logic devices were proposed but almost all of them could not be realized experimentally except for NOT logic operation. A magnetic field controlled reconfigurable semiconductor logic using InSb was reported. However, InSb is very expensive and not compatible with the silicon technology. Based on our Si based magnetoresistance (MR) device [1], we developed a Si based reconfigurable magnetic logic device [2], which could do all four Boolean logic operations including AND, OR, NOR and NAND. By coupling nonlinear transport effect of semiconductor and anomalous Hall effect of magnetic material, we propose a PMA material based MR device with a remarkable non local MR of >20000 % at ˜1 mT. Based on this MR device, we further developed a PMA material based magnetic logic device which could do all four Boolean logic operations. This makes it possible that magnetic material does both memory and logic. 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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