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Magnetic phase transitions driven by non-equilibrium spins and their potential applications to magnetic cooling LUTFE SIDDIQUI, ABU NASER ZAINUDDIN, SUPRIYO DATTA, School of Electrical and Computer Engineering, Purdue University — It is well-known that the Curie temperature in diluted magnetic semiconductors (DMS) like GaMnAs can be controlled by changing the equilibrium density of holes in the material. In this letter we predict,that even with a constant hole density, large changes in the magnetization can be obtained with a relatively small imbalance in the spin population. We show, by coupling mean field theory of diluted magnetic semiconductor ferromagnetism with master equations governing the Mn spin-dynamics, that a splitting of the up-spin and down-spin quasi-Fermi level in the channel by 0.1meV have the same effect as an external magnetic field of 1 T. Experimentally, it has been shown that splitting of the quasi-Fermi level for the two spins by 0.1meV can be conveniently obtained in the channel region of a lateral spin-valve structure with anti-parallel contacts, which can be used to demonstrate the effect we are proposing. Such an effect could also form the basis for a novel class of cooling devices where the electrical input to a spin-valve leads to ferromagnetic ordering of Mn ions which then demagnetize by absorbing energy from the environment.

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