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Electrical manipulation of non-volatile spin cell based on diluted magnetic semiconductor quantum dots KI WOOK KIM, North Carolina State University — Electrical manipulation of a memory cell based on a semiconductor nanostructure consisting of a diluted magnetic semiconductor quantum dot (QD) and a reservoir of itinerant holes separated by an energy barrier is investigated theoretically. The operating principle takes advantage of the paramagnetic-ferromagnetic phase transition mediated by the itinerant holes in the diluted magnetic semiconductor QD that can lead to electrically controlled Write/Erase operations. Non-volatility can be achieved when the structure is properly designed to reach a thermodynamic equilibrium at both the PM and FM configurations (i.e., bistability). Assuming a parabolic confining potential in the QD, the performance characteristics of the proposed nanostructure are analyzed including the scalability and the lifetime. An advantage of this memory concept is the extremely small dissipative energy for Write/Erase functions due to the open circuit nature of the process. A readout scheme enabling electrical detection with the repetition rate up to the 10 - 100 MHz range is also explored by utilizing only two contacts.

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