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All Spin Digital Circuits BEHTASH BEHIN-AEIN, Purdue University / NSF Network for Computational Nanotechnology (NCN), DEEPANJAN DATTA, Purdue University, SAYEEF SALAHUDDIN, UC Berkeley, SUPRIYO DATTA, Purdue University — Switching of a magnetic free layer using spin polarized current has been demonstrated in Magnetic Tunnel Junction (MTJ) devices. Currently MTJ's are being studied for memory and microwave oscillator applications. The purpose of this talk is to explore a modified MTJ where a clock pulse via the fixed layer facilities the switching of the free layer in accordance with a weak bias provided by an input magnet in the form of a spin current. Based on the Landau-Lifshitz-Gilbert equation (LLG) augmented with spin torque functions, we show the switching energy and the switching time of the free layer which indicates the possibility of very low power digital logic applications. Ordinary digital circuits store information in the form of capacitor charges that communicate through electrical interconnects. The purpose of this paper is to show that modified MTJ's can be the basis for all spin digital circuits. Our primary objective is to stimulate proof of concept experiments that could usher in a whole new set of devices suitable for spintronic circuits.

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