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Mechanisms of Spin Torque Driven Ballistic Precessional Switching OUKJAE LEE, VLAD PRIBIAG, PRAVEEN GOWTHAM, TAKA MORIYAMA, DAN RALPH, ROBERT BUHRMAN, Cornell University, CORNELL UNIVERSITY TEAM — Spin-torque-driven ballistic precessional switching is a very fast and energy-efficient write operation in which the magnetization of a nanomagnet rotates from one stable state to the other without any preceding small-angle oscillation. This reversal scheme can be implemented with a non-collinear spin-valve device incorporating both a perpendicular polarizer to quickly excite a free layer and an in-plane analyzer to read its state via the GMR effect. Recent experiments utilizing such devices have shown significantly higher reversal speeds and a much narrower distribution of reversal probability with current, in comparison to conventional collinear devices. More interestingly, there was a pronounced asymmetry in the threshold currents for reversal as function of both the initial state and pulse current direction. This asymmetry can provide a way of achieving the desired state with a simple unipolar pulse current. We will discuss the details of the short-pulse reversal behavior, the physical origins of the asymmetry and the optimization of this structure for high-speed magnetic memory.

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