SPIN TRANSFER TORQUE AND THERMALLY ASSISTED FERROMAGNETIC RESONANCE IN MAGNETIC TUNNEL JUNCTIONS

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The observation of steady magnetization excitations induced by spin transfer torque has been reported by several groups in magnetic nanostructures traversed by a spin-polarized current of sufficient density. Here we show that far below this precessional critical current density, spin torque impacts also magnetization thermal fluctuations. Voltage noise measurements on magnetic tunnel junctions show that thermal fluctuations of the magnetization are either amplified or quenched by sub-critical spin transfer torque depending on the current direction. We present an analytical model that describes the dependence of the thermally assisted ferromagnetic resonance with the bias current. The evolution of the peak amplitude and linewidth with the applied current is directly related to the longitudinal torque whereas the shift of the resonance frequency is sensitive to the transverse torque. Both spin torque terms are independently extracted from the measured noise spectra. Our results support the prediction of a critical voltage instead of a critical current in magnetic tunnel junctions.