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Spin dependent tunneling and possible spin torque effects in magnetic nanoparticle tunnel junctions CHEN WANG, HSIN-WEI TSENG, ROBERT A. BUHRMAN, DANIEL C. RALPH, Cornell University — It has been predicted that electron tunneling between two magnetic electrodes via a magnetic nanoparticle can exhibit enhanced magnetoresistance at low temperature due to a coherent tunneling mechanism in the Coulomb blockade regime. This has been qualitatively demonstrated for large ensembles of nanoparticles. It has also been predicted that the tunneling current in such a system might exert spin transfer torque with quantum behaviors associated with the discrete energy level of the nanoparticles. Here we report the fabrication and measurement of sub-100 nm nano-pillar tunnel junctions with the layer structure CoFeB/MgO/(CoFeB nanoparticles)/MgO/CoFeB with the dual goal of 1) probing the spin-dependent coherent tunneling associated with the magnetization of a single or very few nanoparticles and 2) exploring the potential for magnetization switching and current-driven dynamics in the nanoparticles induced by spin transfer torque.

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