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Spin-Torque Ferromagnetic Resonance Spectroscopy of Permalloy Nanowires CARL BOONE, JORDAN KATINE, JEFF CHILDRESS, JIAN ZHU, XIAO CHENG, ILYA KRIVOROTOV, KRIVOROTOV GROUP COLLABORATION, HITACHI GLOBAL STORAGE COLLABORATION — We develop a technique for studies of spectral properties of spin waves excited by spin transfer torque in metallic ferromagnetic nanowires, and apply this technique to measure frequencies and damping constants of several low-energy quantized spin wave modes in permalloy nanowires of rectangular cross section. Our measurements demonstrate that the spin wave spectrum of nanowires as narrow as 100 nm is well described by an analytic theory of dipole-exchange spin waves in thin ferromagnetic strips. Geometric quantization of the spin wave spectrum in nanowires significantly reduces the phase space for magnon-magnon scattering leading to opening and closing of discrete scattering channels as a function of magnetic field. These scattering channels manifest themselves as peaks in plots of spin wave damping versus magnetic field. In particular, we observe damping enhancement of the lowest energy spin wave mode at the values of magnetic field corresponding to three-magnon confluence processes in which two lowest energy magnons merge into a single higher-energy mode magnon.

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