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Thermal noise model of antiferromagnetic dynamics: A macroscopic approach¹ XILAI LI, YURIY SEMENOV, KI WOOK KIM, North Carolina State Univ — In the search for post-silicon technologies, antiferromagnetic (AFM) spintronics is receiving widespread attention. Due to faster dynamics when compared with its ferromagnetic counterpart, AFM enables ultra-fast magnetization switching and THz oscillations. A crucial factor that affects the stability of antiferromagnetic dynamics is the thermal fluctuation, rarely considered in AFM research. Here, we derive from theory both stochastic dynamic equations for the macroscopic AFM Neel vector (L-vector) and the corresponding Fokker-Plank equation for the L-vector distribution function. For the dynamic equation approach, thermal noise is modeled by a stochastic fluctuating magnetic field that affects the AFM dynamics. The field is correlated within the correlation time and the amplitude is derived from the energy dissipation theory. For the distribution function approach, the inertial behavior of AFM dynamics forces consideration of the generalized space, including both coordinates and velocities. Finally, applying the proposed thermal noise model, we analyze a particular case of L-vector reversal of AFM nanoparticles by voltage controlled perpendicular magnetic anisotropy (PMA) with a tailored pulse width.

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