Direct and multistage spin reversal in chains of magnetic nanoparticles

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Magnetic systems exhibiting well-defined sequences of stable states are useful in design of memory storage devices. We have studied the switching of magnetization in linearly arranged particles of different shapes under variations of the magnetic field (applied perpendicular to the chains). Several approximations appropriate for macrospins have been employed: from an extended Stoner-Wohfarth model by a 1D model of magnetic threads to the extensive micromagnetic calculations reflecting the actual shape of the particle [1, 2, 3, 4, 5]. A qualitative difference in behavior of infinite and finite chains has been observed. Whereas the infinite chains tend to switch the magnetization in a direct one-step manner, chains of finite number of particles turn out to exhibit a sequence of macrospin reversals giving rise to several intermediate configurations of well-defined magnetisations. Some of the reversal sequences turn out repeatable that make them promising models for many-stage memory elements.

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