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Topic: Non-equilibrium Statistical Physics Preference: Poster

Dynamic phase transition properties and hysteretic behavior of a ferrimagnetic core/shell nanoparticle in the presence of a time dependent perturbation

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In recent years, influences of small-size and surface effects on the magnetic properties of magnetic nanoparticles have provided a conspicuous and productive field for the interaction between theoretical works [1] and technological [2], as well as biomedical applications [3, 4]. As the physical size of a magnetic system reduces to a characteristic length, surface effects become dominant on the system, hence, some unusual and interesting magnetic phenomena can be observed, which may differ from those of bulk materials [5]. It is a well known fact that physical properties of a bulk material are independent from size; however, below a critical size, nanoparticles often exhibit size-dependent properties, and some unique phenomena have been reported, such as superparamagnetism [6, 7], quantum tunneling of the magnetization [8], and unusual large coercivities [9]. On the other hand, a magnetic system exhibits nonequilibrium phase transition properties in the presence of a driving magnetic field. Namely, when a magnetic material is subject to a periodically varying time dependent magnetic field, the system may not respond to the external magnetic field instantaneously which causes interesting behaviors due to the competing time scales of the relaxation behavior of the system and periodic external magnetic field.

Nonequilibrium DPT properties of small magnetic systems needs particular attention and the following questions need to be answered: (i) What is the effect of the amplitude and frequency of the oscillating magnetic field on the dynamic phase transition properties (i.e. critical and compensation temperatures) of the nanoparticle systems? (ii) What kind of physical relationships exist between the magneto-optical properties (compensation point and coercivity) of the particle and the system size? In order to clarify these questions we present some results regarding the dynamic phase transition features and stationary-state behavior of a ferrimagnetic small nanoparticle system with a core-shell structure.

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