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Some questions that appears when doing experiments with magnetic nanostructures

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In this talk we will present some topics of our experimental research on magnetic nanostructures. We will present the quest for understanding interacting cluster glass or superferromagnetism states; and giant magnetoresistance and electric transport in graphene-based nanoheterostructures. The first situation happens when a dispersion of magnetic nanoparticles is immersed in a non-magnetic medium. When concentration of these nanoparticles is low, meaning that each one are far from the others, the phenomenon called superparamagnetism takes place. If nanoparticle concentration increases, dipolar interaction takes place. Some models where developed to address the issue, but they fail when nanoparticle concentration is higher. For that situation, the observed magnetic behavior is called interacting cluster glass or superferromagnetism. There are not reliable models to explain the observed features.

The second situation that requires a theoretical explanation is observed in nanoheterostructures consisting of magnetic nanoparticles attached to reduced graphene oxide layers. At first, such a structure should display negative magnetoresistance at low temperatures and electric conduction that should follow a variable range hopping model. These behaviors where not observed in several measurements performed on this system.