

Short Course on Magnetic Nanoparticles in Fluids

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Although magnetic nanoparticles and their applications have been investigated for several decades, new preparations of these materials and novel applications make this topic quite relevant for current research. The goal of this short course (about 6-7 hours) is to review the physics of magnetic nanoparticles as well as to start discussion of some of the current applications that may be of interest. An approximate outline for the presentation of this material is given below:

1. Brief overview of the main types of magnetic materials used in nanoparticle preparations
2. Review of equilibrium thermodynamics of magnetic moment fluctuation, relaxation dynamics
3. Discussion magnetization dynamics (Landau-Gilbert equations)
4. Magnetic property measurement methodology
5. Particle interactions, magnetic and hydrodynamic
6. Description of particle movement in fluid and diffusion
7. Quick overview of some applications (hyperthermia, MRI contrast, magnetic particle imaging)
8. Discussion of separation technology and nanoparticle manipulations on patterned substrates, magnetoelastic materials and some applications