**Magnetic Nanoparticles (9:00 – 11:00)**

Davide Peddis, *Istituto Struttura della Materia (ISM), CNR*

ABSTRACT. A physical property depends on the size of an object, if its size is comparable to a dimension relevant to that property. In magnetism typical sizes – as for example the dimension of magnetic domains or lengths of exchange coupling interaction - are in the nanometer range. For this reason, starting some decades ago, great attention has been directed towards nanostructured magnetic materials (NMM) where constituent phase or grain structures are modulated on a length scale from 1 to 100 nm. In particular, among NMM, magnetic nanoparticles are unique complex physical objects whose physical properties differ greatly from their parent massive materials. After an introduction on the fundamental concept of nanoparticle’s magnetism, the correlation between crystalline structure, morphology and magnetic properties of MN relevant to several applications (ferrofluid technology, catalysts and biomedicine) will be discussed\(^1\-^3\).


\(^3\) L. Suber, and D. Peddis. in *Nanomater. Life Sci.* (Kumar, C. S. S. R.) 4, 431475 (Wiley, 2010).

**Thin film magnetism (11:30 – 13:30)**

Sara Laureti, *Istituto Struttura della Materia (ISM), CNR*

ABSTRACT. Magnetic thin films and multilayer heterostructures are the most extensively studied magnetic systems with nanoscopic dimensions. In addition to their interest in fundamental physics, magnetic thin films and heterostructures have been exploited for a number of different applications in particular in the fields of magnetic recording and spintronics. The research field has grown to such an extent in the last decades that only a general overview will be given in this lecture. After the introductory remarks, the preparation and characterization techniques, including also lithographic methods for the fabrication of laterally confined systems, will be presented, with a special emphasis given to physical deposition methods and magnetometry techniques. Next, the magnetic anisotropy, the magnetic domain
structure and some aspects related to the reversal mechanism will be covered. Finally, the properties of thin film heterostructures combining magnetic layers in direct contact (direct exchange coupling – exchange bias and exchange coupled systems –) or separated by a non-magnetic spacer (indirect exchange coupling – antiferromagnetically coupled systems, GMR effect) will be illustrated. Some examples of applications of thin films and heterostructures will be also illustrated across the entire lecture.

Magnetic recording (15:00 – 16:00)
Gaspare Varvaro, Istituto Struttura della Materia (ISM), CNR

ABSTRACT. The demand for digital storage devices is continuously growing in response to the extraordinary increase of the volume of data created worldwide, which would reach the value of 40 zettabytes ($10^{21}$ bytes) in 2020. Among the different storage devices currently available, Hard Disk Drives (HDDs), based on the magnetic recording technology, remain the most convenient (cost/GB 0.02 $) and diffusive devise (~400 millions of units sold in 2016) for massive digital data storage. Currently available HDDs using CoCrPt:SiO$_2$ granular thin films with perpendicular anisotropy as the recording medium are reaching their physical limit (~1 Tbit/in$^2$ density) and a further increase of the recording density towards and beyond 1 Tbit/in$^2$ requires new high anisotropy materials (e.g. L$_{10}$-FePtX alloy) as well as novel media and recording designs to simultaneously optimize thermal stability, write-ability and signal-to-noise ratio issues (the so-called magnetic recording trilemma)\. After a brief introduction on the history of magnetic recording, the current technologies and issues as well as the most promising technologies and materials for next generation HDDs will be illustrated.