

Title : Functional Antiferromagnets and their Encapsulation inside Carbon nanotubes

Antiferromagnets (AFM) are known to exhibit a number of functionalities which are not only intriguing from fundamental point of view but also important for applications based aspects. Weak ferromagnetism, for instance, in otherwise AFM is understood to arise from spin canting associated with the famous Dzyaloshinskii Moriya interaction (DMI). In the first part of the talk I will present remanence measurements conducted using SQUID magnetometry on a number of such DMI driven weak ferromagnets, which are also symmetry allowed piezomagnets. We consistently observe a unique remanence, which practically does not decay with time and exhibits a counter-intuitive magnetic field dependence. I will first establish the generality of the phenomenon by showing remanence data on a series of 3d transition metal based weak ferromagnets. I will also show how remanence in these systems is fundamentally different from the one typically observed in routine antiferromagnets, ferromagnets or spin glasses. In the second part of the talk, I will show that the magnitude of this unique remanence can be substantially enhanced by encapsulation inside carbon nanotubes (CNT). I will also show current (I) – voltage(V) characteristics on these filled CNT. Here the I-V data are recorded on individual CNT with in-situ Transmission Electron Microscopy Imaging. These data illustrate why encapsulation of such functional magnetic oxides inside carbon nanotubes is interesting and potentially useful - as this approach can provide some practical solutions for oxide-based electronics.