

# T<sub>c</sub>SUH Bi-Weekly Seminar

Texas Center for Superconductivity at the University of Houston

## Dr. Milko Iliev

Project Leader, Raman & Infrared Laboratory  
Texas Center for Superconductivity  
University of Houston



## “Magnetic-Ordering-Related Phonon and Crystal Field Anomalies in Rare Earth Manganites”

**Friday, October 28, 2005**

Room 102, University of Houston Science Center  
1:00 p.m. – 2:00 p.m.

### Abstract

The complex relationships among the lattice distortions, magnetism, and dielectric and transport properties of rare earth manganites  $\text{RMnO}_3$  ( $R = \text{rare earth, Y, Sc}$ ) with both orthorhombic and hexagonal structure are attracting increasing interest. The role of structural distortions is widely recognized, but there are only a few studies on their variation with  $R$  and how this affects the spin-phonon and electron-phonon coupling.

The results of recent experiments on the variations with  $R$  of the Raman spectra of orthorhombic  $\text{RMnO}_3$  ( $R = \text{La, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Y}$ ) will be reported. In this series, with decreasing radius  $r_R$  of  $R$  ( $R = \text{La to Eu}$ ), the magnetic transition temperature  $T_N$  to A-type antiferromagnetic (A-AFM) ordering of  $\text{Mn}^{3+}$  decreases from  $\sim 140$  K to  $\sim 40$  K. With further decrease of  $r_R$  ( $R = \text{Gd to Ho}$ ), however, the magnetic structure below  $T_N$  changes from A-AFM to an incommensurate antiferromagnetic one (IC-AFM) with sine-wave ordering of the  $\text{Mn}^{3+}$  moments. It will be shown that the change of magnetic structure correlates with strong mixing of phonon modes involving in-plane Mn-O stretchings and bendings of  $\text{MnO}_6$  octahedra. The strong spin-phonon coupling is evidenced by phonon softening at  $T < T_N$  in A-AFM, but not in IC-AFM manganites.

Another promising experimental approach—temperature-dependent crystal field IR spectroscopy—will be discussed and the first results on crystal field anomalies near  $T_N$  in hexagonal  $\text{RMnO}_3$  ( $R = \text{Ho, Er, Tm, Yb}$ ) will be reported.

### Bio

Milko Iliev received his Ph.D. degree in Physics in 1973 at the University of Sofia, Bulgaria, and worked there as assistant, associate, and full professor and Dean of the Faculty of Physics until 1996. During 1976-77 he worked as a postdoctoral researcher and later (1992, 1995) as a visiting scientist in the group of Prof. M. Cardona at the Max-Planck-Institute for Solid State Research, Stuttgart, Germany. Since 1996, Dr. M. Iliev has been a Research Professor and Project Leader in T<sub>c</sub>SUH. His research interests are in the field of Raman and infrared spectroscopy of HTS and related materials. He has over 130 publications in peer-reviewed journals.

*Persons with disabilities who require special accommodations in attending this lecture should call (713) 743-8210 as soon as possible.*



TEXAS CENTER FOR  
SUPERCONDUCTIVITY