

## CONDENSED MATTER THEORY SEMINAR

Subject: **A microscopic solution to the magnetic detwinning mystery in  $\text{EuFe}_2\text{As}_2$**

Speaker: **Dr. I. I. Mazin, NRL Washington D.C., USA**

Date & time: **Friday, May 12<sup>th</sup>, 2017 at 3:15 p.m.**

Venue: **Seminar room 1.114**

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One of the greatest recent advances in studying nematic phenomena in Fe-based superconductors was the mechanical detwinning of the 122-family compounds. Unfortunately, these techniques generate considerable stress in the investigated samples, which contaminates the results. Recently, it was observed that a minuscule magnetic field of the order of 0.1 T irreversibly and persistently detwins  $\text{EuFe}_2\text{As}_2$ , opening an entirely new avenue for addressing nematicity. However, further development was hindered by the absence of a microscopic theory explaining this magnetic detwinning. In fact,  $\text{Eu}^{2+}$  has zero orbital moment and does not couple to the lattice, and its exchange coupling with the Fe sublattice cancels by symmetry. Moreover, further increase of the field to  $\sim 1$  T leads to a reorientation of Fe domains, while even larger fields  $\sim 10$  T reorient the domains once again. We will present a new microscopic model, based on a sizable biquadratic coupling between the Fe 3d and Eu 4f moments. This model quantitatively explains all magnetization and neutron diffraction data, thus removing the veil of mystery and finally opening the door to full-scale research into magnetic detwinning and nematicity in Fe-based superconductors.

Full authorship:

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