Abstract Submitted
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A microscopic solution to the magnetic detwinning mystery in $EuFe_2As_2$ J. MAIWALD, Exp. Physics VI, U. Augsburg, Germany, I. I. MAZIN, NRL, Washington, DC, USA, S. NANDI, Indian Inst. of Technology, Kanpur, India, Y. XIAO, Forschungszentrum Jülich, Germany, P. GEGENWART, Exp. Physics VI, U. Augsburg, Germany — 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, we observed that a minuscule magnetic field of the order of 0.1 T irreversibly and persistently detwins $EuFe_2As_2$, opening an entirely new avenue for addressing nematicity[1]. However, further development was hindered by the absence of a microscopic theory explaining this magnetic detwinning. In fact, 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 ~ 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 our old and new 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.

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