MAR17-2016-009662

Abstract for an Invited Paper
for the MAR17 Meeting of
the American Physical Society

Elastoresistance measurements as a probe of electronic nematicity in Fe-based superconductors

IAN FISHER, Department of Applied Physics, Stanford University

Elastoresistance measurements provide a new and powerful insight to electronic nematicity in strongly correlated materials. For Fe-based superconductors, such measurements have directly revealed the divergence of the nematic susceptibility towards a thermally driven nematic phase transition for underdoped compositions, and inferred the presence of a quantum phase transition with a nematic character near optimal doping. The elastoresistivity tensor $m_{ij,kl}$ relates changes in resistivity to strains experienced by a material. As a fourth-rank tensor, it contains considerably more information than the simpler (second-rank) resistivity tensor; in particular, for a tetragonal material, the B_{1g} and B_{2g} components of the elastoresistivity tensor ($m_{xx,xx} - m_{xx,yy}$ and $2m_{xy,xy}$, respectively) can be related to the material's nematic susceptibility for those symmetry channels. Spurred by our initial observations of a large elastoresistivity in Fe-based superconductors, which is directly related to the large nematic susceptibility in these materials, we have further developed the necessary formalism to describe elastoresistivity and have established improved methods to measure the most relevant elastoresistivity coefficients. In this talk I will outline some of these most recent developments in the context of elastoresistivity measurements of Fe-based superconductors. In addition, I will describe the effect of anisotropic strain on the coupled nematic/structural phase transition found for underdoped compositions, and make the case that this is an important, and thus far largely neglected, tuning parameter for materials that undergo nematic order.