Chez Pierre

Presents ...

Monday, November 16, 2020

12:00pm Noon

Broadcast via Zoom

Chez Pierre Seminar

David Hsieh – California Institute of Technology

"Signatures of anomalous symmetry breaking in the cuprates"

The temperature versus doping phase diagram of the cuprate high-T_c superconductors features an enigmatic pseudogap region whose microscopic origin remains a subject of intensive study. Experimentally resolving its symmetry properties is imperative for narrowing down the list of possible explanations. In this talk I will give an overview of how optical second harmonic generation (SHG) can be used as a sensitive probe of symmetry breaking, and recap the ways it has been used to solve outstanding problems in condensed matter physics. I will then describe how we have been applying SHG polarimetry and spectroscopy to interrogate the cuprate pseudogap. In particular, I will discuss our data on $YBa_2Cu_3O_y$ [1], which show an order parameter-like increase in SHG intensity below the pseudogap temperature T^* across a broad range of doping levels. I will then focus on our more recent results on a model parent cuprate $Sr_2CuO_2Cl_2$ [2], where evidence of anomalous broken symmetries surprisingly also exists. Possible connections between these observations will be speculated upon.

[1] L. Zhao, C. A. Belvin, R. Liang, D. A. Bonn, W. N. Hardy, N. P. Armitage and D. Hsieh, "A global inversion-symmetry-broken phase inside the pseudogap region of $YBa_2Cu_3O_y$," Nature Phys. 13, 250 (2017).
[2] A. de la Torre, K. L. Seyler, L. Zhao, S. Di Matteo, M. S. Scheurer, Y. Li, B. Yu, M. Greven, S. Sachdev, M. R. Norman and D. Hsieh. "Anomalous mirror symmetry breaking in a model insulating cuprate $Sr_2CuO_2Cl_2$," Preprint at https://arxiv.org/abs/2008.06516.