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Superconductivity and the pseudogap phase in LSCO under uniaxial strain

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A prominent open question in understanding the cuprate phase diagram is whether the pseudogap represents a competing phase or is a precursor to superconductivity. Strain is an effective tuning parameter, modifying the crystal structure and thereby hopping amplitudes, the position of the van Hove singularity, and the Fermi surface topology independent of doping.

In $\text{La}_{1.6-x}\text{Nd}_{0.4}\text{Sr}_x\text{CuO}_4$ under hydrostatic pressure, transport measurements indicate that the critical doping p^* at which the pseudogap closes shifts with strain [1]. Accompanying calculations suggest that this shift tracks the doping p_{FS} at which the Fermi level crosses the van Hove singularity (a Lifshitz transition). The relation between p^* and p_{FS} point to a close link between the pseudogap and the Fermi surface topology.

We investigate the connection between the pseudogap and the Lifshitz transition by performing ARPES on uniaxially strained, microstructured $\text{La}_{2-x}\text{Sr}_x\text{CuO}_4$ (LSCO). Our initial measurements show that the superconducting gap is suppressed by uniaxial strain, while the pseudogap increases. The contrasting behaviour of the gaps suggests a distinct microscopic origin, consistent with a competition between the pseudogap and superconductivity.

[1] N. Doiron-Leyraud et al., 'Quantum Oscillations and the Fermi Surface in an Underdoped High-Tc Superconductor', Nature 447, 565 - 568 (2007).