

Plenary Talk (SKM) PV XX Thu 9:15 HSZ 01
Towards a quantitative understanding of high-temperature superconductivity — ●BERNHARD KEIMER — Max Planck Institute for Solid State Research, Stuttgart, Germany

Twenty-five years after the discovery of high-temperature superconductivity in the copper oxides, we are rapidly approaching a quantitative understanding of this phenomenon. Using a combination of inelastic neutron scattering and resonant inelastic x-ray scattering, we have developed an essentially complete experimental description of the magnetic excitation spectrum in the model compound $\text{YBa}_2\text{Cu}_3\text{O}_{6+x}$. [1] A numerical solution of the Eliashberg equations based on the experimental spin excitation spectrum of $\text{YBa}_2\text{Cu}_3\text{O}_7$ reproduces its superconducting transition temperature within a factor of two, strongly

supporting magnetic Cooper pairing models. [1] We also present evidence that an analogous mechanism is responsible for the recently discovered superconducting state in iron arsenides. [2] In the underdoped regime of $\text{YBa}_2\text{Cu}_3\text{O}_{6+x}$, this theoretical description breaks down due to vertex corrections, and we experimentally observe an "electronic nematic" state that competes with superconductivity. [3] Finally, we will briefly discuss possible signatures of competing electronic order in conventional, elemental superconductors. [4]

[1] M. Le Tacon et al., to be published. [2] D. S. Inosov et al., Nature Phys. 6, 178 (2010); P. Popovich et al., Phys. Rev. Lett. 105, 027003 (2010). [3] D. Haug et al., New J. Phys. 12, 105006 (2010); V. Hinkov et al., Science 319, 597 (2008). [4] P. Aynajian et al. Science 319, 1509 (2008); P. Aynajian, N. Munnikes et al., to be published.