S-wave anisotropic Pseudogap in Cuprates

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After 27 years of research, the high critical temperature superconductivity is not yet understood and submitted to the most intensive debates. The coexistence and the competition of two distinct orders namely superconductivity and the pseudo-gap make the Cuprate phase diagram very complex. In our group (Spectroscopy of Quasi-Particles) , we study strongly correlated systems by inelastic light scattering called the electronic Raman scattering. The electronic Raman scattering technique allows us to probe selected regions of the momentum space such as the principal axes (B1g geometry) and the diagonal axes (B2g geometry) of the Brillouin zone .

In this work we present experimental data on single crystals of $Bi_2Sr_2Ca_1Cu_2O_{8+\delta}$ in the superconducting and the normal states. In the superconducting state, we observe the "d" wave symmetry of the superconducting gap in a large doping range. In the normal state, we detect a strong depletion of the electronic background in a large energy range (from the low to high frequency) along the principle axes of the Brillouin zone (B1g). In sharp contrast, along the diagonal axes of the Brillouin zone (B2g), we detect a depletion only for an intermediate energy range and not at low frequency. These observations advocate in favor of an “anisotropic S wave " pseudo-gap which takes a different symmetry from the superconducting gap [1,2] .

[1] - Evidence of an s-Wave Structure for the Pseudogap, S. Sakai et al .PRL 111,107001(2013)

[2] -Pseudogap in Cuprates by Electronic Raman Scattering, Alain Sacuto, Siham Benhabib et al .Journal of Physics: Conference Series 449(2013) 012011