Competing ground states in cuprates:
disentangling Cooper-pair formation above Tc from the pseudogap state

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Pseudogap state in cuprates is one of most interesting topics in modern condensed matter physics. This state is characterized by anisotropic energy gap that leads to seemingly disconnected segments of the Fermi surface, so called “Fermi arcs”. The relationship between the pseudogap and superconductivity is one of the central issues in physics of cuprates. One of the leading theories explaining it is so called "pre-formed" pair scenario, where pseudogap is thought to be a state of paired electrons that lack the long range coherence. Another class of theories attributes the pseudogap to an ordered state that would naturally compete with superconductivity. By studying the spectral weights associated with pseudogap and superconductivity using Angle Resolved Photoemission Spectroscopy (ARPES) we found that there is a direct correlation between the loss of the low energy spectral weight due to the opening of the pseudogap and a decrease of the spectral weight associated with superconductivity as a function of momentum and doping. High accuracy data lead us to conclude that the pseudogap competes with the superconductivity by depleting the spectral weight available for pairing in the region of momentum space, where the superconducting gap is largest. We also conducted detailed studies of the temperature dependence of the spectral weight at the chemical. We found evidence for a spectroscopic signature of pair formation and demonstrated that in a region of the phase diagram commonly referred to as the ``pseudogap'', two distinct states coexist: one that persists to an intermediate temperature Tpair and a second that extends up to T*. The first state is characterized by a doping independent scaling behavior and is due to pairing above Tc, but significantly below T*. The second state is the "proper" pseudogap - characterized by a "checker board" pattern in STM images, the absence of pair formation, and is likely linked to Mott physics of pristine CuO2 planes.