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Unconventional Low-Energy Excitations of Cuprate Superconductors

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Recent development in the physics of high-temperature cuprate superconductivity is reviewed, with special emphasis on the phenomena of unconventional and non-universal low-energy excitations of hole- and electron-type cuprate superconductors and the possible physical origin. A phenomenology based on coexisting competing orders with cuprate superconductivity in the ground state appears to provide a consistent account for a wide range of experimental findings, including the presence (absence) of pseudogaps and Fermi arcs above the superconducting transition T_c in hole-type (electron-type) cuprate superconductors and the novel conductance modulations below T_c, particularly in the vortex state. Moreover, the competing order scenario is compatible with the possibility of preformed Cooper pairs and significant phase fluctuations in cuprate superconductors. The physical implications of the unified phenomenology for the microscopic mechanism of cuprate superconductivity are discussed.

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