Session 25aE

$Bi_2Sr_2CaCu_2O_{8+\delta}$ Bicrystal c-Axis Twist Josephson Junctions: A New Phase-Sensitive Test of Order Parameter Symmetry **25aE1**

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We prepared atomically clean $Bi_2Sr_2CaCu_2O_{8+\delta}$ Josephson junctions between identical single crystal cleaves stacked and twisted an angle ϕ_0 about the c axis. For each bicrystal, the ratio J_c^J/J_c^S of the c axis twist junction critical current density to that across either single crystal part is unity, independent of ϕ_0 and the ratio A^J/A^S of junctions areas. From extensive theoretical studies involving a variety of tunneling and order parameter forms, we conclude that the results provide strong evidence for incoherent c-axis tunneling and that the dominant superconducting order parameter is s-wave for $T \leq T_c$.

Shapiro step effect in the vortex state of $Bi_2Sr_2CaCu_2O_{8+\delta}$ **25aE2**

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We report the first observation of Shapiro step effect in the vortex state of $Bi_2Sr_2CaCu_2O_{8+\delta}$ in strong magnetic field ($H \geq 1T$). We observed phase locking between external microwave radiation and Josephson oscillation in whole stack ($N \approx 67$) of intrinsic Josephson junctions at fields tilted with respect to the c-axis. Steps were observed in flux-flow and excess current region of the $I-V$ characteristic at voltage $V_{st} = pNh\nu/2e$, with p integer, ν = 45-142 GHz. The height of Shapiro steps and Josephson critical current increase sharply with tilting angle and then decrease. We attribute this anomaly to the interaction between Josephson and pancake vortices.

25aE3 Josephson Vortex Flow in $Bi_2Sr_2CaCu_2O_{8+y}$

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We have studied the flow resistance of Josephson vortices(JV's) in $Bi_2Sr_2CaCu_2O_{8+y}$ intrinsic Josephson junctions, fabricated with focused ion beam etching. In the flow resistance, we have found a coherent motion of JV's, which appears in periodical oscillations of the resistance as a function of magnetic field. This phenomenon is related to the matching between JV lattice and the size of the sample. From the results, it is shown that JV's take a triangular lattice as the ground state and magnetic phase diagram of JV's has been established. Furthermore, the size effect causes a new vortex phase in the JV system.

25aE4 STM Studies of Individual Ti Impurity Atoms in Sr_2RuO_4

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We report atomic resolution scanning tunneling microscopy of the unconventional superconductor, Sr_2RuO_4, at temperatures between $\sim$20 mK and 20 K. Spectroscopic measurements show a complex density of states with multiple gap-like structures. Upon substitutional doping with Ti atoms, we find a local impurity state at -1.5 meV, outside the superconducting gap. We will discuss possible connections between this local state and results of neutron scattering experiments.

25aE5 Critical state models for a granular ferromagnetic superconductor

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Measurements of the magnetic moment M as a function of the magnetic field B can be used to extract information about the penetration behavior of the magnetic field in a superconducting sample. In granular superconductors the response to an applied a.c. field is governed by both intra- and intergranular shielding currents. We have employed low field a.c. susceptibility measurements to investigate the magnetic properties of a polycrystalline $RuSr_2GdCu_2O_8$ weak ferromagnet in its superconducting state. For fields below $\sim 10\,\mathrm{G}$ the results are consistent with the Bean critical state model. For $B > 10\,\mathrm{G}$, the Kim model is more suitable for the description of the sample's properties.