

Frontiers Problems of the Josephson Effect in High T_c: From unconventional superconductivity to Mesoscopics and Macroscopic Quantum Phenomena

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The recent experiments on macroscopic quantum effects in High critical temperature superconductors (HTS) junctions represent another relevant step towards a Josephson platform, where important device functionalities are not anymore precluded to HTS unconventional junctions. Possible strategies towards more uniform and reproducible devices pass through progress in material science and a systematic use of nanotechnology. We will report on different nanotechnology approaches, employed to achieve high quality YBaCuO nano-junctions. Macroscopic and mesoscopic quantum phenomena have been observed. The possibility to have reproducible and reliable HTS nanostructures with quality factors above 10 meV, is also a major contribution towards nanoscale experiments. Results encourage the integration of HTS nanostructures in quantum circuits and hybrid systems, and pave the way to similar fundamental studies on novel superconducting materials. Comparative studies on macroscopic quantum phenomena in various unconventional systems might be inspiring for novel insights on coherence and dissipation.