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Mesoscopic conductance oscillations in superconducting nanoparticle films AL-AMIN DHIRANI, BRIAN LAM — Recent advances in nanoparticle synthesis yield control over key nanoparticle characteristics such as structure and chemical composition. This in turn enables fabrication of nanostructured materials with novel and controlled properties. We have found that superconducting 100 nm niobium nanoparticles can be sintered to make porous macroscopic films that routinely exhibit conductance oscillations as a function of bias voltage and magnetic field. We speculate the effect is related to electron-hole interference previously observed at interfaces between disordered normal materials and superconductor electrodes. Our results show that the oscillations in the present system are associated with nanoparticle state (superconducting vs. normal) and ubiquitous elastic scattering at length scales dictated by nanoparticle size. Robust observation of this mesoscopic interference phenomenon in a disordered, macroscopic system is remarkable. It is enabled by the present approach's ability to balance conterveiling considerations: sufficient disorder to induce elastic scattering and restricted averaging to limit dephasing.

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