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Magnetic Field-Induced Metallic Behavior in Superconducting Tantalum Films YONGGUANG QIN, CARLOS VICENTE, JONGSOO YOON, University of Virginia — We present the results of electronic transport measurements on superconducting thin tantalum films. The films are grown by dc sputtering on Si substrates. No sign of crystalline ordering is found from X- ray diffraction studies, particularly for films with thickness less than $\sim$ 5nm, indicating that the structure of the films is amorphous. The superconducting transition temperatures are found to continuously decrease with decreasing film thickness, which is characteristic of homogeneously disordered superconducting films. At zero magnetic field, a direct superconductor-insulator transition is observed at a critical thickness $\sim$ 3 nm. At this thickness the normal conducting sheet resistance is close to the quantum resistance, $h/4e^2$. When the superconductivity is suppressed by applying magnetic fields, however, the system exhibits an unexpected metallic behavior in the limit of zero temperature. The metallic behavior is characterized by a drop in resistance followed by an apparent saturation to a finite value as the temperature is reduced. We observe qualitatively different nonlinear voltage-current characteristics across the "superconductor- metal" boundary, and also the "metal-insulator" boundary.

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