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**Phase diagram of amorphous Ta thin films in B-T-disorder space**
YIZE LI, YONGGUANG QIN, CARLOS VICENTE, JONGSOO YOON, University of Virginia — We have studied the effect of temperature (T) and perpendicular magnetic fields (B) on the transport properties in amorphous Ta thin films. In the zero T limit, the films exhibit superconducting, metallic, and insulating phases with increasing B. Each phase can be identified by distinct nonlinear current-voltage (I-V) characteristics: the I-V curves in the superconducting phase are characterized by a hysteresis, in the metallic phase the differential resistance (dV/dI) increases with increasing I, while in the insulating phase dV/dI decreases with increasing I [1]. As demonstrated for the superconducting and metallic phase, these nonlinear transports arise from a non-thermal origin [2]. In order to understand the effect of B, T, and disorder on the electronic states and the nature of the resulting ground states, we construct a B-T-disorder space "phase diagram". Disorder is controlled by film thickness. The resulting phase diagram shows that the superconducting phase is completely surrounded by the metallic phase; in the zero temperature limit (B-disorder plane) a B-induced direct superconductor-insulator transition is not allowed, while a superconductor-metal-insulator or metal-insulator transition are possible depending on the degree of disorder in our 2D system. [1] Y. Qin et al., Phys. Rev. B 73, 100505(R) (2006). [2] Y. Seo et al., Phys. Rev. Lett. 97, 057005 (2006).

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