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The superconductor-insulator transition in ultrathin Pb: the effects of disorder, magnetic field, and magnetic impurities JEFFREY PARKER, DAN READ, PENG XIONG, DEPARTMENT OF PHYSICS/MARTECH, FLORIDA STATE UNIVERSITY TEAM — Using ultrathin quench-condensed Pb films we have performed a systematic comparative study of the superconductor-insulator transition (SIT) driven by disorder (d), magnetic field (B), and magnetic impurities (MI). The Pb films were quench-condensed at low temperature onto an Sb buffer layer. The d-tuned transition was studied by increasing the thickness of the same film in small steps and performing *in situ* transport measurements. The film was driven back into the insulating state by a perpendicular magnetic field and then later in zero field by magnetic impurities deposited in small increments. We observed that the d- and MI-tuned transitions showed similar features across the SIT, while the B-tuned transition appeared qualitatively different. In particular, the B-field induced a quasi-reentrant behavior near the critical field and activated transport immediately on the insulating side, indicating possible B-induced mesoscale phase separation across the B-tuned SIT. These are distinguishing features for the SIT in granular films and were absent in the d- and MI-tuned transitions which exhibited sharp well-defined phase boundaries.

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