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Berezinsky Kosterlitz Thouless transition in ultrathin NbN films near superconductor-insulator transition JIE YONG, Department of Physics, Ohio State University, K. IL'IN, M. SIEGEL, Institute of Micro- und Nanoelectronic Systems, Karlsruhe Institute of Technology, Germany, THOMAS LEMBERGER, Department of Physics, Ohio State University — We report temperature dependent superfluid densities λ^{-2}(T) in ultrathin NbN films near thickness-tuned superconductor-insulator transition (SIT). Superfluid densities in these films are measured by two-coil mutual inductance apparatus. For thick films, dirty limit BCS theory fits experimental data well and this verifies the correctness of this technique. As films get thinner and closer to SIT, sharp downturns near transition temperatures (T_c), signature of Berezinsky-Kosterlitz-Thouless transition, are observed. This downturn occurs much earlier than what 2-D XY theory predicts. This might due to smaller vortex core energy than expected in 2-D XY model. The superconducting gap, deduced from fitting low temperature λ^{-2}(T), is linear with T_c for most films but remain finite across SIT. This is consistent with the scenario that superconductivity is destroyed by phase fluctuations. Zero temperature sheet superfluid density also shows correlation with T_c, further proving the importance of fluctuations near SIT.

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