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Influence of spatial disorder on the superconducting state of a 3D superconductor CAROLINA PARRA, Universidad Tecnica Federico Santa María, FRANCIS NIESTEMSKI, PAULA GIRALDO-GALLO, ALEX W. CONTRYMAN, THEODORE H. GEBALLE, IAN R. FISHER, HARI C. MANOHARAN, Stanford University — We present the first measurements of the local tunneling density of states on the three-dimensional superconductor $BaPb_{1-x}Bi_xO_3$ as a function of Bi doping. Scanning tunneling spectroscopy measurements are performed on a sequence of samples which exhibit a field-tuned superconductor-to-insulator (SIT) transition. Our study shows that gap variations in the superconducting (SC) state (as a sign of SC disorder level) increase when the system moves towards the SIT phase boundary, with spatial inhomogeneity comparable in size to the material's coherence length. We demonstrate that this highly inhomogeneous local gap size is always finite at every location, even for Bi concentration closest to the SIT, where local insulating behavior is expected and globally confirmed in transport experiments. Our results also suggest a method for increasing the critical temperature for this material by reducing its spatial disorder in the appropriate part of the phase diagram.

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