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The Local Properties of Superconducting LiFeAs: From the Pure Crystal to the Influence of Defects STEPHANIE GROTHE, SHUN CHI, PINDER DOSANJH, RUIXING LIANG, WALTER N. HARDY, SARAH A. BURKE, DOUG A. BONN, YAN PENNEC, Department of Physics and Astronomy, University of British Columbia, Vancouver BC, Canada V6T 1Z1 — The iron pnictide superconductor LiFeAs is of particular interest as it is superconducting without chemical substitution and therefore presents a clean system to study the mechanisms behind unconventional superconductivity. We study the unreconstructed surface of LiFeAs by scanning tunneling microscopy and spectroscopy [1]. In regions free of defects, spectra at 2 K show two nodeless superconducting gaps, homogeneous over tens of nanometers, as well as a dip-hump structure with an energy scale consistent with a magnetic resonance recently reported by inelastic neutron scattering [2]. The gaps close at the bulk T_c, indicating that the surface accurately represents the bulk properties. We study how the superconducting phase of LiFeAs is modified in the vicinity of defects. The most commonly observed Fe site defect exhibits a bound state near the edge of the smaller gap. Three other common defects, including another one on an Fe site, are pair-breaking indicated by clear in-gap bound states, in addition to states near the smaller gap edge. Spectroscopic mapping reveals the high complexity of the real space bound state patterns.

[1] Chi et al., Phys. Rev. Lett. 109, 087002 (2012)
[2] Qureshi et al., Phys. Rev. Lett. 108, 117001 (2012)

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