

Opportunities for Quantum Information Research Using Angle-Resolved Photoemission Spectroscopy

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Angle-resolved photoemission spectroscopy (ARPES) is a premier tool for determining the charged excited states of quantum materials. It directly measures the single particle spectral function $A(k, \omega)$ that encodes the renormalized lifetime and energy of quasiparticle states as a function of momentum (k) and energy (ω). ARPES is complementary to both scanning tunneling microscopy (STM), which does not access the Bloch quantum numbers k , and transport measurements which are sensitive to excited states only near $\omega = 0$. In addition, ARPES is a highly sensitive probe of the symmetry of itinerant Bloch states.

Therefore, ARPES plays a key role in understanding the fundamental properties of emergent ground states in complex materials such as superconductors, 2D, and topological materials, all of which have potential applications in quantum information science. In this talk I will present a review of recent studies of candidate materials for quantum information at the ALS, and in particular I will focus on efforts to enhance spatial resolution, low temperature performance, and *in situ* sample preparation. These abilities will allow ARPES to provide fundamental information for quantum materials not only in pure materials, but also in practical forms such as devices and with tailored surface properties.

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