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Tuning across the BCS-BEC crossover in superconducting $Fe_{1+y}Se_xTe_{1-x}$: An angle-resolved photoemission study SHAHAR RINOTT, AMIT RIBAK, KHANAN CHASHKA, Technion, Physics department, MOHIT RANDERIA, Ohio State University, Physics Department, AMIT KANIGEL, Technion, Physics department — The crossover from Bardeen-Cooper-Schrieffer (BCS) superconductivity to Bose-Einstein condensation (BEC) was never realized in quantum materials. It is difficult to realize because, unlike in ultra cold atoms, one cannot tune the pairing interaction. We realize the BCS-BEC crossover in a nearly compensated semimetal $Fe_{1+y}Se_xTe_{1-x}$ by tuning the Fermi energy ϵ_F via chemical doping, which permits us to systematically change Δ/ϵ_F from 0.16 to 0.50, where Δ is the superconducting (SC) gap. We use angle-resolved photoemission spectroscopy to measure the Fermi energy, the SC gap and characteristic changes in the SC state electronic dispersion as the system evolves from a BCS to a BEC regime. Our results raise important questions about the crossover in multi-band superconductors which go beyond those addressed in the context of cold atoms.

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