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High-temperature superconductivity from fine-tuning of Fermi-surface singularities in iron oxypnictides ALIAKSEI CHARNUKHA, Physics Department, University of California - San Diego, La Jolla, CA 92093, USA — In the family of iron-based superconductors, 1111-type materials exhibit superconductivity with the highest transition temperature Tc=55K. Early theoretical predictions of their electronic structure revealed multiple large circular sheets of the Fermi surface. Here we use ARPES to show that two prototypical compounds of the 1111 type are at odds with this description. Their low-energy band structure is formed by the edges of several bands, which are pulled to the Fermi level from the depths of the theoretically predicted band structure by strong electronic interactions. We further demonstrate that although their low-energy electronic looks remarkably similar, the Tc differs by a factor of 2. Upon closer examination we uncover that one of the bands in the higher-Tc compound sinks to 2.3meV below the Fermi level and thus does not produce a Fermi surface. And yet we find that it hosts a superconducting energy gap 10x larger than the same band in the lower-Tc sister compound. Our results show that the Fermi-surface singularities in the iron-oxypnictides dramatically affect their low-energy electronic properties, including superconductivity, and must therefore be explicitly taken into account in any attempt to understand the pairing mechanism.

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