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ARPES investigation of heavily hole-doped Fe-based superconductor (Ba,K)Fe_2As_2 XUN SHI, PIERRE RICHARD, PENG ZHANG, AMBROISE VAN ROEKEGHEM, TIAN QIAN, JIANGPING HU, HONG DING, Chinese Academy of Sci (CAS), DELONG FANG, HAIHU WEN, Nanjing University, NAN XU, MING SHI, Paul Scherrer Institut, TIMUR KIM, MORITZ HOESCH, Diamond Light Source, XIANHUI CHEN, University of Science and Technology of China, PHOTOELECTRON SPECTROSCOPY RESEARCH TEAM, NANJING UNIVERSITY COLLABORATION, PAUL SCHERRER INSTITUT COLLABORATION, DIAMOND LIGHT SOURCE COLLABORATION, UNIVERSITY OF SCIENCE AND TECHNOLOGY OF CHINA COLLABORATION — A Lifshitz transition occurs in the (Ba,K)Fe_2As_2 family upon K doping and electron pocket are absent in the heavily doped compounds, including KFe_2As_2. The pairing symmetry is argued to undergoes a phase transition due to the existence of gap node(s) reported in various experiments. In this work we present angle-resolved photoemission spectroscopy and scanning tunneling spectroscopy studies of KFe_2As_2. We observe a van Hove singularity (vHs) in proximity of the Fermi level (E_F), which locates in the middle of the principal axes of the first Brillouin zone. The density-of-states at E_F mainly comes from the vHs whereas it is non-gapped in the superconducting state. Our observation provides natural explanations for many novel behaviors in this material. In particular, it is consistent with our measurements of the gap structure in $Ba_{0.1}K_{0.9}Fe_2As_2$. All these results suggest that Cooper pairing is induced by a strong-coupling mechanism.

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