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Evidence of competing s and d-wave pairing channels in iron-based superconductors FLORIAN KRETZSCHMAR, BERNHARD MUSCHLER, THOMAS BÖHM, ANDREAS BAUM, RUDI HACKL, Walther Meissner Institute, Bavarian Academy of Sciences and Humanities, 85748 Garching, Germany, HAI-HU WEN, National Laboratory of Solid State Microstructures and Department of Physics, Nanjing University, Nanjing 210093, China, VLADIMIR TSURKAN, JOACHIM DEISENHOFER, ALOIS LOIDL, Experimental Physics 5, Center for Electronic Correlations and Magnetism, Institute of Physics, University of Augsburg, 86159 Augsburg, Germany — Superconductivity is determined by the interactions that drive Cooper pairing. However, experimental access to the pairing potential $V_{\mathbf{k},\mathbf{k}'}$ becomes increasingly complicated upon going from conventional metals to complex systems such as the cuprates, some heavy fermion compounds or the iron-based superconductors. We show that electronic Raman scattering affords a window into the essential properties of $V_{\mathbf{k},\mathbf{k}'}$ of iron-based superconductors. In $Ba_{0.6}K_{0.4}Fe_2As_2$ we observe band dependent energy gaps along with excitonic Bardasis-Schrieffer modes characterizing, respectively, the dominant and subdominant pairing channel. The $d_{x^2-y^2}$ symmetry of all excitons allows us to identify the subdominant channel to originate from the interaction between the electron bands. Consequently, the dominant channel driving superconductivity results from the interaction between the electron and hole bands and has the full lattice symmetry. The results in $Rb_{0.8}Fe_{1.6}Se_2$ along with earlier ones in $Ba(Fe_{0.939}Co_{0.061})_2As_2$ highlight the influence of the Fermi surface topology on the pairing interactions.

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