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Optical Investigations of the Superconducting State in 122 Iron-Pnictides¹

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The new high-T_c iron pnictide superconductors have a pronounced multiband character, which complicates the electronic properties and allows for a variety of possible superconducting ground states. We have used the infrared spectroscopy—one of the most powerful tools to investigate the low-energy electrodynamic properties of superconductors—to study several pnictide families. We made a comparison between them with the aim to answer the following questions: (1) Is it possible to have more than one superconducting gap in iron pnictide? (2) Can their order parameters be distinct from each other? (3) How does the coupling between different bands influence the gap? (4) Do the gaps have a three-dimensional character? (5) Is the gap scenario universal for all the iron pnictides? We could show that the pairing condition depends sensitively on the similarity of geometry and dimension between hole and electron Fermi-surfaces.

¹The work was done in collaboration with N. Barisic, J. Carbotte, G. H. Cao, P. Gegenwart, B. Gorshunov, B. Holzapfel, E. Schachinger and Z. A. Xu.