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Optical spectroscopy study on Fe-pnictides/chalcogenides

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I present our optical spectroscopic measurements on several different Fe-based superconducting systems. We find that, for all investigated FeAs-based compounds, the optical conductivity spectra contain, in addition to the free carrier response at low frequency, a peculiar temperature-dependent gap-like suppression at rather high energy scale near 0.6 eV. This suppression evolves with the As-Fe-As bond angle induced by electron- or hole-doping. Furthermore, the feature weakens in the Fe-chalcogenide compounds. We elaborate that the feature is mainly caused by the strong Hund's coupling effect between the itinerant electrons and localized electron moment arising from the multiple Fe 3d orbitals. I shall also present our recent optical spectroscopy study on the iron-selenide superconductor $K_{0.75}Fe_{1.75}Se_2$. The measurement revealed the development of a sharp reflectance edge below T_c at frequency much smaller than the superconducting energy gap on a relatively incoherent electronic background, a phenomenon which was not seen in any other Fe-based superconductors so far investigated. Our analysis indicates that this edge structure develops from a Josephson-coupling plasmon in the superconducting condensate due to the presence of nanoscale phase separation between superconductivity and magnetism.

Work done with Z. G. Chen, R. H. Yuan, W. Z. Hu, B. Cheng, T. Dong, P. Zheng.

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