Optical properties of electron and hole-doped 122 iron-arsenic superconductors

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Superconductivity in the iron-arsenic compounds have various interesting aspects. One of the most distinguishing features of this family of superconductors is that a set of Fe 3*d* bands are crossing the Fermi Level and can participate in the forming of the cooper pairs. Multiple superconducting gaps may exist in iron-arsenic superconductors.

We present optical conductivity measurements on the electron-doped 122 system $Ba(Fe_{1-x}Co_x)_2As_2$ and hole-doped 122 system $Ba_{1-x}K_xFe_2As_2$ single crystals. In both samples, a clear signature of the superconducting gap is observed when the temperature is below T_c, but a simple s-wave description fails in accounting for the low-frequency response. In the electron-doped sample $Ba(Fe_{1-x}Co_x)_2As_2$, the data and the model can be reconciled by introducing an additional Drude peak which accounts for the additional low energy absorption. In the hole-doped sample $Ba_{1-x}K_xFe_2As_2$, the low-frequency optical response can be well described by introducing a second isotropic superconducting gap which is a strong evidence for the existence of multiple superconducting gaps in iron-arsenic superconductors.