Momentum dependent $s_\pm$ superconductivity and isotope effect in electron and hole doped iron pnictides from the small-q phonon mechanism

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We report self-consistent calculations of the gap symmetry for the iron pnictide superconductors (SC) using a realistic small-q phonon mediated pairing potential within a four-band model. When both electron and hole Fermi surface (FS) pockets are present, we obtain the nodeless $s_\pm$ state that was first encountered in a spin-fluctuations mechanism picture. Nodal gap structures are also accessible upon doping[1]. Focusing on $s_\pm$ solution regime, we present self-consistent calculations of the isotope coefficient and the **k**-anisotropy of the SC gap. We find that the gap is strongly momentum anisotropic in the hole doped side while it becomes almost isotropic on the electron doped side, exhibiting a strong dependency on the FS in agreement with recent ARPES observations. The isotope coefficient changes from negative to positive upon electron doping. We argue that our phonon theory can explain in a unifying manner seemingly uncorrelated phenomena, such as the momentum anisotropy and the magnitude variation over different FS portions of the $s_\pm$ SC gap, as well as the puzzling isotope effect observed in these compounds.

[1]A. Aperis *et al*, Phys. Rev. B **83**, 092505 (2011).