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(G*) Raman response modelling in multiband superconductors with competing order parameter symmetries

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Recent experimental studies in the hole-doped iron pnictide $BaFe_2As_2$ observed features in its Raman response that are consistent with the existence of particle-particle excitons, also known as Bardasis–Schrieffer (BaSh) modes. The presence of such collective modes indicates the existence of a strong *d*-wave subleading channel in an otherwise *s*-wave superconductor. In light of such results, a spin-fluctuation based pairing mechanism seems the most promising and some studies argue that the ground-state symmetry could become a pure *d*-wave state in some cases. To facilitate the connection between experiments and theory of the pairing mechanism in these systems with symmetry competition, we formulate a self-consistent framework to calculate the Raman response in multiband 2D superconductors using any pairing interaction of electronic origin, which is applicable to models with any Fermi surface geometry. Our unified framework not only reproduces all the known collective modes, like BaSh modes and Leggett modes in the appropriate symmetry channels, but also allows one to study the Raman response of models with an arbitrary number of bands. We will present our results for two-band models and discuss the implications for the five-band system $Ba_{1-x}K_xFe_2As_2$.

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