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Interacting electrons in 2D in the presence of van Hove singularities and phonons SHAN-WEN TSAI, ANTONIO H. CASTRO NETO, DAVID K. CAMPBELL, Boston University — We have recently extended the RG approach to interacting electrons[1] to include electron-phonon interactions[2]. We now apply this method to study van Hove singularities. We consider the 2D Hubbard model at half-filling and use the two-patch model. Without phonons, there is a spin-density wave instability due to (π,π) nesting. We first consider isotropic phonons, which suppress this instability channel. Angle-resolved photoemission spectroscopy data have suggested that electron-phonon interactions in the cuprates are highly anisotropic[3]. There is an out-of-phase buckling mode of the oxygen atoms that couples strongly to electronic states in the anti-nodal direction and a breathing mode of the copper-oxygen bond that couples strongly to nodal electronic states. We study the effect of such phonons in our simplified model of interacting electrons. The retardation effects give important corrections to the imaginary-part of the electron self-energy. We also study the competition between the spin-density wave and the s- and d-wave superconducting instabilities.

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[2]S.-W. Tsai, A. H. Castro Neto, R. Shankar, and D. K. Campbell, *"Renormalization Group Approach to Strong-Coupled Superconductors"*, cond-mat/0406174
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