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Polaron-plasmon Superconductivity in Strontium Titanate ALEXANDER EDELMAN, PETER LITTLEWOOD, Univ of Chicago — Strontium titanate is a bulk insulator that becomes superconducting at remarkably low carrier densities. Even more enigmatic properties become apparent at the strontium titanate/lanthanum aluminate (STO/LAO) interface and it is important to disentangle the effects of reduced dimensionality from the poorly-understood pairing mechanism. Recent experiments measuring the surface photoemission spectrum[1] and bulk tunneling spectrum[2] have found a cross-over, as a function of carrier density, from a polaronic regime with substantial spectral weight associated with strongly coupled phonons, to a more conventional weakly coupled Fermi liquid. Interestingly, it is only the polaronic state that becomes superconducting at low temperatures, although the properties of the superconducting phase itself appear entirely conventional. We interpret these results in a simple analytical model that extends an Engelsberg-Schrieffer theory of electrons coupled to a single longitudinal optic phonon mode to include the response of the electron liquid, and in particular phonon-plasmon hybridization. We perform a Migdal-Eliashberg calculation within our model to obtain this material's unusual superconducting phase diagram.

[1]Z. Wang et al, Nat. Mater. (2016)
[2]G. Swartz et al, arXiv:1608.05621

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