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Duality and the vibrational modes of a Cooper-pair Wigner crystal

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When quantum fluctuations in the phase of the superconducting order parameter destroy the off-diagonal long range order, duality arguments predict the formation of a Cooper pair Wigner crystal. This effect is thought to be responsible for the static checkerboard patterns observed recently in various underdoped cuprate superconductors by means of scanning tunneling spectroscopy. I will sketch the calculation of the vibrational modes of this pair crystal using a continuum version of the standard vortex-boson duality. Such calculations yield bounds on the sound velocity of the phonon modes which are in agreement with the numbers extracted from the thermal conductivity measurements but indicate that vibrations are robustly three dimensional in nature. Generalization of the inherently two-dimensional vortex-boson duality to three dimensions is outlined and an intriguing connection to the theory of bosonic strings is pointed out.