A SPIN-DENSITY-WAVE GROUND STATE IN Pb? EXPERIMENTAL EVIDENCE FROM PHONON IMAGING

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Recently we have been able to image ballistic phonons in superconductors. At the last phonon conference we reported results on Nb, and the most interesting questions centered around the interactions between quasiparticles and phonons. In the present work, phonon images of Pb show remarkable absorption lines corresponding to strong scattering of phonons traveling in {111} planes. We interpret these data as evidence for sharp dips in the superconducting energy gap, contrary to the usual belief that the gap in Pb is nearly isotropic. In 1988, Overhauser and Daemen postulated that Pb possesses a spin-density-wave ground state. They predicted sharp reductions in the gap that might explain the anomalous heat capacity and ultrasonic attenuation of this crystal. We have applied their ideas to the detailed Fermi surface of Pb and find remarkable agreement with our imaging data. Further theoretical and experimental is needed to confirm these initial findings.

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