U_c is obtained from the inversion program only with moderate accuracy; the apparent pressure-dependence of U_c can therefore not be taken seriously.

The following parameters were calculated from $\alpha^2(\omega)F(\omega)$:

(i) the average electron–phonon interaction:

$$\langle\alpha^2\rangle = \int \alpha^2(\omega)F(\omega)\,d\omega \Big/ \int F(\omega)\,d\omega; \quad (1)$$

(ii) the electron–phonon coupling constant λ, defined by:

$$\lambda = 2\int \frac{\alpha^2(\omega)F(\omega)}{\omega}\,d\omega; \quad (2)$$

(iii) the renormalization constant $Z = 1 + \lambda$;

(iv) an average squared phonon frequency $\langle\omega^2\rangle$, introduced by McMillan:[8]

$$\langle\omega^2\rangle = \int \omega\alpha^2(\omega)F(\omega)\,d\omega \Big/ \int \alpha^2(\omega)\,\frac{F(\omega)}{\omega}\,d\omega. \quad (3)$$

The results are given in Table 1.

Table 1

P (bar)	$\langle\alpha^2\rangle$ (meV)	λ	Z	$\langle\omega^2\rangle$ (meV)^2
0	1.30	1.53	2.53	30.5
3445	1.32	1.43	2.43	33.7

The pressure-dependence of the various quantities is then given by:

$$d\ln\langle\alpha^2\rangle/dP = + 4.4 \times 10^{-6}/\text{bar}, \quad (4)$$

$$d\ln\lambda/dP = - 18.8 \times 10^{-6}/\text{bar}, \quad (5)$$

$$d\ln Z/dP = - 11.2 \times 10^{-6}/\text{bar}, \quad (6)$$

$$d\ln\langle\omega^2\rangle/dP = + 28.9 \times 10^{-6}/\text{bar}. \quad (7)$$

We estimate the error in these derivatives at ± 10 per cent.

The small, positive pressure derivative of $\langle\alpha^2\rangle$ is not too surprising. In calculating the average, the region near the phonon peaks is heavily weighted and in this region one has $d\alpha^2/d\omega > 0$, according to the estimates given by Scalapino *et al.*[7] The shift of the phonon peaks to higher energies under pressure can therefore explain a positive pressure derivative of $\langle\alpha^2\rangle$. In spite of this, it is obvious from the pressure derivative of λ and Z, that the coupling strength is reduced under pressure. The reason for this is that all phonon frequencies are shifted to higher energies, where they enter the integral for the energy gap with reduced weight.

Electron–phonon renormalization changes most parameters of the metal. We want to comment here on the density of states, N_0 which is given by:

$$N_0 = N_{bs} Z, \quad (8)$$

where N_{bs} is the band-structure density of states. The densities of states are here referred to unit volume. The measured pressure-dependence of Z allows us therefore to estimate the pressure-dependence of N_0:

$$d\ln N_0/dP = d\ln N_{bs}/dP + d\ln Z/dP. \quad (9)$$

From the work of Anderson, O'Sullivan and Schirber[9] it is known that the Fermi-surface of Pb scales under pressure approximately twice as fast as the Brillouin zone. We can therefore estimate, that the change of the band-structure density of states is about twice the free electron value. Numerically this gives $d\ln N_{bs}/dP \simeq 2/3\,\kappa = 1.4 \times 10^{-6}$/bar, where κ is the low temperature compressibility of Pb.[10] Using our result (6) we get then:

$$d\ln N_0/dP = - 9.8 \times 10^{-6}/\text{bar}. \quad (10)$$

The pressure-dependence of N_0 is therefore negative and almost totally due to the change in electron–phonon renormalization with pressure. An experimental determination of this derivative has been published by Garfinkel and Mapother,[11] who measured the pressure-dependence of γ, the coefficient of the normal electronic specific heat. These authors quote $d\ln N_0/dP = (-8.2 \pm 1.5) \times 10^{-6}$/bar, in good agreement with our result.

In a recent paper, McMillan[8] has derived approximate relations for T_c and λ of strong-coupling superconductors. One of his central results is that

$$\lambda = C/\langle\omega^2\rangle, \quad (11)$$

where $\langle\omega^2\rangle$ is the average defined by (3). C is found by McMillan to be approximately constant within a given class of materials, and *a fortiori* could be expected to be a constant for a metal