emprical determination. In doing this, we have assumed that the observed attenuation per echo, α_{total}, is a sum of background and intrinsic cooperative contributions. Once α_{back} is known, the desired attenuation coefficient α (in neper cm^{-1}) is obtained by simply dividing $(\alpha_{total}-\alpha_{back})$ by $8{\cdot}69\ (2L)$.

Total attenuation values obtained at 30 MHz as a function of pressure on a fused-silica test sample at 250 and 260°K showed very little change with temperature, which strongly suggests that the background attenuation is independent of temperature over a moderate range. All the 20 MHz runs were made on crystal I using transducers with an $\frac{1}{8}$ in. active spot, and these data at various temperatures were combined to construct a temperature-independent background as a function of pressure. Almost all the 30 MHz runs were made on crystal II, also using $\frac{1}{8}$ in. transducers, and the same analysis was made for these data. This analysis consisted of plotting α_{total} vs. $|T-T_\lambda|^{-1}$ at several constant pressures, where T_λ at each pressure is determined from the phase diagram of Renard and Garland[8]. This method of handling the data produces almost linear plots which can be easily extrapolated to zero (infinite ΔT) to yield the background attenuation. For Garland and Yarnell's 1-atm data[4], where there is little or no background attenuation, such plots are close to linear over a wide temperature range. It appears that a comparable behavior persists at high pressures even though the fraction of the total attenuation due to the background loss is increasing.

Another method of determining the background attenuation is to carry out isotherm runs which do not cross the lambda line in the range 0–3·5 kbar. This was done at 236·4°K on crystal I, and the results at pressures above 1 kbar (sufficiently far away from the lambda line) were in good agreement with those obtained with the first method. A series of runs were made at 10 and 30 MHz on crystal III using $\frac{1}{4}$ in. transducers. Data obtained at 240·5°K were used to establish a high-pressure ($p > 1{\cdot}5$ kbar) background curve for a 255·6°K run, and 281·8°K data provided a complete background curve for a 270·2°K run. It was observed that the pressure variation of the background attenuation was the same in the ordered and in the disordered phase.

Critical attenuation

One-atmosphere data has shown that the critical attenuation α is quadratic in frequency over the range 5–60 MHz except perhaps at temperatures very close to T_λ[3, 4]. Our present attenuation data at 10–30 MHz are proportional to ω^2 at all temperatures and pressures. Typical isotherms of ω^2/α vs. pressure are shown in Figs. 1 and 2. The arrow

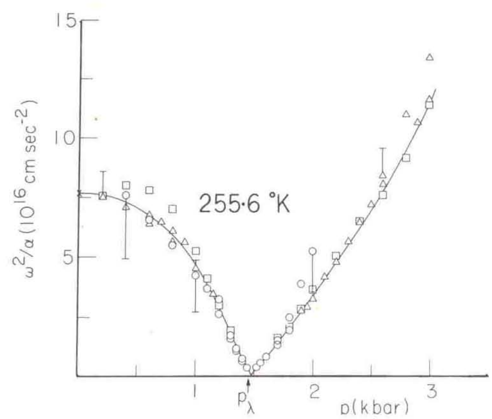

Fig. 1. Variation of ω^2/α with pressure at 255·6°K (see text): ○ 10 MHz. □ 20 MHz. △ 30 MHz.

labelled p_λ on each plot indicates the critical pressure at that temperature as determined from shear velocity data[2]. Garland and Yarnell's ω^2/α values[4] are indicated by the crosses on the vertical axis, and the smooth curves were drawn so as to tie into these values. Smooth-curve ω^2/α values along all seven isotherms are listed in Table 1. These results are subject to both experimental errors in α_{total}, which are largely random in nature, and to systematic errors related to the choice of α_{back}. These two contributions to the

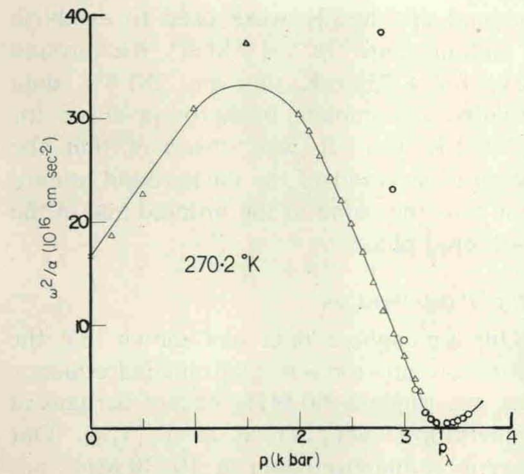

Fig. 2. Variation of ω^2/α with pressure at 270·2°K: ○ 10 MHz, △ 30 MHz.

uncertainty are comparable near the transition but uncertainties due to α_{back} are dominant away from the transition region.

A somewhat non-exponential variation in the echo amplitudes is the limiting factor in the accuracy of our α_{total} values. However, the character of the echo pattern did not change during a pressure run, and ± 5 per cent represents our estimate of the random error in measuring α_{total}. The effect of fluctuations or errors in the temperature and pressure varies considerably. Near the lambda line, where α is a sensitive function of p and T, this can cause ± 4 per cent errors in α. In the essentially normal region away from the lambda line, this will cause only a 0·7 per cent uncertainty in α. An estimate of the systematic error in α due to the choice of α_{back} was obtained for the 255·6°K run by drawing an alternate background for each frequency. The vertical error bars shown in Fig. 1 illustrate the effect of this change on a few representative data points. Near the transition pressure, the α values change by about 10 per cent at 10 MHz and 5 per cent at 20 and 30 MHz. Far from the transition, the change

Table 1. *Smooth-curve values of* ω^2/α, *in units of* 10^{16} cm sec^{-2}, *as a function of pressure at various constant temperatures*

p (kbar)	241·0	246·5	250·6	255·6	260·6	265·6	270·2°K
0·001	0·80		4·95	7·70	10·40	13·60	16·7
0·2	1·55		4·55	7·60	10·90	14·50	19·5
0·4	2·45		3·80	7·30	11·00	15·00	22·4
0·6	3·55	1·35	2·55	6·75	10·85	15·25	25·2
0·8	4·75	2·25	0·95	5·90	10·50	15·35	27·9
1·0	6·00	3·25	0·75	4·70	9·85	15·15	30·5
1·2	7·35	4·30	1·75	2·90	9·00	14·70	32·3
1·4	8·80	5·45	2·85	0·80	7·75	14·00	33·0
1·6	10·30	6·65	4·25	0·85	6·00	12·85	32·9
1·8	11·80	7·90	6·05	2·10	3·70	11·20	32·0
2·0	13·35	9·15	8·15	3·40	1·00	9·20	30·1
2·2	14·90	10·45	10·45	4·75	0·80	6·90	26·4
2·4	16·50	11·75	12·80	6·15	2·50	4·45	21·9
2·6				7·70	4·15	1·90	17·0
2·7						0·60	
2·8				9·45	5·80		11·9
2·9						0·40	
3·0				11·45	7·45	1·15	6·60
3·2						2·75	1·50
3·3							0·35
3·4							0·40
3·5							0·80
3·6							1·35