plotted in Figure 2, which also shows some experimental data for liquid argon, obtained by van Itterbeek, van Dael, and Grevendonk (1959) in the pressure range 1 to 72 atm. Again the theory predicts the right kind of trend in u^* with increasing pressure. The agreement between theory and experiment would probably be better at higher pressures ($P^*>2$; that is, $P>1000$ atmospheres for argon), where the cell model becomes a more realistic one. There is a clear need for some experiments in this pressure range.

(c) Rao's (1940) Relation

Rao (1940) found empirically that the thermal coefficient of the speed of sound in many liquids is close to three times the thermal coefficient of the density. Expressed in a reduced form this relation becomes

$$\frac{1}{u^*}\left(\frac{\partial u^*}{\partial T^*}\right)_P=-A\frac{1}{V^*}\left(\frac{\partial V^*}{\partial T^*}\right)_P, \tag{16}$$

where $A\approx 3$. Later Carnevale and Litovitz (1955) observed that a parallel relation applies if the density is changed, not by temperature, but by pressure: that is

$$\frac{1}{u^*}\left(\frac{\partial u^*}{\partial P^*}\right)_T=-A'\ \frac{1}{V^*}\left(\frac{\partial V^*}{\partial P^*}\right)_T \tag{17}$$

where again $A'\approx 3$. These relations are very simple and we considered it worthwhile to see whether they have any basis in the LJD theory.

We find that for classical LJD liquids in the temperature range $T^*=0\cdot 7$ to $1\cdot 0$, the relation (16) fails rather badly. The factor A is only about $1\cdot 7$ and it decreases with increasing temperature. On the other hand, the relation (17) is obeyed quite accurately. A' has the value $2\cdot 7\pm 0\cdot 1$ and is independent of both the temperature and the pressure, to at least $P^*=2\cdot 5$ (equivalent to an absolute pressure of 1000 atm in liquid argon).

IV. References

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