the ratio C_{Add}/C_{Tot} varies from 0.4 to 0.5 with decreasing sample molar volume, but by 2 K is in the range from 0.16 to 0.26. This ratio reaches a minimum of approximately 0.06 for all samples at 10 K, and then increases to 0.11 at 20 K, 0.25 at 30 K, 0.37 at 40 K, and 0.46 at 50 K. Hence, it is only at very low temperatures (below 1.5 K) and at high temperatures (above 30 K) where the precision with which the addenda is determined has a significant effect on the accuracy of the data. Typically, many data points were taken at low temperatures both for the addenda and for the samples (see below) so some precision is gained through averaging. The high-temperature data are in general less reliable in all cases.

3.2. Typical Neon Data

The data for each of the samples Ne 5 through Ne 8 are represented by variations of Eq. (3) in three separate temperature ranges; roughly, 1–3.5 K, 3.5–15 K, and 15 K to the melting temperature. The Ne 4 data are analyzed only for temperatures below 5 K. The low-temperature expansions must approach T^3 behavior in the $T = 0$ Debye limit, and are chosen to include only odd values of n, beginning with $n = 3$. The two higher temperature expansions use all integer values of n (0, 1, 2, 3, ...) since the heat capacity is approximately linear in the temperature near 4 K and becomes roughly constant at high temperatures. The rms deviations for all of these representations are approximately 0.2 % for the lowest range, 0.1 % for the intermediate range, and 0.3 % for the highest range.

The data for the Ne 7 sample are presented in Figs. 2, 3, and 4 as being typical of those for all four samples, both in number of data points and in the experimental scatter. Figure 2 contains a reduced plot (C_V/T^3 vs. T^2), which is useful for extrapolation to $T = 0$ of the low-temperature data. The least-squares fit of Eq. (3) to these data is represented by the solid line; the rms deviation of 0.26 % is somewhat greater than is found for the other samples at these temperatures, possibly due to the scatter below $T^2 = 2\,K^2$. The $T = 0$ intercept can be defined to better than ± 0.3 %, which suggests that Θ_0 (as calculated from the coefficient of the T^3 term) should be reliable to ± 0.1 %.

Representations of this type were used to calculate the values of Θ_0 for the Ne 4, Ne 5, Ne 6, and Ne 7 samples which are given in the tables. The determination of Θ_0 for Ne 8 is not as straightforward since the extrapolation to $T = 0$ is dominated by two data points near 1 K which appear to be 1 % too high. The computer fit which includes these data points gives $\Theta_0 =$ 91.1 K, instead of the 91.5 K which appears in Tables I and V. We find that all of the data (Ne 4 through Ne 7) for temperatures up to 4 K can be represented within the experimental scatter as a single curve on a reduced

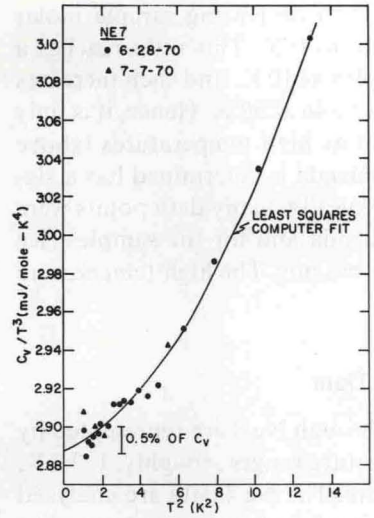

Fig. 2. Typical low-temperature results for one solid neon sample, Ne 7. The rms deviation is 0.26%.

plot of $C_V(\Theta_0/T)^3$ vs. $(T/\Theta_0)^2$, while the Ne 8 data lie roughly 1% below this curve when $\Theta_0 = 91.1$ K is used. If, however, Θ_0 for Ne 8 is increased to 91.5 K, the Ne 8 data also lie on this common curve to better than $\pm 0.5\%$ except for the two points near 1 K. It is interesting to speculate that an orthohydrogen impurity of approximately 10 ppm could produce an effect of this magnitude.

Figures 3 and 4 present the experimental data in the form of deviations from smooth least-square fits of Eq. (3) to the C_{meas} (molar heat capacity

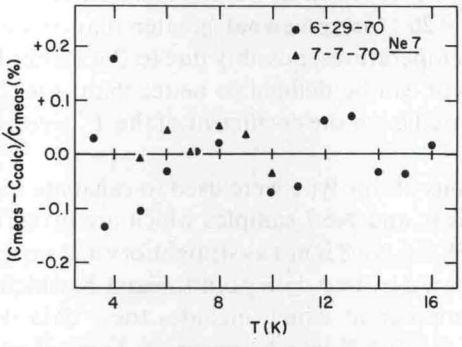

Fig. 3. Typical deviations of experimental data from a smooth curve for intermediate temperatures. The rms deviation is 0.07%.