In Fig. 6 are shown the perpendicular, Hall and parallel ($\lambda^{\perp}$ when B = 0) components of λ_r and λ_h for B = 100kG at this pressure. Note that the Hall components of λ_r and λ_h are negative, while λ_e^H is positive, reflecting the fact that the ions drift in the opposite direction from electrons in crossed fields. In connection with Fig. 6 it is interesting to consider the use of an applied magnetic field to reduce the thermal conductivity. For example, one could hope to reach higher axis temperatures in electrical arcs by reduction of the radial thermal conductivity. From Fig. 6 we see that there would be no reduction in the thermal conductivity of low temperature argon through the use of the B-field, which we would expect since this field cannot affect the atoms. $\lambda_r^{\perp}$ is reduced by almost an order of magnitude near the maximum through the slowing down of the ambipolar diffusion through the B-field. At higher temperatures the heavy translational thermal conductivity is considerably reduced. For comparison purposes, the electron thermal conductivity at p = 0.01 with no B-field is also plotted in Fig. 6.

As a last illustration of these computations, the electrical conductivity, as computed with three different methods, is plotted vs. pressure for temperatures of 10000 and 12000^{o}K in Figures 7 and 8. At 10000^{o}K, all three methods yield curves of the same general shape, although the absolute values differ somewhat. At 12000^{o}K, however, the asymptotic formulas of Ref. 26 yield an electrical conductivity curve which begins to diverge sharply from the other curves. As discussed above, this arises because the term $\ln \Lambda$ approaches order unity (actually near two). At higher temperatures, this divergence occurs at even lower pressures (e.g. for 15000^{o}K at about 50 atm).

DISCUSSION

The final check on calculations such as these should come from experimental measurements. Unfortunately, it has to date proved difficult to perform measurements with sufficient accuracy to critically evaluate these and similar theoretical predictions. Nonetheless, comparison with experiments is useful in judging which experiments agree best, if at all, with theory.

Experimental values of electrical conductivity at $p = 1$ atm are collected in Fig. 9. Theoretical curves have been computed as described here with shielding length equal to d' (Eq. 11) or d (Eq. 12). We note somewhat better agreement with the latter choice, although the former curve is probably still within the experimental error. It is evident that additional experiments at high temperatures, particularly beyond the maximum in the curve would be highly desirable. Also needed are measurements of σ. to check the validity of the models in these computations at high pressures.

In Fig. 10 are plotted experimental values of thermal conductivity as reported by several workers. All experimental values lie above the theoretical curve, some deviating much more strongly than others. Some of the major discrepancies can be explained as a faulty analysis of the experimental data. In neither Ref. 39 or Ref. 42 did the authors subtract the radiative transport of energy within the arc gas from their measurement of the total radial heat transport. Thus, their measured λ contains an unknown contribution due to radiative transport. It can be shown that this contribution is larger for larger diameter arcs, which explains why the curve from Ref. 39 is so much higher than that from Ref. 42 at the same temperature. Morris et al[43] did attempt to correct for radiative transport, so it is somewhat surprising that their average values of λ are so much higher than theory. The best agreement is with the values of Asinovskii and Kirillin,[46] who exploited the above-mentioned dependance of the radiative transport on radius to extrapolate back to zero radius and so obtain the true thermal conductivity.

In view of the generally higher experimental values of λ, it is worth inquiring if the theoretical values might not still be somewhat low. In order to bring the theory into agreement, substantial adjustments would be necessary in the charge transfer as well as