Abstract Submitted
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Transport coefficients of He^+ ions in helium RAINER JOHNSEN, University of Pittsburgh, LARRY VIEHLAND, Chatham University, BENJAMIN GRAY, TIMOTHY WRIGHT, University of Nottingham — New experimental mobilities of $^4He^+$ in ^4He at 298.7 K, as a function of E/N, have been determined. Uncertainties in the mobilities were reduced to about 1% by using a shuttered drift tube. Comparison with previously measured values show that only one set of previous data is reliable. We demonstrate that the mobilities and diffusion coeffcients of $^4He^+$ in ^4He can be calculated over wide ranges of E/N with high precision if accurate potential energy curves are available for the $X^2\Sigma_u^+$ and $A^2\Sigma_g^+$ states, and if one takes into account resonant charge transfer and corrects for quantum-mechanical effects. Potentials, obtained by extrapolation of results from d-aug-cc-pVXZ (X=6,7) basis sets using the CASSCF+MRCISD approach were found to be in exceptionally close agreement with the best potentials available (separately) and with experiment, and those were subsequently used in a new computer program to determine semi-classical phase shifts and transport cross sections, from which the gaseous ion transport coefficients are determined. A new set of data for the mobilities of alpha particles (He^{2+}) ions was obtained as a byproduct of the experiment, but the transport theory has not yet been completed.

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