

1992

Erratum: Asymptotic expansion for γ -function matrix elements of helium (Phys. Rev. a (1992) 45,9 (6933-6934))

Gordon W. F. Drake
University of Windsor

Follow this and additional works at: <http://scholar.uwindsor.ca/physicspub>



Part of the [Physics Commons](#)

Recommended Citation

Drake, Gordon W. F. (1992). Erratum: Asymptotic expansion for γ -function matrix elements of helium (Phys. Rev. a (1992) 45,9 (6933-6934)). *Physical Review A*, 45 (9), 6933-6934.
<http://scholar.uwindsor.ca/physicspub/74>

This Response or Comment is brought to you for free and open access by the Department of Physics at Scholarship at UWindsor. It has been accepted for inclusion in Physics Publications by an authorized administrator of Scholarship at UWindsor. For more information, please contact scholarship@uwindsor.ca.

closer to the nongrid results with a very much smaller grid-focusing effect than in our original calculation as shown in inset (c) of Fig. 1. The net effect is that in case (c) the punch through fields increases the maximum energy that can be collected with 100% efficiency (excluding grid transmission losses) by the detector from 4 to 5 eV. Also note that the more realistic simulations of insets (b) and (c) have a well-defined maximum energy that can be detected, while for case (a) the trajectories tend to be randomized by the grids.

The problem with modeling grid-focusing effects should not have any bearing on the results reported by us on CF_4 with the possible exception of the partial ionization cross section for F^+ since that is the only ion which is believed to have initial kinetic energies capable of exceeding our upper collection limit. Hence our published results in the case of F^+ can be regarded as a lower bound on the true result. Our model calculations indicate that for our geometry using an extraction field of 167 V/cm (200 V across 12 mm) it is necessary to employ a drift potential between 1500 and 2000 V in order to guarantee 100% collection of ions with an initial kinetic energy of 10 eV. However, experimentally we find that there is less than a 5% change in the F^+ count rate at 80-, 150-, and 500-eV electron impact energies for extraction voltages (V_e) between 50 and 90 V and drift voltages (V_d) between -600 and -1000 V, while there is a considerable loss in count rate for lower voltages. From the SIMION calculations, this implies that most of the F^+ ions must dissociate with less than 5 eV of kinetic energy. The experimental conditions in the original paper were 60 V for the extraction and -800 V for the drift tube, therefore we expect the F^+ cross sections in Table I of the original paper to be well within their stated 15% uncertainties (that is to say, the 15% uncertainty has built into it the uncertainties in the effects of the kinetic energies of the ions). Recently new results have appeared for CF_4 [1] which are in agreement with our published results although the F^+ cross section, still within our error bars, was systematically larger than ours. It may be that the problem discussed above is related to this last observation.

One additional correction is that on p. 2934 of the original article, in the sentence beginning 9 lines from the bottom of the left-hand column, the range over which the relative efficiency of the detector was tested for ion impact energy should read 2–3 keV, and not 2–4 keV as stated. That this range is too narrow to get a valid test of the sensitivity to detector impact energy is discussed elsewhere [2]. The implications of this problem do not lead to significant corrections to any of our singly charged cross sections, but do have some influence on the results for the doubly charged cross sections although not nearly enough to explain the disagreement between our results and those of [1].

In conclusion we would like to emphasize that it is important to model grid-focusing effects, but that problems can arise by using SIMION to do this if insufficient field sampling points are employed. It is also important to point out that a shorter extraction tube can increase the maximum collectable initial ion energy, but if it is too short a field punch through may alter the course of the incoming electron pulse. Fast ions can be focused by the use of electrostatic lenses but ions with low kinetic energy may be lost in the process. In the present approach all ion energies less than the maximum detectable are collected.

We wish to acknowledge support from NSF Grant No. PHY-8913096 and to thank Professor G. G. B. de Souza for calling this problem to our attention.

- [1] H. U. Poll, C. Winkler, D. Margreiter, V. Grill, and T. D. Mark, *Int. J. Mass Spectrom. Ion Proc.* **112**, 1 (1992).
 [2] M. R. Bruce and R. A. Bonham (unpublished).

© 1992 The American Physical Society

Erratum: Asymptotic expansion for δ -function matrix elements of helium [Phys. Rev. A 45, 70 (1992)]

G. W. F. Drake

PACS number(s): 31.20.Di, 31.15.+q, 31.30.Gs, 99.10.+g

The line labeled ϵ in Table I of this paper is incorrect. The corrected values are given below. The numerical values in the other tables are correct.

TABLE I. Asymptotic expansion coefficients for the energy (ξ) and δ function ($\Delta\xi$). For each line, ξ stands for the coefficient in the first column.

Coeff. (ξ)	ξ	$\Delta\xi$	$\Delta\xi'$	$\Delta\xi''$
ϵ	$\frac{4329}{32Z^{10}}$	$\frac{131\,393}{64Z^{12}}$	$\frac{122\,035}{128Z^{12}}$	$\frac{140\,751}{128Z^{12}}$

Also, there are the following typing errors in the text.

- (i) On the right-hand side of Eq. (9), Ψ_{k-j} should be Ψ_{j-k} .
- (ii) Δ_m should be replaced by D_m on the left-hand side of Eq. (18) and the right-hand side of Eq. (21).
- (iii) In Eq. (26), x^{-l-l} should be x^{-l-1} .
- (iv) A factor of $4\pi/(2l+1)$ is missing from the right-hand sides of Eqs. (27) and (29).
- (v) In the seventh line following Eq. (41), the replacement should be $n \rightarrow n_0$ instead of $p \rightarrow p_0$.
- (vi) In the text following Eq. (76), the two references to Eq. (56) should be to Eq. (55).
- (vii) The second term of Eq. (73) should be $2\langle \varphi_0 \chi_0^{(1)} | W | \varphi_0 \chi_0 \rangle$.
- (viii) A factor of π is missing from the left-hand side of the unnumbered equation following Eq. (89).
- (ix) At the top of p. 78, the text should read " $\mu/M = 1.370\,745\,620 \times 10^{-4}$ ".

(x) In Eqs. (49), (79), and (85), there is an additional Z scaling of the γ and $\Delta\gamma$ terms which comes from the use of the recursion relation $(Z-1)^2 \langle x^{-6} \rangle_{nL} / n^2 = \frac{11}{5} (Z-1) \langle x^{-7} \rangle_{nL} - \frac{3}{10} [(2L+1)^2 - 36] \langle x^{-8} \rangle_{nL}$ for these terms. The effect is to replace the $\langle x^{-7} \rangle_{nL}$ coefficients $\frac{16}{5}\gamma$ and $\frac{16}{5}\Delta\gamma$ in Eqs. (49) and (79) by $\frac{16}{5}\gamma(Z-1)$ and $\frac{16}{5}\Delta\gamma(Z-1)$, respectively, and $\frac{16}{5}\Delta\gamma(Z-1)$ in Eq. (85) by $\frac{16}{5}\Delta\gamma(Z-1)^2$. The additional Z scaling has no effect on the helium results.