Erratum: Gamow shell model description of the radiative capture reaction ^{8}Li(n, γ)^{9}Li [Phys. Rev. C 105, 064608 (2022)]

G. X. Dong, X. B. Wang, N. Michel, and M. Płoszajczak*

(Received 14 August 2023; published 6 October 2023)

DOI: 10.1103/PhysRevC.108.049902

Due to an error in the code, related to the effective charge, the calculated radiative capture cross sections have to be corrected. It originated from a wrong normalization of capturing states in radiative capture cross sections. Hence, in order to compensate for this error, larger effective charges were used to reproduce experimental data. The code used is publicly available in Ref. [1] and the error has been corrected in the latest version. The error in cross sections is proportional to the square of the scaling factor f_{E1} in the used effective charge. However, the overall shape of the cross section is almost the same.

In this erratum, we present the corrected cross section of neutron capture reaction ^{8}Li(n, γ)^{9}Li, in Fig. 2. The corrected Table VI is given. The corrected astrophysical reaction rate is shown in Fig. 7, and the corrected rate at $T_9 = 1$ is given in Fig. 8.

The corrected rate by GSM-CC of neutron capture reaction ^{8}Li(n, γ)^{9}Li agrees well with earlier estimates, and within the experimental limits. It indicates the destruction of ^{8}Li in the early universe, and a reduction of the nucleosynthesis of heavier elements in the principal chain of reactions: ^{8}Li(α, n)^{11}B(n, γ)^{12}B(β^{+})^{12}C....

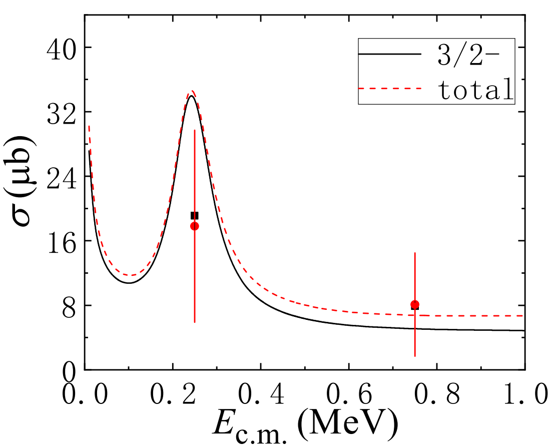

FIG. 2. The GSM-CC neutron radiative capture cross section of the reaction ^{8}Li(n, γ)^{9}Li is plotted as a function of the neutron projectile energy in the $n + {}^{8}$Li center of mass frame. The solid line shows the direct capture to the ground state $J^{\pi} = 3/2_1^-$ of ^{9}Li and the red dashed line exhibits the total neutron radiative capture cross section which is a sum of contributions from the capture to $J^{\pi} = 3/2_1^-$, $1/2_1^-$, and $5/2_1^-$ final states. All lines represent the fully antisymmetrized GSM-CC results in the long wavelength approximation [2–4]. The red points and black squares are the upper limits obtained in the Coulomb-dissociation experiment with Pb and U targets, respectively [5]. Experimental cross sections at $\tilde{E}_n = 0.25$ MeV and 0.75 MeV correspond to average cross sections in the two decay energy bins: $E_n \in [0.0, 0.5]$ MeV and $E_n \in [0.5, 1.0]$ MeV.

*ploszajczak@ganil.fr

TABLE VI. The GSM-CC direct neutron radiative capture cross section to the ground state $J^{\pi} = 3/2^{-}$ of ^{9}Li is compared to the experimental data [5]. Contributions to the cross section from the neutron capture to the first excited bound state $1/2^{-}_{1}$ and the first resonance $5/2^{-}_{1}$ are shown as well. Experimental and theoretical cross sections are averaged in the two decay energy bins: $E_n \in [0.0, 0.5]$ MeV and $E_n \in [0.5, 1.0]$ MeV, and assigned to the representative energies $\tilde{E}_n = 0.25$ and 0.75 MeV, respectively.

GSM-CC			Experiment [5]		
$\tilde{E}_n$	0.25 MeV	0.75 MeV	$\tilde{E}_n$	0.25 MeV	0.75 MeV
J^{π}	σ (μb)	σ (μb)	Target	σ (μb)	σ (μb)
$3/2^{-}$	15.23	5.24	U	19.1 × 10.4	7.9 × 5.5
			Pb	17.8 × 11.9	8.1 × 6.4
$1/2^{-}$	0.80	0.59			
$5/2^{-}$	0.54	1.11			

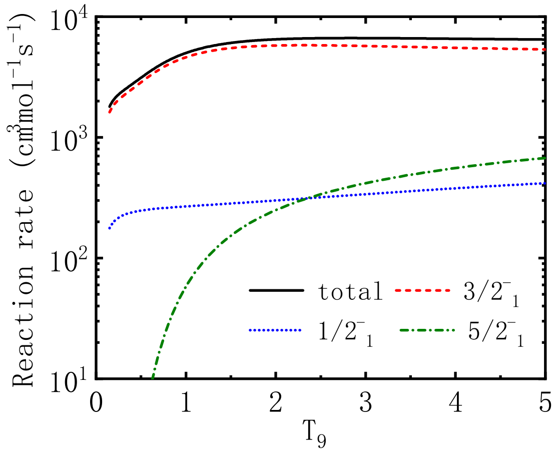

FIG. 7. The rate of the ^{8}Li$(n,\gamma)^{9}$Li reaction calculated in GSM-CC is shown as a function of temperature T_9. The total reaction rate is depicted by the solid line. The separate contributions from the ground state $3/2^{-}_{1}$ and excited states $1/2^{-}_{1}$, $5/2^{-}_{1}$ are shown by dashed, dotted, and dashed-dotted lines, respectively.

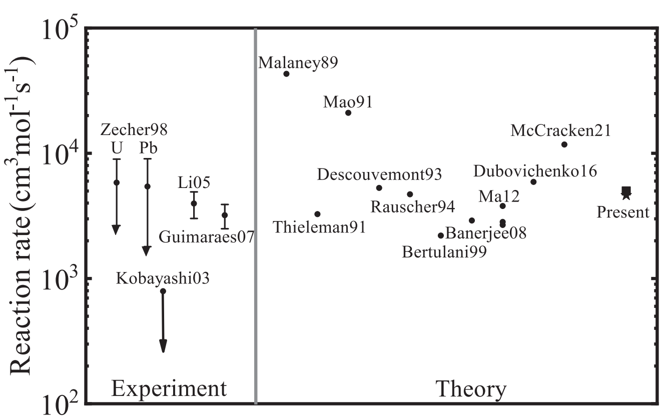

FIG. 8. The comparison of experimental [5–8] and theoretical [9–18] reaction rates for the direct radiative neutron capture ^{8}Li$(n,\gamma)^{9}$Li at $T_9 = 1$. The experimental upper limits in the Coulomb dissociation experiment with Pb and U targets [5] are shown separately. The GSM-CC results are labeled as 'Present'. The star and square symbols stand for the rate of the direct neutron capture to the ground state $3/2^{-}_{1}$ and total reaction rate obtained, respectively.

This work has been supported by the National Natural Science Foundation of China under Grant Nos. U2067205, 12275081, 12175281, 11605054, and U1732138.

---

[1] https://github.com/GSMUTNSR.
[2] K. Fossez, N. Michel, M. Płoszajczak, Y. Jaganathen, and R. M. Id Betan, Phys. Rev. C **91**, 034609 (2015).
[3] G. X. Dong, N. Michel, K. Fossez, M. Płoszajczak, Y. Jaganathen, and R. M. Id Betan, J. Phys. G: Nucl. Part. Phys. **44**, 045201 (2017).
[4] N. Michel and M. Płoszajczak, *Gamow Shell Model – The Unified Theory of Nuclear Structure and Reactions*, Lecture Notes in Physics Vol. 983 (Springer, Cham, 2021).
[5] P. D. Zecher, A. Galonsky, S. J. Gaff, J. J. Kruse, G. Kunde, E. Tryggestad, J. Wang, R. E. Warner, D. J. Morrissey, K. Ieki, Y. Iwata, F. Deák, A. Horváth, A. Kiss, Z. Seres, J. J. Kolata, J. von Schwarzenberg, and H. Schelin, Phys. Rev. C **57**, 959 (1998).
[6] H. Kobayashi, K. Ieki, Á. Horváth, A. Galonsky, N. Carlin, F. Deák, T. Gomi, V. Guimaraes, Y. Higurashi, Y. Iwata, Á. Kiss, J. J. Kolata, T. Rausche, H. Schelin, Z. Seres, and R. Warner, Phys. Rev. C **67**, 015806 (2003).
[7] Z. H. Li, W. P. Liu, X. X. Bai, B. Guo, G. Lian, S. Q. Yan, B. X. Wang, S. Zeng, Y. Lu, J. Su, Y. S. Chen, K. S. Wu, N. C. Shu, and T. Kajino, Phys. Rev. C **71**, 052801(R) (2005).
[8] V. Guimarães, R. Lichtenthäler, O. Camargo, A. Barioni, M. Assunção, J. J. Kolata, H. Amro, F. D. Becchetti, H. Jiang, E. F. Aguilera, D. Lizcano, E. Martines-Quiroz, and H. Garcia, Phys. Rev. C **75**, 054602 (2007).
[9] R. Malaney and W. F. Fowler, Astrophys. J. Lett. **345**, L5 (1989).
[10] Z. Mao and A. Champagne, Nucl. Phys. A **522**, 568 (1991).
[11] H. L. Ma, B. G. Dong, Y. L. Yan, and X. Z. Zhang, Eur. Phys. J. A **48**, 125 (2012).
[12] P. Descouvemont, Astrophys. J. **405**, 518 (1993).
[13] S. B. Dubovichenko and A. V. Dzhazairov-Kakhramanov, Astrophys. J. **819**, 78 (2016).
[14] C. A. Bertulani, J. Phys. G: Nucl. Part. Phys. **25**, 1959 (1999).
[15] P. Banerjee, R. Chatterjee, and R. Shyam, Phys. Rev. C **78**, 035804 (2008).
[16] C. McCracken, P. Navrátil, A. McCoy, S. Quaglioni, and G. Hupin, Phys. Rev. C **103**, 035801 (2021).
[17] F. K. Thielemann, J. H. Applegate, J. H. Cowan, and M. Wiescher, in *Nuclei in the Cosmos*, Baden/Vienna 1990, edited by H. Oberhummer (Springer-Verlag, Heildelberg, 1991), p. 147.
[18] T. Rauscher, J. H. Applegate, J. J. Cowan, F.-K. Thielemann, and M. Wiescher, Astrophys. J. **429**, 499 (1994).