

PHYSICAL REVIEW C (/PRC/)
covering nuclear physics

[Highlights \(/prc/highlights\)](#) [Recent \(/prc/recent\)](#) [Accepted \(/prc/accepted\)](#) [Collections \(/prc/collections\)](#) [Authors \(/prc/authors\)](#)
[Referees \(/prc/referees\)](#) [Search \(/search\)](#) [Press \(/press\)](#) [About \(/prc/about\)](#) [Editorial Team \(/prc/staff\)](#) [RSS \(/feeds\)](#)

Elastic scattering and breakup reactions of the mirror nuclei ^{12}B and ^{12}N on ^{208}Pb using *ab initio* structure inputs

K. Wang *et al.* (RIBLL Collaboration)
Phys. Rev. C **109**, 014624 – Published 29 January 2024

More

Article

[PDF \(/prc/pdf/10.1103/PhysRevC.109.014624\)](#) [HTML \(/prc/abstract/10.1103/PhysRevC.109.014624#fulltext\)](#)
[Export Citation \(/prc/export/10.1103/PhysRevC.109.014624\)](#)



ABSTRACT

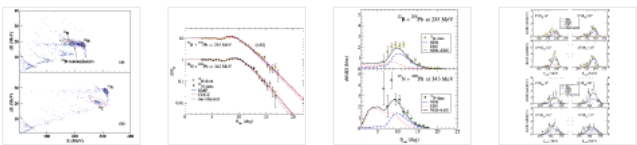
AUTHORS

ARTICLE TEXT

- [INTRODUCTION](#)
- [EXPERIMENT AND DATA ANALYSES](#)
- [RESULTS AND DISCUSSIONS](#)
- [SUMMARY](#)
- [ACKNOWLEDGMENTS](#)
- [REFERENCES](#)

ABSTRACT

The angular distributions for the elastic scattering and breakup reactions of the mirror nuclei ^{12}B and ^{12}N on a ^{208}Pb target, at incident energies of 255 MeV and 343 MeV, respectively, were measured at HIRFL-RIBLL. The elastic scattering and breakup angular distributions of the halo-like nucleus ^{12}N ($S_p = 0.601$ MeV) have been measured simultaneously. Elastic scattering cross sections were accurately reproduced by continuum discretized coupled channel calculations, which did not exhibit any significant Coulomb rainbow suppression. We have analyzed the energy and angular distributions of inclusive ^{11}B and ^{11}C fragments, produced by direct reaction processes, taking into account the contributions from both elastic breakup (EBU) and nonelastic breakup (NEB). Since the breakup data is inclusive with respect to the final state of the core nucleus, the contribution of each of these core states was calculated separately and then the corresponding cross sections added together using as weights the spectroscopic factors for each configuration computed with the *ab initio* no-core shell model. The results were found to be mostly consistent with the experimental data and, furthermore, demonstrate that EBU is highly dependent on the binding energy, while the results of NEB show no clear effect.



Received 25 July 2023 Accepted 11 January 2024

DOI: <https://doi.org/10.1103/PhysRevC.109.014624>

©2024 American Physical Society

Physics Subject Headings (PhySH)

Research Areas



[Breakup reactions \(/search/results?clauses=%5B%7B%22field%22%3A%22physh%22%2C%22value%22%3A%22%7B%5C%22facetid%5C%22%3Anull%2C%5C%22conceptid%5C%22%3A%5C%22%2C%5C%22label%5C%22%3A%5C%22Breakup%20reactions%5C%22%2C%5C%22facetlabel%5C%22%3A%5C%22%5C%22%7D%22%2C%22operator%22%3A%22%26%20induced%20nuclear%20reactions%5C%22%2C%5C%22facetlabel%5C%22%3A%5C%22%5C%22%7D%22%2C%22operator%22%3A%22%26%20direct%20reactions%5C%22%2C%5C%22facetlabel%5C%22%3A%5C%22%5C%22%7D%22%2C%22operator%22%3A%22%26%20elastic%20scattering%20reactions%5C%22%2C%5C%22facetlabel%5C%22%3A%5C%22%5C%22%7D%22%2C%22operator%22%3A%22%26%20heavy-ion%20reaction%20mechanisms%5C%22%2C%5C%22facetlabel%5C%22%3A%5C%22%5C%22%7D%22%2C%22operator%22%3A%22AND%22%7D%5D&per_page=20\)](#)

[Heavy-ion reaction mechanisms \(/search/results?clauses=%5B%7B%22field%22%3A%22physh%22%2C%22value%22%3A%22%7B%5C%22facetid%5C%22%3Anull%2C%5C%22conceptid%5C%22%3A%5C%22%2C%5C%22label%5C%22%3A%5C%22Heavy-ion%20reaction%20mechanisms%5C%22%2C%5C%22facetlabel%5C%22%3A%5C%22%5C%22%7D%22%2C%22operator%22%3A%22AND%22%7D%5D&per_page=20\)](#)

[Unstable nuclei induced nuclear reactions \(/search/results?clauses=%5B%7B%22field%22%3A%22physh%22%2C%22value%22%3A%22%7B%5C%22facetid%5C%22%3Anull%2C%5C%22conceptid%5C%22%3A%5C%22%2C%5C%22label%5C%22%3A%5C%22Unstable%20nuclei%20induced%20nuclear%20reactions%5C%22%2C%5C%22facetlabel%5C%22%3A%5C%22%5C%22%7D%22%2C%22operator%22%3A%22%26%20induced%20nuclear%20reactions%5C%22%2C%5C%22facetlabel%5C%22%3A%5C%22%5C%22%7D%22%2C%22operator%22%3A%22%26%20direct%20reactions%5C%22%2C%5C%22facetlabel%5C%22%3A%5C%22%5C%22%7D%22%2C%22operator%22%3A%22%26%20elastic%20scattering%20reactions%5C%22%2C%5C%22facetlabel%5C%22%3A%5C%22%5C%22%7D%22%2C%22operator%22%3A%22%26%20heavy-ion%20reaction%20mechanisms%5C%22%2C%5C%22facetlabel%5C%22%3A%5C%22%5C%22%7D%22%2C%22operator%22%3A%22AND%22%7D%5D&per_page=20\)](#)

Properties

[6 ≤ A ≤ 19 \(/search/results?clauses=%5B%7B%22field%22%3A%22physh%22%2C%22value%22%3A%22%7B%5C%22facetid%5C%22%3Anull%2C%5C%22conceptid%5C%22%3A%5C%22%2C%5C%22label%5C%22%3A%5C%226%20%26%20E%2%89%A4%20A%20%26%20%26%20E%2%89%A4%2019%5C%22%2C%5C%22facetlabel%5C%22%3A%5C%22%5C%22%7D%22%2C%22operator%22%3A%22AND%22%7D%5D&per_page=20\)](#)

Techniques

[Ab initio calculations \(/search/results?clauses=%5B%7B%22field%22%3A%22physh%22%2C%22value%22%3A%22%7B%5C%22facetid%5C%22%3Anull%2C%5C%22conceptid%5C%22%3A%5C%22%2C%5C%22label%5C%22%3A%5C%22Ab%20initio%20calculations%5C%22%2C%5C%22facetlabel%5C%22%3A%5C%22%5C%22%7D%22%2C%22operator%22%3A%22AND%22%7D%5D&per_page=20\)](#)

[Optical, coupled-channel & distorted wave models \(/search/results?clauses=%5B%7B%22field%22%3A%22physh%22%2C%22value%22%3A%22%7B%5C%22facetid%5C%22%3Anull%2C%5C%22conceptid%5C%22%3A%5C%22%2C%5C%22label%5C%22%3A%5C%22Optical%20coupled-channel%20%26%20distorted%20wave%20models%5C%22%2C%5C%22facetlabel%5C%22%3A%5C%22%5C%22%7D%22%2C%22operator%22%3A%22AND%22%7D%5D&per_page=20\)](#)

[Radioactive beams \(/search/results?clauses=%5B%7B%22field%22%3A%22physh%22%2C%22value%22%3A%22%7B%5C%22facetid%5C%22%3Anull%2C%5C%22conceptid%5C%22%3A%5C%22%2C%5C%22label%5C%22%3A%5C%22Radioactive%20beams%5C%22%2C%5C%22facetlabel%5C%22%3A%5C%22%5C%22%7D%22%2C%22operator%22%3A%22AND%22%7D%5D&per_page=20\)](#)

[Shell model \(/search/results?clauses=%5B%7B%22field%22%3A%22physh%22%2C%22value%22%3A%22%7B%5C%22facetid%5C%22%3Anull%2C%5C%22conceptid%5C%22%3A%5C%22%2C%5C%22label%5C%22%3A%5C%22Shell%20model%5C%22%2C%5C%22facetlabel%5C%22%3A%5C%22%5C%22%7D%22%2C%22operator%22%3A%22AND%22%7D%5D&per_page=20\)](#)

Nuclear Physics

AUTHORS & AFFILIATIONS
CLICK TO EXPAND

ARTICLE TEXT (SUBSCRIPTION REQUIRED)
CLICK TO EXPAND

REFERENCES (SUBSCRIPTION REQUIRED)
CLICK TO EXPAND

Issue
Vol. 109, Iss. 1 — January 2024 ([/prc/issues/109/1](#))



ArticleTitle=Elastic+scattering+and+breakup+reactions+of+the+mirror+nuclei+ ^{12}B +and+ ^{12}C

Access Options
[Buy Article » \(/cart/add/10.1103/PhysRevC.109.014624\)](#)
[Log in with individual APS Journal Account » \(https://journals.aps.org/login\)](#)



[\(/prxlife/?](#)

[utm_source=prc&utm_medium=web&utm_campaign=prxlife\)](#)



[\(/prxenergy/?utm_source=prc&utm_medium=web&utm_campaign=prxenergy\).](#)



[\(https://authorservices.aps.org/?utm_source=physicalreviewjournals&utm_medium=referral\)](#)

Sign up to receive regular email alerts from *Physical Review C*

Sign up [\(/https://info.aps.org/journals-emails\)](#)

AUTHORS General Information (/prc/authors) Submit a Manuscript (https://authors.aps.org/Submissions/) Publication Rights (/pub_rights.html) Open Access (/open_access.html) SCOAP³ (/authors/scoap3) Policies & Practices (/authors/editorial-policies) Tips for Authors (/authors/tips-authors-physical-review-physical-review-letters) Professional Conduct (/authors/professional-conduct-ethics)	REFEREES General Information (/prc/referees) Submit a Report (http://referees.aps.org/) Update Your Information (http://referees.aps.org/) Policies & Practices (/authors/editorial-policies) Referee FAQ (/referees/faq.html) Guidelines for Referees (/prc/referees/advice-referees-physical-review) Outstanding Referees (/OutstandingReferees) LIBRARIANS General Information (https://librarians.aps.org/) Subscriptions (https://librarians.aps.org/subscriptions) Online License Agreement (https://librarians.aps.org/sitelicense.pdf) Usage Statistics (https://librarians.aps.org/login) Your Account (https://librarians.aps.org/account)
STUDENTS Physics (https://physics.aps.org) PhysicsCentral (http://www.physicscentral.com/) Student Membership (https://www.aps.org/membership/student.cfm)	APS MEMBERS Subscriptions (https://www.aps.org/membership/aps-publications.cfm) Article Packs (https://journals.aps.org/article-packs) Membership (https://www.aps.org/membership/index.cfm) FAQ (https://www.aps.org/membership/faq.cfm) APS News (https://www.aps.org/publications/apsnews/index.cfm) Meetings & Events (https://www.aps.org/meetings/index.cfm)