Nuclear Science and Transmutation Research Division
Superheavy Element Research Group
Superheavy Element Device Development Team

1. Abstract

A gas-filled recoil ion separator has been used as a main experimental device for the study of superheavy elements. This team is in charge of maintaining, improving, developing, and operating the separators and related devices. In the RIBF facility, three gas-filled recoil ion separators are installed at RILAC and RRC facility. One is GARIS that is designed for a symmetric reaction such as coldfusion reaction, and the other two are developed for an asymmetric reaction such as hot-fusion reaction, GARIS-II and GARIS-III. New elements ^{278}113 were produced by ^{70}Zn + ^{209}Bi reaction using GARIS. Further the new element search is currently in progress by using GARIS-II and GARIS-III.

2. Major Research Subjects

(1) Maintenance of GARIS, GARIS-II and development of new separator GARIS-III
(2) Maintenance and development of detector and DAQ system for superheavy element research
(3) Maintenance and development of target system for GARIS, GARIS-II and GARIS-III

3. Summary of Research Activity

The GARIS-II and III are newly developed which has an acceptance twice as large as existing GARIS, in order to realize higher transmission. A new element search program aiming to element 119 was started using GARIS-II. And new separator GARIS-III was developed and installed into the RILAC experimental hall. After the some commissioning works of GARIS-III, new 119th element search has been started. We will also offer user-support if a researcher wishes to use the devices for his/her own research program.

Members

Team Leader

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Student Trainees

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List of Publications & Presentations

Publications

[Original Papers]

S. Hofmann, S. N. Dmitriev, C. Fahlander, J. M. Gates, J. B. Roberto, and H. Sakai, "On the discovery of new elements (IUPAC/IUPAP Report), —Report of the 2017 Joint Working Group of IUPAC and IUPAP—," Pure Appl. Chem. **92**, 1387 (2020).

[Review Articles]

庭瀬暁隆, 「MRTOF+α-TOF による ^{257}Db の直接質量測定」, 放射化学 **43**, 31 (2021 年 3 月).

Presentations

[International Conferences/Workshops]

K. Morimoto (oral), "Present status and plans of GARIS, GARIS-II and GARIS-III," SSRI-PNS Collaboration Meeting 2020, online, September 3, 2020.

[Domestic Conferences/Workshops]

庭瀬暁隆 (口頭), P. Schury, 和田道治, P. Brionnet, S. Chen, 橋本尚志, 羽場宏光, 平山賀一, D. S. Hou, 飯村俊, 石山博恒, 石澤倫, 伊藤由太, 加治大哉, 木村創大, 小浦寛之, J. Liu, 宮武宇也, J. Y. Moon, 森田浩介, 森本幸司, 長江大輔, M. Rosenbusch, 高峰愛子, 渡辺裕, W. Xian, S. X. Yan, H. Wollnik, 「MRTOF + α-TOF による ^{257}Db の直接質量測定」, 日本放射化学会第 64 回討論会 (2020), オンライン, 2020 年 9 月 9 日–11 日.

庭瀬暁隆 (口頭), 「MRTOF + α-TOF 検出器による（超）重核の精密質量と α 崩壊の相関測定」, 2020 重元素核化学ワークショップ, オンライン, 2021 年 3 月 30 日.

Awards

庭瀬暁隆, 若手優秀発表賞, 日本放射化学会第 64 回討論会 (2020), 令和 2 年度 理研桜舞賞, 理化学研究所.

Others

石澤 倫, 「超重元素探索に用いられる TOF 検出器の検出率向上に関する研究」, 山形大学大学院理工学研究科博士学位論文 (2021).

Toshitaka Niwase, "First direct mass measurement of superheavy nuclide via MRTOF mass spectrograph equipped with an α-TOF detector," Department of Physics, Kyushu University, Doctoral Thesis (2021).

内藤夏樹, 「後方準弾性散乱測定による ^{51}V + ^{248}Cm/^{208}Pb 系の融合障壁分布の 研究」, 九州大学大学院理学研究院修士論文 (2021).