Research Facility Development Division
Research Instruments Group
SAMURAI Team

1. Abstract

In collaboration with research groups in and outside RIKEN, the team designs, develops and constructs the SAMURAI spectrometer and relevant equipment that are and will be used for reaction experiments using RI beams at RI Beam Factory. The SAMURAI spectrometer consists of a large superconducting dipole magnet and a variety of detectors to measure charged particles and neutrons. After the commissioning experiment in March 2012, the team prepared and conducted, in collaboration with researchers in individual experimental groups, the first series of experiments with SAMURAI in May 2012. Then, amount numbers of experiments were well performed until now utilizing the property of SAMURAI. The team also provides a basis for research activities by, for example, organizing collaboration workshops by researchers who are interested in studies or plan to perform experiments with the SAMURAI spectrometer.

2. Major Research Subjects

Design, operation, maintenance and improvement of the SAMURAI spectrometer and its related research instruments. Support and management for 2 research programs. Generate future plans for next generation instruments for nuclear reaction studies.

3. Summary of Research Activity

The current research subjects are summarized as follows:

(1) Operation, maintenance and improvement of a large superconducting dipole magnet, the main component of the SAMURAI spectrometer
(2) Design, development and construction of various detectors that are used for nuclear reaction experiments using the SAMURAI spectrometer
(3) Preparation for planning experiments using SAMURAI spectrometer
(4) Maintenance and improvement of the SAMURAI beam line
(5) Formation of a collaboration platform called “SAMURAI collaboration”
(6) Preparation for next generation spectrometer for nuclear reaction studies

Members

Team Leader

Hideaki OTSU

Visiting Researcher

Julien J.J.C. LEMARIE (JSPS)

List of Publications & Presentations

Publications

[Original Papers]

P. Andre *et al*., “Evolution of the two-neutron configuration from ^{11}Li to ^{13}Li,” Phys. Lett. B **857**, 138977 (2024).

C. Y. Tsang, M. Kurata-Nishimura *et al*., “Constraining nucleon effective masses with flow and stopping observables from the SπRIT experiment,” Phys. Lett. B **853**, 138661 (2024).

J. Kahlbow *et al*., “Magicity versus Superfluidity around ^{28}O viewed from the Study of ^{30}F,” Phys. Rev. Lett. **133**, 082501 (2024).

B. D. Linh *et al*., “Onset of collectivity for argon isotopes close to $N = 32$,” Phys. Rev. C **109**, 034312 (2024).

B. Monteagudo *et al*., “Mass, spectroscopy and two-neutron decay of ^{16}Be,” Phys. Rev. Lett. **132**, 082501 (2024).

Presentations

[International Conferences/Workshops]

SAMURAI International Workshop 2024. IBS, Korea, July 14–16, 2024
`https://indico.ibs.re.kr/event/677/` .

T. Isobe, “Experimental study of asymmetric nuclear matter EOS from heavy-ion reactions with RIBF-SPiRIT,” Workshop on Evolution of Matter in the Universe, RIKEN, June 5, 2024.

J. Lemarie, “Probe the pygmy dipole resonance of ^{50}Ca by Coulomb excitation” DREB 2024, Wiesbaden Kurhaus, Germany, June 24–28, 2024.

T. Isobe, “Measurement of charged pion ratio in RI collisions for the constraint of density dependent nuclear symmetry energy at RIKEN-RIBF,” Seminar on nuclear physics at Tsinghua University, China Beijing, August 9, 2024.

J. Lemarie, “Probe the pygmy dipole resonance of ^{50}Ca by Coulomb excitation,” NN2024, Whistler Conference center, Canada, August 18–23, 2024.

T. Isobe, “Systematic measurement of charged pion production in HIC with RI beams at RIKEN-RIBF,” XIIth International Symposium on Nuclear Symmetry Energy (NuSym24) France GANIL, September 10, 2024.

T. Isobe, “Heavy ion collision experiments by using RI beam at RIBF for the study of high dense neutron rich nuclear matter,” 3rd RIKEN RNC − CAS IMP Joint Symposium, RIKEN, November 8, 2024.

T. Isobe, “From nucleus to neutron star: experimental study of nuclear matter by using heavy ion collisions,” Korea-Japan Symposium on TOPTIER Platform in Extreme Rare Isotope Science Korea Seoul National Unit., December 17, 2024.

T. Isobe, “Heavy ion collision experiment by using RI beam at RIBF for the study of density dependent symmetry energy,” RCNP − CENuM − OMEG Symposium on Nuclear Structure, Reaction, and Astrophysics: NuSRAP2024 Osaka University RCNP, December 18, 2024.

H. Otsu (invited), “ Recent progress and achievements with the SAMURAI Spectrometer,” VII Topical Workshop on Modern Aspects in Nuclear Structure, The Many Facets of Nuclear Structure, Bormio, Italy, February 3–8, 2025.

T. Isobe, “High density, Neutron Star EoS—experimental study of many body system of asymmetric nuclear matter at RIKEN-RIBF—,” The 2nd Workshop on Highly Baryonic Matter at RHIC-BES and Future Facilities— beyond the Critical Point towards Neutron Stars— (WHBM2025) Tsukuba University, March 29, 2025.

[Domestic Conferences/Workshops]

大津秀暁, 「逆運動学法を用いた終状態の同定と核データへの寄与」, 将来の核データワークショップ「残留核の反跳」, シグマ調査専門委員会, 2024 年 5 月.

高橋里緒, 「多中性子系観測のための新型中性子検出器のシミュレーション」, 日本物理学会第 79 回年次大会, 2024 年 9 月, 北海道大学.

槇村泰都, 「多中性子系観測のための新型中性子検出器の性能評価」, 日本物理学会第 79 回年次大会, 2024 年 9 月, 北海道大学.

安部清尚, 「ニュートリノジェネレータ NEUT における電子散乱の実装と初期評価」, 日本物理学会第 79 回年次大会, 2024 年 9 月, 北海道大学.

中島康博, 「ニュートリノ原子核反応予測の精度向上に向けた酸素ビーム実験の概要」, 日本物理学会第 79 回年次大会, 2024 年 9 月, 北海道大学.

水野祐介, 「ニュートリノ原子核反応予測の精度向上に向けた酸素ビーム実験の検出器シミュレーション」, 日本物理学会第 79 回年次大会, 2024 年 9 月, 北海道大学.

磯部忠昭, 「RI ビーム衝突を用いた原子核 EOS の実験的研究」, 第 2 回 J-PARC と重イオン衝突実験の交差点, J-PARC, 2025 年 3 月 7 日.

大澤悠真, 「^{14}Be のクーロン分解反応III」, 日本物理学会 2025 年春季大会, オンライン, 2025 年 3 月.

安部清尚, 「ニュートリノ酸素原子核反応予測の精度向上に向けた SAMURAI-79 実験の概要」, 日本物理学会 2025 年春季大会, オンライン, 2025 年 3 月.

水野祐介, 「ニュートリノ酸素原子核反応予測の精度向上に向けた SAMURAI-79 実験の検出器シミュレーション—陽子ノックアウト反応の測定—」, 日本物理学会 2025 年春季大会, オンライン, 2025 年 3 月.

林崎響, 「ニュートリノ酸素原子核反応予測の精度向上に向けた SAMURAI-79 実験の検出器シミュレーション—中性子ノックアウト反応の測定—」, 日本物理学会 2025 年春季大会, オンライン, 2025 年 3 月.

姜和輝, 「SAMURAI における多粒子測定に向けたファイバーシンチレーション検出器の読み出し」, 日本物理学会 2025 年春季大会, オンライン 2025 年 3 月.

Master Theses

大澤悠真, 「^{14}Be のクーロン分解反応」, 東京工業大学, 2024 年 7 月.

高橋理緒, 「多中性子系観測のための新型中性子検出器のシミュレーション」, 東京工業大学, 2025 年 2 月.