

Recent activities

JLab Hypernuclear Experiment

T. Gogami (Kyoto Univ.)

July 22, 2022

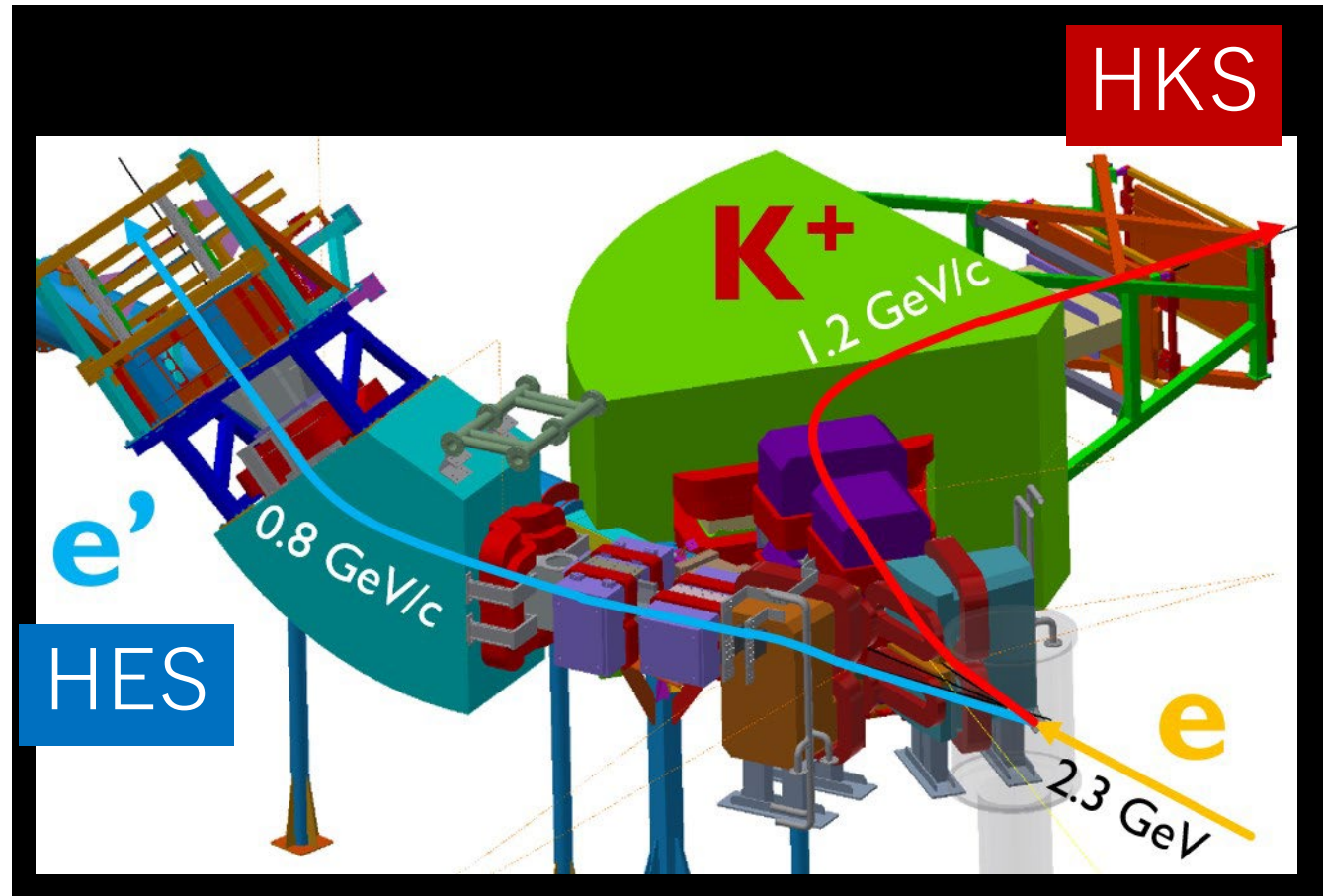


京都大学

KYOTO UNIVERSITY

Experiments at Hall C

- E12-15-008 (${}^{40}_{\Lambda}\text{K}$, ${}^{48}_{\Lambda}\text{K}$)
- E12-19-002 (${}^3_{\Lambda}\text{H}$, ${}^4_{\Lambda}\text{H}$)
- E12-20-013 (${}^{208}_{\Lambda}\text{Tl}$)



Meetings (2021, 2022)

Regular group Meetings

- Weekly meeting (Tokyo-Tohoku-Kyoto)
- biweekly meeting (Hampton-Kyoto)

JLab Hypernuclear Collaboration meeting

- Dec 7—9 in 2021 (online):
https://wiki.jlab.org/tegwiki/index.php/Hypernuclear_CollaborationMeeting_2021Dec

Target Meeting (Dave + Toshi + etc.)

- 4 meetings in 2021
- 6 meetings in 2022 so far

Analysis meeting (tritium experiment: Λnn)

- >12 meetings in 2021

Strategy (spokespeople) meeting

- Biweekly

Theses (2021, 2022): 3 Ph.D.'s + 4 Masters

2022

- K. Itabashi (Ph.D. thesis, Tohoku Univ. 2022),
“Study of Lambda quasi-free production in the ${}^3\text{H}(e,e'\text{K}^+)$ reaction”
- K.N. Suzuki (Ph.D. thesis, Kyoto Univ., 2022),
"Search for the $nn\Lambda$ state via the ${}^3\text{H}(e,e'\text{K}^+)\text{X}$ reaction at JLab“

2021

- B. Pandey (Ph.D. thesis, Hampton Univ., 2021) → [web page](#)
"A Possible Observation of Sigma- nn Continuum Structures and A Bound Sigma- NN State Using the $(e,e'\text{K}^+)$ Reaction"
- K. Katayama (Master's thesis, Kyoto Univ., 2021) → [PDF](#)
"Development of HRS-HKS trigger system with FPGA -High precision measurement of hypernuclei at JLab-"
- T. Toyoda (Master's thesis, Kyoto Univ., 2021) → [PDF](#)
"Basic design of gas target for high accuracy mass measurement of hypertriton at JLab"
- T. Akiyama (Master's thesis, Tohoku Univ., 2021) → [PDF](#)
"Development of water Cherenkov counter for medium-heavy hypernuclear spectroscopy at JLab"
- K. Okuyama (Master's thesis, Tohoku Univ., 2021) → [PDF](#)
"Study of the hyperon electroproduction using the $p(e,e'\text{K}^+)\Lambda/\Sigma^0$ reaction"

Invited talks (2021, 2022)

- T. Gogami, “Strangeness nuclear physics by electron beam at JLab”, The 15th Asia Pacific Physics Conference (APPC15), Online, Aug 2022.
- S. N. Nakamura, "Future prospects of spectroscopy of Lambda hypernuclei at JLab and J-PARC HIHR", 14th International Conference on Hypernuclear and Strange Particle Physics (HYP2022), Prague, Czech Republic + online, June 2022.
- L. Tang, “Newly completed JLab experiment (E12-17-003): Determine the unknown Λn interaction by investigating the possible $\Lambda n n$ resonance”, 14th International Conference on Hypernuclear and Strange Particle Physics (HYP2022), Prague, Czech Republic + online, June 2022.
- T. Gogami, “Hyperons and Hypernuclear Physics”, D12 Mini-Symposium: Strangeness and Hypernuclei, APS April Meeting 2022, New York, U.S. + online, Apr 2022.
- S. N. Nakamura, "Investigation of deep inside of nuclei and neutron stars with electron beams", JPS Co-sponsored Symposium, Online, March, 2022.
- T. Gogami, “Light Lambda Hypernuclear Measurement at JLab”, Strangeness Nuclear Physics Workshop 2021, Online, Dec 2021.
- T. Gogami, “Hypernuclear Physics at Jefferson Lab”, JPS meeting, Online, Sep 2021.
- S. N. Nakamura, "Precise spectroscopy of Lambda hypernuclei with electron and meson beams", Hadron 2021, Mexico/on-line, July, 2021.

Publications (2021, 2022)

- K. Itabashi et al., being drafted
- B. Pandey et al., “Spectroscopic study of a possible Λ_{nn} resonance and a pair of ΣNN states using the $(e,e'K^+)$ reaction with a tritium target”, PRC 105, L051001 (2022).
- K. N. Suzuki et al., “The cross-section measurement for the ${}^3\text{H}(e,e'K^+)nn\Lambda$ reaction”, PTEP 2022, 013D01 (2022).
- K. Itabashi et al., “Study of the $nn\Lambda$ state and Λn interaction at Jefferson Lab”, Few-body systems 63, 16 (2022)
- T. Gogami et al., “Spectroscopy of $A = 9$ hyperlithium with the $(e,e'K^+)$ reaction”, PRC 103, L041301 (2021).
- T. Gogami et al., “Accurate Λ hypernuclear spectroscopy with electromagnetic probe at Jefferson Lab”, AIP Conf. Proc. 2319, 080019 (2021); <https://doi.org/10.1063/5.0037353>.

2 PRCs, 1 PTEP, 2 proceedings, 1 draft

Grant-in-aid

SPIRITS 2020 (Kyoto University)

DONE

- 2020 Apr—2022 Mar
- Project name : Investigation of nuclei with the strangeness degrees of freedom by using tools of real/virtual photons
- Principle investigator (PI) : Toshiyuki Gogami
- Cost: **6,135,000 JPY** (Direct cost)

Grant-in-Aid for Scientific Research on Innovative Areas (Research in a proposed research area) (JSPS)

- 2018 Apr—2023 Mar
- Project number: 18H05459
- Project name : Investigation of deep inside of nuclei and neutron stars with high energy photons
- PI: S.N. Nakamura
- Cost: **144,100,000 JPY** (Direct cost)

On-going

Grant-in-Aid for Scientific Research (B) (JSPS)

On-going

- 2018 Apr—2023 Mar
- Project number: 18H01219
- Project name : Solving puzzles in the baryon interaction through electron beam spectroscopy of few-body Lambda hypernuclei
- PI: Toshiyuki Gogami
- Cost: **12,900,000 JPY** (Direct cost)

Grant-in-Aid for Scientific Research (A) (JSPS)

DONE

- 2017 Apr—2021Mar
- Project number: 17H01121
- Project name : Study of baryonic force through the electromagnetic spectroscopy of Lambda hypernuclei
- PI: S.N. Nakamura
- Cost: **33,500,000 JPY** (Direct cost)

Experimental preparation

- **Spectrometer base (for vertical bending)**
 - Need support
- **PCS**
 - Has already been transported to ESB from Japan
- **Target + new vacuum chamber**
 - Basic design has been fixed
 - Details design needs to be done by the target group
- **Detectors**
 - Aerogel Cherenkov counters (AC)
 - Cosmic ray test for at ESB (Bishnu works with a support by Brad)
 - Water Cherenkov counters (WC)
 - New containers are being constructed
- **MC simulation**
 - Optimal experimental condition is being investigated

Schedule

We are here → **2022:** Design, detector comm.
2023: ERR, detector comm.
2024: Installation
2025: Experiment