

Meson Science Laboratory
Chief Scientist: Masahiko Iwasaki (D.Sci.)



(0) Research field

CPR Subcommittee: Physics

Keywords: Nuclear Physics, Meson, Hadron

(1) Long-term goal of laboratory and research background

We are conducting two different research subjects. One is the hadron physics focusing at the interaction between mesons and nuclei in the “Pioneering Research Cluster”. The major activity is to study K-meson, second lightest meson having strange-quark, property in the nuclear matter using J-PARC. Another is the muon science, muon science researches covering from condensed matters physics to the fundamental science, mostly using RIKEN-RAL muon facility in “Nishina Center for Accelerator Based Science”. We are also making experimental spectroscopy of pionic atoms at RI Beam Factory and experimental exploratory of η' -mesic nuclei at GSI, Germany.

(2) Current research activities (FY2020) and plan (until Mar. 2025)

We conducted the detailed analysis of the kaon nuclear bound state (the K-pp bound state). We will perform a systematic investigation on the kaonic nuclei at J-PARC, by a totally new large spectrometer system as shown in the figure.

For the precise measurement of muon g-2, we are developing the ultra-cold muon beam as the key technique. In FY2020, we published the result of the measurement of the muonium emission yield from silica aerogel and its polarization carried out at TRIUMF in 2017. We also developed a new simpler evaluation method of muonium emission yield using μ SR (muon spin polarization) at RIKEN-RAL. We are now designing the new muon source apparatus for the muon g-2 experiment expecting start in 2025.

Concerning spectroscopy of pionic atoms, we have been analyzing data to achieve information on the chiral symmetry in nuclear medium. We are also making preparation for the next experiment at RI Beam Factory. We are developing a new beam optics with dispersion matching conditions of the primary beams and new detectors. For exploratory of η' -mesic nuclei, we are developing a new trigger detector installed at WASA detector system.

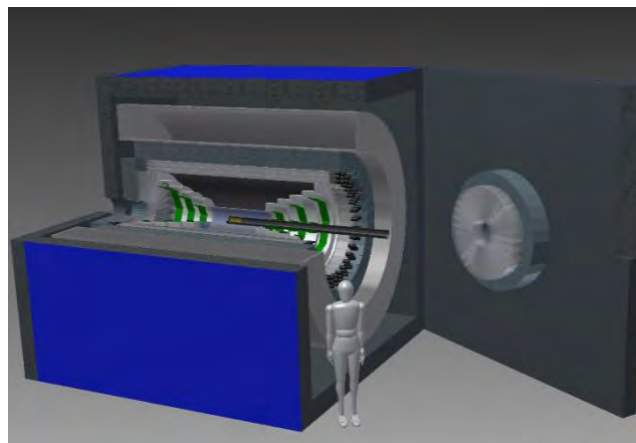


Fig.1: A conceptual design of a large-solid angle spectrometer system to realize systematic study of the light kaonic nuclear states.

(3) Members

(Chief Scientist)

Masahiko Iwasaki

(Senior Research Scientist)

Fuminori Sakuma, Haruhiko Outa,

Yue Ma, Kenta Itahashi

(Postdoctoral Researcher)

Takumi Yamaga, Hidemitsu Asano,

Rie Murayama

(Junior Research Associate)

Toya Tanaka, Shota Matsumoto,

as of March, 2021

Masaya Ichikawa, Ryohei Sekiya

(International Program Associate)

Chengdong Han

(Student Trainee)

Yuika Tani, Takaya Akaishi,

Hideharu Yamauchi

(Assistant)

Mitsue Yamamoto

(4) Representative research achievements

1. "Observation of a $K^{\text{bar}}\text{NN}$ bound state in the $^3\text{He}(K^{\text{bar}},\Delta p)n$ reaction", T.Yamaga et al., *Physical Review C* **102**, 044002 (2020).
2. "Study of muonium emission from laser-ablated silica aerogel", J. Beare, et al.: *Prog. Theor. Exp. Phys.* **2020**, 123C01 (2020).
3. "Spectroscopy of η' -mesic Nuclei with WASA at GSI/FAIR", Y.K. Tanaka et al., *Acta Phys. Polon. B* **51**, 39 (2020).

Supplementary



Laboratory Homepage

https://www.riken.jp/en/research/labs/chief/mes_sci/index.html

<http://ag.riken.jp/J-PARC/>