

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 (FY2019) 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 investigations 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 FY2019, we completed the analysis of the measurement of the muonium emission yield from silica aerogel and its polarization carried out at TRIUMF in 2017. We also demonstrated a new evaluation method of the muonium emission yield using μ SR (muon spin polarization) at RIKEN-RAL.

In preparation for the proton radius measurement using muonic hydrogen atom, we carried out the residual muon spin polarization measurement for the negative muons stopped in low density hydrogen gas.

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.

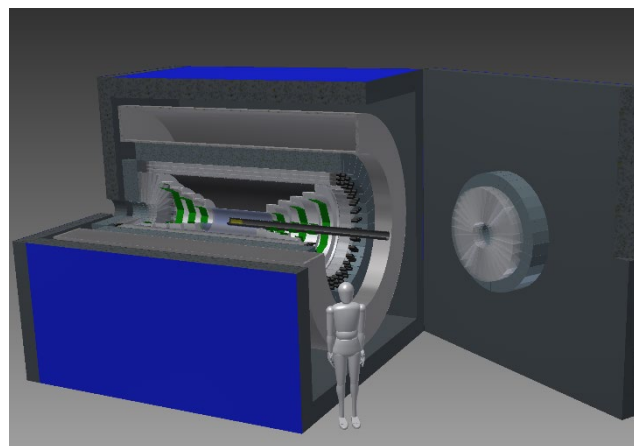


Fig.1 : A conceptual design of a large-solid angle spectrometer system to realize systematic study of the light kaonic nuclear states.

(3) Members

(Chief Scientist)

Masahiko Iwasaki

(Senior Research Scientist)

Fuminori Sakuma, Haruhiko Outa,

Yue Ma, Kenta Itahashi

(Special Postdoctoral Researcher)

Hidemitsu Asano

(Postdoctoral Researcher)

Takumi Yamaga

(Junior Research Associate)

Toya Tanaka, Shota Matsumoto,

Masaya Ichikawa

as of March, 2020

(International Program Associate)

Chengdong Han

(Research Fellow)

Wan Nurfadhilah Zaharim

(Student Trainee)

Yuika Tani, Sumiya Umezu,

Ryohei Sekiya, Takaya Akaishi,

Hideharu Yamauchi

(Assistant)

Mitsue Yamamoto

(4) Representative research achievements

1. "Kaonic Nuclear Bound State "K-pp" Observation and Possible Future Plan", M.Iwasaki, The 3rd J-PARC symposium (J-PARC2019), September 23-26, 2019, Tsukuba, Japan.
2. "Using negative muons as a probe for depth profiling silver Roman coinage", B. V. Hampshire, K. Butcher, K. Ishida, G. Green, D. Paul and A. Hillier: *Heritage* 2019, 2, (2019) 400-407.
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/>