

International workshops on the extension project for the J-PARC hadron experimental facility (J-PARC HEF-ex WSs)

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International Workshops on the Extension Project for the J-PARC Hadron Experimental Facility (J-PARC HEF-ex WSs) were held online on [first] June 7–9, 2021, and [second] February 16–18, 2022. The workshops were organized by Hadron Hall Users' Association (HUA) and supported by J-PARC Center, KEK Theory Center, RCNP, and RIKEN Nishina Center.

We have been extensively discussing a new plan for the J-PARC Hadron Experimental Facility to extend the existing experimental facility. The idea is to extend the Hadron Hall to include another production target downstream of the current production target and build multiple new beamlines. Four new beamlines are being planned to be constructed with the highest priority.

- A “high-intensity and high-energy-resolution beamline (HIHR)” and “high-purity and high-intensity low-momentum charged K beamline (K1.1)” to solve the so-called hyperon puzzle through the super-precision spectroscopy of Λ -hypernuclei and precise hyperon-nucleon scattering measurement, respectively
- A “high-intensity neutral KL beamline (KL2)” to explore new physics beyond the Standard Model by dramatically increasing the sensitivities of the kaon rare decay
- A “high-momentum particle-separated beamline (K10)” to resolve the conundrum of the strong interaction based on the investigation of Xi and Omega baryons

We will develop new physics programs in particle and nuclear physics that cannot be implemented at the existing facilities.

The J-PARC HEF-ex WSs were part of a series of workshops to discuss and detail the physics case at the Hadron Experimental Facility. In the first half of 2021, several workshops were held focusing on the future physics case at the extended Hadron Experimental Facility; their outputs were summarized as the third white paper.¹⁾ The extension project was reviewed by an international committee formed under J-PARC PAC in August 2021 and was highly evaluated toward the early realization of the facility extension. Detailed information on the extension project can be found on HUA's home page.²⁾

[First J-PARC HEF-ex WS on 7–9 June 2021]

The first workshop was dedicated to discussions on important physics features at the extended J-PARC Hadron Experimental Facility. This workshop included plenary sessions by invited speakers, and the physics case for the new beamlines was discussed.

- ✓ Project overview
- ✓ Strangeness nuclear physics at the HIHR and K1.1



Fig. 1. The Second J-PARC HEF-ex WS.

beamlines

- ✓ Flavor physics at the KL2 beamline
- ✓ Hadron physics at the K10 beamline

The workshop included 138 participants from 12 countries (42 participants from abroad). There were 12 plenary talks. The full program and presentation files are available online at the workshop website.³⁾

[Second J-PARC HEF-ex WS on 16–18 February 2022]

In the second workshop, discussions were dedicated to the physics case connecting the “present” and “future” Hadron Experimental Facility of J-PARC. For that purpose, this workshop covered wide-ranging topics related to experimental and theoretical activities conducted at the Hadron Experimental Facility.

- ✓ $S = -1$ and -2 hypernuclei
- ✓ Meson in nuclei
- ✓ Baryon spectroscopy
- ✓ Kaon rare decays
- ✓ μ - e conversion
- ✓ Future facilities and instrumentation

The scientific program comprised plenary sessions by invited speakers and parallel sessions by invited and contributed speakers. The workshop included 250 participants from 15 countries (94 participants from abroad). There were 19 plenary talks and 86 parallel talks (including 23 invited keynote talks). The full program and presentation files are available online at the workshop website.⁴⁾ A group photo is shown in Fig. 1.

Following the success of the workshops, we are planning to conduct the third workshop in FY2022 to continuously discuss physics at the J-PARC Hadron Experimental Facility and its extension.

References

- 1) Taskforce on the extension of the Hadron Experimental Facility, arXiv:2110.04462.
- 2) <http://www.rcnp.osaka-u.ac.jp/~jparchua/en/index.html>.
- 3) <https://indico2.riken.jp/event/3773/>.
- 4) <https://kds.kek.jp/event/40010/> (An access key is required.).

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