

Nuclear and Hadron Physics in Korea: Status and Prospects

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Nuclear Physics in Korea: The Landscape

- **IBS:** CENS (rare isotopes) · IRIS (RAON operations) · CUP (underground)
- **Universities:** Korea Univ. · SNU · Yonsei · SKKU · PNU · Inha · Soongsil, PKNNU · etc
- **Support:** APCTP (theory) · KAERI · KISTI (computing)
- **Many working groups:** KLASIQ · OMEG · EIC WG · and more
- **Community scale:** INPC 2025 · xQCD2026 · QM2027 · APFB2028 · OMEG2028
- **Shift underway:** from participation abroad to operating a domestic user facility

RAON: Status

- First facility combining IF and ISOL; design goal 200 MeV/u, 400 kW
- **May 2023:** beam through the full low-energy linac (SCL3): 17.6 MeV/u, 21.3 μA
- **Jul 2024:** user experiments begin (KoBRA · recoil spectrometer)
- **Jun 2026:** Physics publication · $^{40}\text{Ar} + \text{p}$ elastic scattering near the Coulomb barrier;
existing reaction models fail in this regime
- **Open:** high-energy section (SCL2) deferred to Phase 2; drip-line reach and new-element search depend on it
- **Now:** annual RAON Workshop and LOI cycle for user beam time, open to overseas groups

Experimental Program Abroad

- **Hot/dense matter:** ALICE, CMS (LHC) · STAR, sPHENIX (RHIC)
- **Hadrons:** J-PARC Hadron Hall (hypernuclei, strangeness) · LEPS2 · Belle II · CLAS12
- **Next generation:** FAIR CBM · EIC
- **Pattern:** detector construction and analysis roles solid; facility leadership limited
- **Underground:** COSINE/AMoRE at Yemilab, adjacent to the low-energy community

Theory and Computation

- Lattice QCD; chiral EFT nuclear forces
- Ab initio many-body: wave-function matching, neutron-rich oxygen binding energies on KISTI Nurion
- Neutron-star EOS and multi-messenger constraints
- Hadron spectroscopy: exotic states, in-medium properties
- ML and quantum computing for many-body and analysis problems
- Theory sets the measurement priorities for RAON and EIC-era programs

Where Korea and Taiwan Meet

- **Natural overlap:** relativistic heavy-ion analysis · lattice QCD · exotic hadron spectroscopy · neutron-star EOS and nuclear astrophysics
- **Concrete channels**
 - A. Joint LOIs for RAON beam time: the facility is open and under-subscribed
 - B. Shared detector R&D toward EIC and FAIR, where neither community alone has scale
 - C. Theory-experiment pairing on dense matter, drawing on both sides' astrophysics groups
 - D. Student and postdoc exchange; a recurring bilateral workshop
- **Ask:** what would each side most want from the other in the next two years?
- The next TK(J?) JW-NP 2027 @ Korea