

# Nuclei in the Cosmos (NIC XVII)



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## Experiments related to Neutron-Rich Nuclei in r-Process Nucleosynthesis

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Where and how were heavy elements which contain many neutrons relative to proton, synthesized? With regards to the origin of these heavy elements, a reaction in which nuclei capture neutrons in a fast and continuous manner during the explosion of a star was proposed and named the rapid neutron capture process (r process) [1].

In 2017, a binary neutron star merger event was discovered by simultaneous observations of gravitational and electromagnetic waves, and its kilonova was also identified, suggesting the synthesis of heavy elements. Were heavy elements such as gold, platinum, and even uranium synthesized in binary neutron star mergers, supernova explosions, or collapsars [2-4]? Analysis of the unique heavy-element compositions left behind in the solar system, meteorites, and old metal-poor stars has begun. The key to deciphering the traces left behind by isotopic elements lies in the thousands of neutron-rich nuclei that disappeared in an instant.

Here, we introduce the experimental research on the explosive r-process nucleosynthesis and future perspective at RIBF [5,6].

- [1] E.M. Burbidge, G.R. Burbidge, W.A. Fowler, and F. Hoyle, *Rev. Mod. Phys.* 29, 547 (1957).
- [2] S. Wanajo et al., *Astrophys. Jour. Lett.* 789: L39 (2014).
- [3] C. Kobayashi, A.I. Karakas, and M. Lugaro, *Astrophys. Jour.* 900, 179 (2020).
- [4] J. Barnes and B.D. Metzger, *Astrophys. Jour. Lett.* 939: L29 (2022).
- [5] V.H. Phong et al., *Phys. Rev. Lett.* 129, 172701 (2022).
- [6] S. Nishimura, *Prog. Theor. Exp. Phys.* 2012, 03C006 (2012).

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