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## Search for r-process nuclear gamma-rays from binary neutron-star merger remnants with the gamma-ray satellite INTEGRAL/SPI

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One of the most promising candidates in the universe for the r-process r-process, which is the only sites that can provide elements heavier than <sup>209</sup>Bi are the binary neutron-star mergers (NSMs). The post-merger remnant becomes optically thin in a few weeks to months, and gamma-rays from the decay of r-process elements are observable in the MeV energy band. The presence of r-process nuclei in NSMs was already shown by the infrared observation of the first NSM gravitational event GW170817 (e.g., Kasen et al. 2017; Roswog et al. 2018; Domoto et al. 2022), and such MeV gamma-rays are expected carry more direct information on the r-process nuclei especially for Lanthanoids. In fact, however, nuclear gamma-rays from NSMs are so dim that they are below sensitivity in the MeV missions. (Hotokezaka et al. 2016).

According to numerical estimation of gamma-rays from NSMs (Terada et al 2022), they have unique gamma-ray spectra compared with other high energy objects and thus the spectral shape can be used to identify NSMs.Numerically, Terada et al.(2022) provides a new method to identify of NSMs using color-color diagram both in the hard Xray (10-500 keV) and gamma-ray (70-3000 keV) bands.

In this study, we searched for NSM remnants at the galactic center region ( $-15^{\circ} < l < 15^{\circ}, -20^{\circ} < b < 20^{\circ}$ ). The search was conducted using archived data from the INTEGRAL/SPI gamma-ray observatory, which currently has the best sensitivity in the MeV energy band. Adopting the method described above, we searched for NSMs using the color-color diagram using the five energy bands; 10-25 keV,25-70 keV, 70-500 keV, 500-1000 keV, and 1000-3000 keV, including the hard X-ray bands. As a result, one and seven candidates of NSM remnants are identified in the hard X-ray and gamma-ray bands,respectively. In this presentation, we will present a detailed analysis of the candidate sources and discuss their validity as NSM remnant candidates.

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