

Contribution ID: 602

Type: Talk

GeV Gamma-Ray Detection Performance of the Nuclear Emulsion Telescope in the GRAINE 2023 Balloon Experiment

Thursday 17 July 2025 13:50 (15 minutes)

We are advancing precise observations of cosmic gamma rays in the sub-GeV/GeV energy range using a largescale nuclear emulsion telescope with high angular resolution (0.1° at 1 GeV), deployed on a balloon. We conducted balloon experiments in 2011, 2015, 2018, and 2023. In 2018, we achieved the first detection of an astronomical gamma-ray source and imaged the Vela pulsar with the world's highest angular resolution in the sub-GeV region. In April 2023, we successfully conducted a 27-hour balloon flight during which the Vela pulsar and the region around the Galactic center were observed (GRAINE 2023).

The nuclear emulsion telescope consists of a converter, a time stamper, and an attitude monitor. The converter section is a stacked structure with nuclear emulsion films, capturing electrons and positrons from gamma rays. The high angular resolution of nuclear emulsion films enables precise determination of gamma-ray directions and momentum measurement through multiple Coulomb scattering.

We are developing new techniques for the detection of high-energy (>GeV) gamma rays. In the nuclear emulsion telescope, detection of high-energy gamma rays is challenging because the two tracks produced by pair production have an opening angle too narrow to be separated. Furthermore, the small scattering of the produced electrons and positrons makes it difficult to reconstruct the gamma-ray energy from momentum measurements. We introduce a new method to improve gamma-ray detection and momentum measurement for the nuclear emulsion telescope.

This presentation will report the current analysis of the GRAINE 2023 converter section and the new gammaray selection method under development.

Collaboration(s)

GRAINE

Author: Mr USUDA, Ikuya (Nagoya University)

Co-authors: Prof. IYONO, Atsushi (Okayama University of Science); Mr MINAMI, Hideyuki (Nagoya University); Dr ROKUJO, Hiroki (Nagoya University); Dr YAMAMOTO, Saya (Nagoya University); Dr NAGAHARA, Shogo (Nagoya University); Dr NAKANO, Toshiyuki (Nagoya University); Mr KAWAHARA, Tsuyoshi (Nagoya University); Mr ISAYAMA, Yudai (Nagoya University); Mr SUGI, Yuki (Okayama University of Science); Dr NAKAMURA, Yuya (Nagoya University); GRAINE COLLABORATION (Nagoya University, Aichi University of Education, Okayama University of Science, Gifu University, Kobe University)

Presenter: Mr USUDA, Ikuya (Nagoya University)

Session Classification: GA

Track Classification: Gamma-Ray Astrophysics