

Concept: Galactic Explorer with a Coded Aperture Mask Compton Telescope (GECCO)

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We present a novel concept for a next-generation γ -ray telescope that will cover the hard X-ray - soft γ -ray region. Despite the progress made by the European Space Observatory INTEGRAL, this energy range is still under-explored. GECCO will conduct high-sensitivity measurements of the cosmic γ -radiation in the energy range from 100 keV to ~ 10 MeV and create intensity maps with high spectral and spatial resolution, focusing on sensitive separation of diffuse and point- source components. These observations will enable the following major objectives for GECCO:

- a) understand the nature, composition and fine structure of the inner Galaxy
- b) localize and discern the origin(s) of the positron annihilation 511 keV line,
- c) resolve Galactic chemical evolution and sites of explosive element synthesis
- d) provide identification and precise localization of gravitational wave and neutrino events
- e) test as-yet unexplored candidates for the dark matter

The instrument is based on a novel CdZnTe Imaging calorimeter and a deployable coded aperture mask. The unique feature of GECCO is that it combines the advantages of two techniques –the high-angular resolution possible with coded mask imaging, and a Compton telescope mode providing high sensitivity measurements of diffuse radiation. Expected GECCO performance is as follows: energy resolution $<1\%$ at 0.5-5 MeV, angular resolution ~ 1 arcmin in the Mask mode (3-4 degree field-of-view, $\sim 2,000$ cm² effective area), and 3-5 degrees in the Compton mode (~ 80 degree field-of-view, ~ 500 cm² effective area). The sensitivity is expected to be $\sim 10\text{--}6\text{MeV/cm}^2/\text{s}$ at 1 MeV. GECCO can be considered for a future NASA Explorer mission.

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