Overview of the GRAMS project

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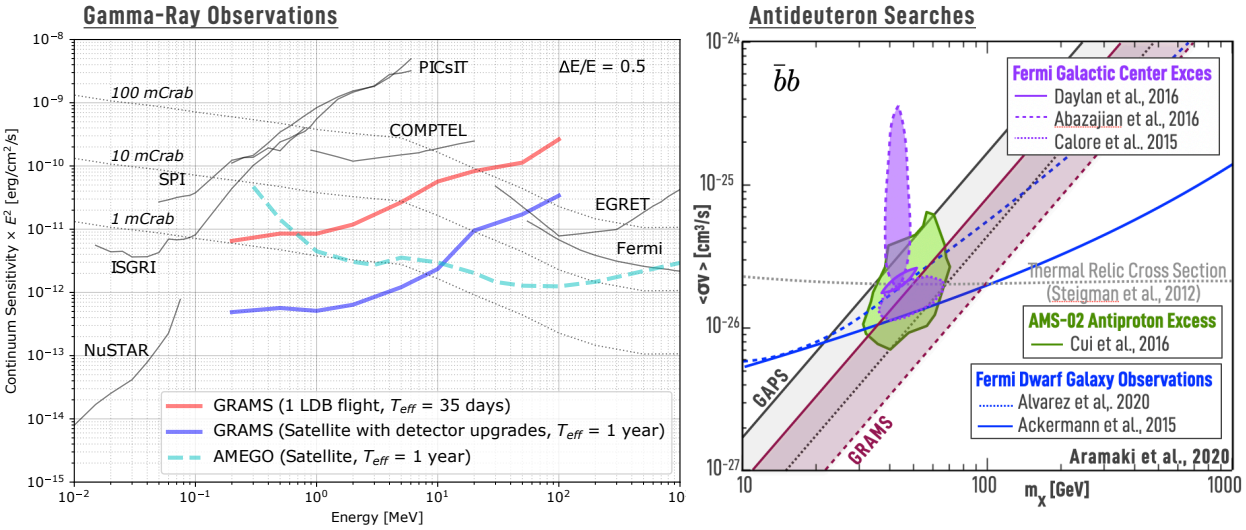
GRAMS (Gamma-Ray and AntiMatter Survey) is a next-generation proposed balloon/satellite mission that uses advanced technology to target both astrophysical observations with MeV gamma rays and indirect dark matter searches with antimatter. The GRAMS instrument is designed with a LArTPC (Liquid Argon Time Projection Chamber) detector surrounded by a plastic scintillator tracker. The GRAMS detector is cost-effective, considering that argon is both naturally abundant and low-cost, which allows a large-scale detector to be deployed, unlike previous and current experiments with semiconductor or scintillation detectors.



Astrophysical observations at MeV energies have not yet been well-explored. With a cost-effective, large-scale detector, GRAMS can have an order of magnitude improved sensitivity with a single long-duration balloon (LDB) flight, compared to previous experiments, while the GRAMS satellite mission could provide a comparable MeV gamma-ray sensitivity to the future proposed missions.

The GRAMS detector is also optimized for cosmic ray antimatter surveys for indirect dark matter searches. GRAMS will be a next-generation experiment beyond the current GAPS (General AntiParticle Spectrometer) project for antimatter survey. Low-energy antideuteron measurements, in particular, will be essentially background-free dark matter searches. We could deeply investigate the parameter space and validate the potential dark matter signatures suggested by the Fermi gamma-ray observations and AMS-02 antiparticle measurements.

We are currently in the R&D phase, building a prototype detector, MiniGRAMS, at Northeastern University to validate the detection concept and establish the event reconstruction techniques. We expect to have the first balloon flight in 5 years while the satellite mission in 10+ years.