AMEGO Mission Polarimetric Prospects

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Introduction

The MeV domain is out of the most underexplored windows on the Universe, not because of a paucity of interesting science, but as a result of technology constraints that have limited advances in detection sensitivity. Now, with currently technology, high-energy astrophysics polarimetry may greatly benefit from AMEGO (All-sky Medium Energy Gamma-ray Observatory), a NASA Probe class mission, proposed to investigate the energy range from 300keV to up to 10 GeV. The polarimetric potential of AMEGO mission for two processes - Compton scattering (E < 10MeV) and pair production (E > 10Mev) is analysed using MEGAlib simulation tools by mass model simulations. The Modulation Factor, Sensibility, Angular Resolution, Effective Area and Sensibility to Polarization are studied for a variety of sources, with different spectrum, energy band and incidence angles. The knowledge obtained by this instrument concept analysis will serve to propose optimization in the original configuration and also to compare with future high-energy instruments and optimize their performances.

AMEGO Scientific Objectives

AMEGO provides three new capabilities in MeV astrophysics: sensitive continuum spectral studies, polarization, and nuclear line spectroscopy. The primary optimization for AMEGO is continuum sensitivity across a broad energy range. The extremely diverse science reach for AMEGO (see figure below) is greatly enhanced by adding polarization and nuclear line spectroscopy. Furthermore, we are at the dawn of the multimessenger era, with the recent discovery of high energy astrophysical neutrinos by IceCube and the first direct observation of gravitational waves by LIGO.

AMEGO – Expected Performances

Simulation Conditions:
- Source: Monenergetic
- Beam Type: Far-Field Point Source
- Energy: 1000, 1500, 2000 and 2500 keV
- N Triggers: 500 000

Simulation Conditions:
- Source: Crab
- Beam Type: Far-Field Point Source
- Energy: 0.2-2 MeV
- Incidence angle: 0, 30, 45, 50, 60, 75 and 90 degrees
- N Triggers: 500 000

The simulation results will provide valuable information to optimize the original configuration of AMEGO and verify how it influences the performance of the instrument. Furthermore, we will simulate gamma-sky objects studying supernovae, fusion of compact objects, excess of gamma-ray emission in the center of galaxies and blazars. Finally, we will ascertain which type of observations as possible and which scientific questions that may potential be addressed, in particular, for multi-messenger astrophysics.

AMEGO Scientific Instruments

AMEGO – Expected Performances

Future Work