# 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 (**A**ll-sky **M**edium **E**nergy **G**amma-ray **O**bservatory), a NASA Probe class mission, proposed to investigate the energy range from 300keV to up 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 varaiety of sources, with different spectrum, energy band and incidece 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.

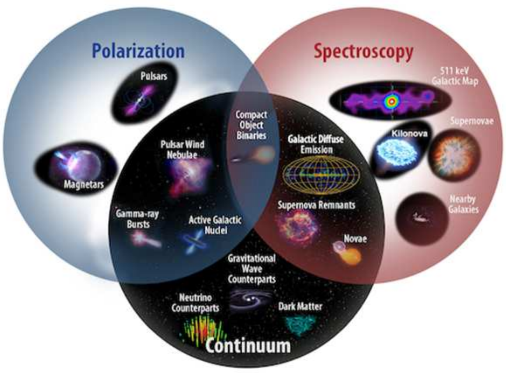



Fig. 1- AMEGO provides three new capabilities in MeV astrophysics: sensitive continuum spectral studies, polarization, and nuclear line spectroscopy.

## AMEGO Scientific Instruments

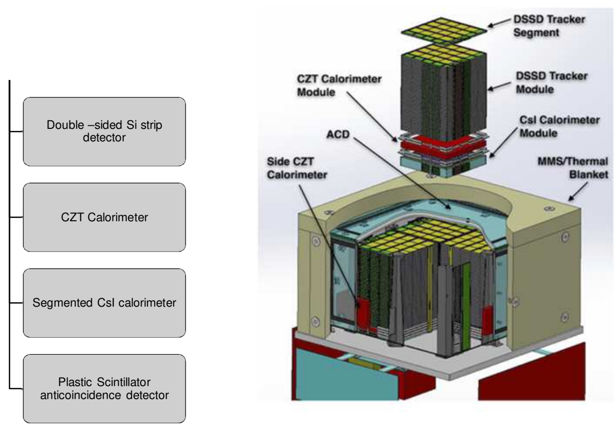



Fig. 2 - A mechanical sketch of AMEGO. The 60 layer double sided silicon detector (DSSD) tracker converts or scatters incoming gamma rays and accurately measures the positions and energies of either the electron-positron pair or the Compton-scattered electron passing through the instrument. The CZT calorimeter modules sit beneath. The CsI calorimeter modules consist of hodoscopic layers of crystal. The modular design of 4 towers (each comprising tracker, CZT, CsI modules) sit within top and side panels of the ACD.

## AMEGO – Expected Performances

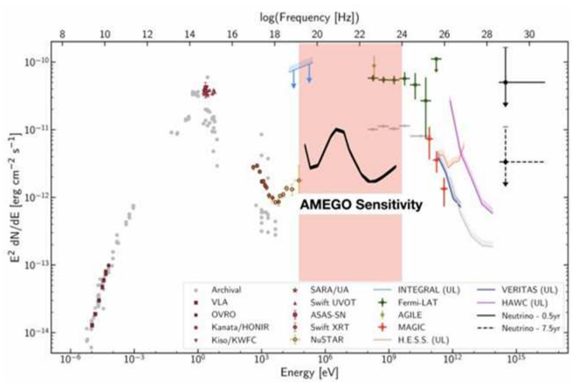
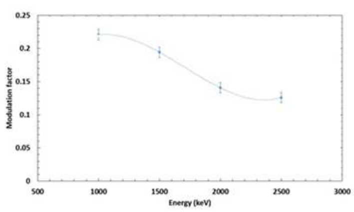



Fig. 3 – Expected performances of AMEGO mission will fill a sensitivity gap in the MeV up to GeV band.

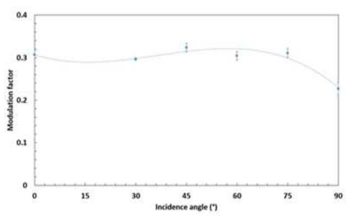
**Simulation Conditions:**

- Source: Monoenergetic
- 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




## Future Work

The simulation results will provide valuable information do 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.

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