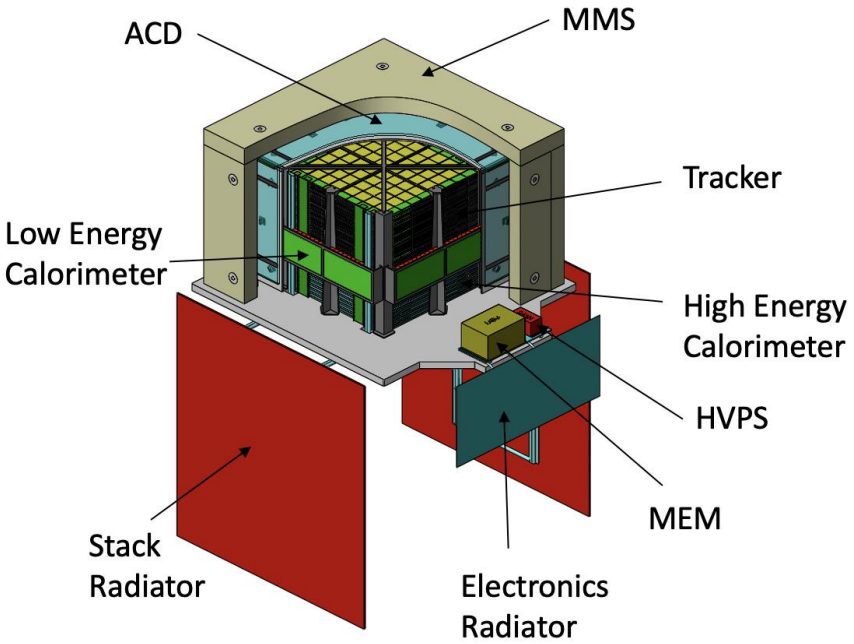
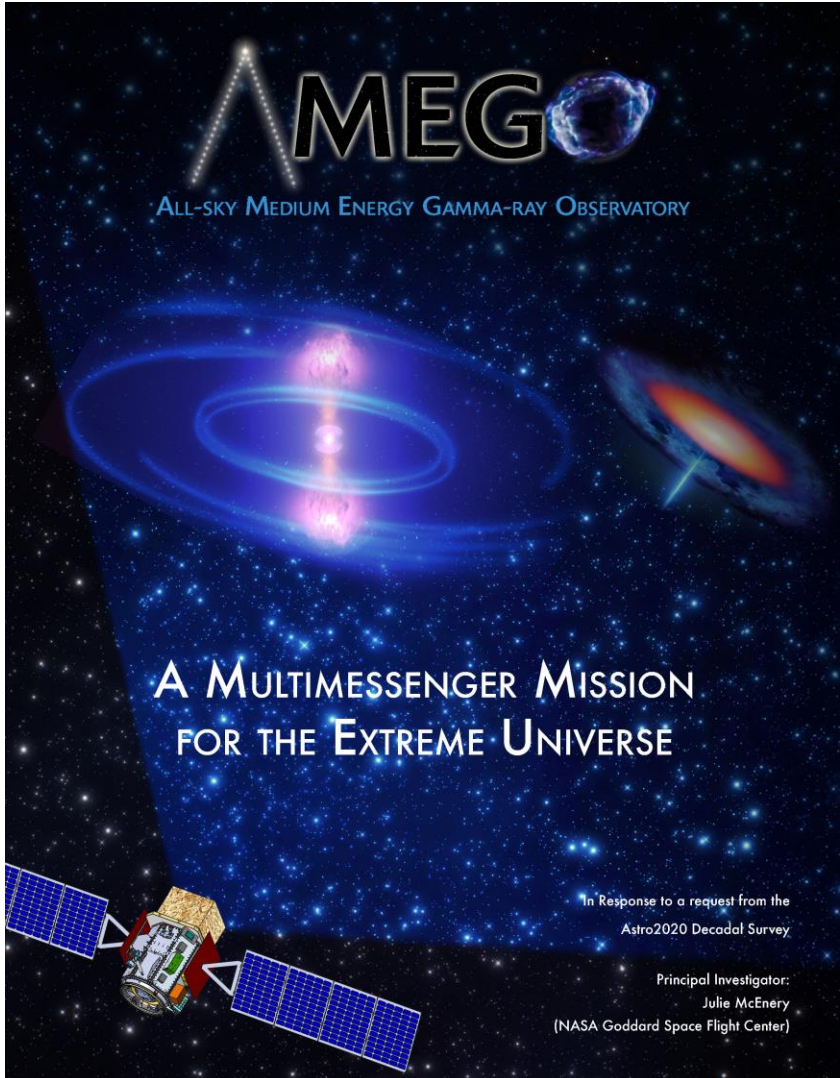
All sky Medium Energy Gamma-ray Observatory (AMEGO)





Medium Energy Gamma-ray Astrophysics

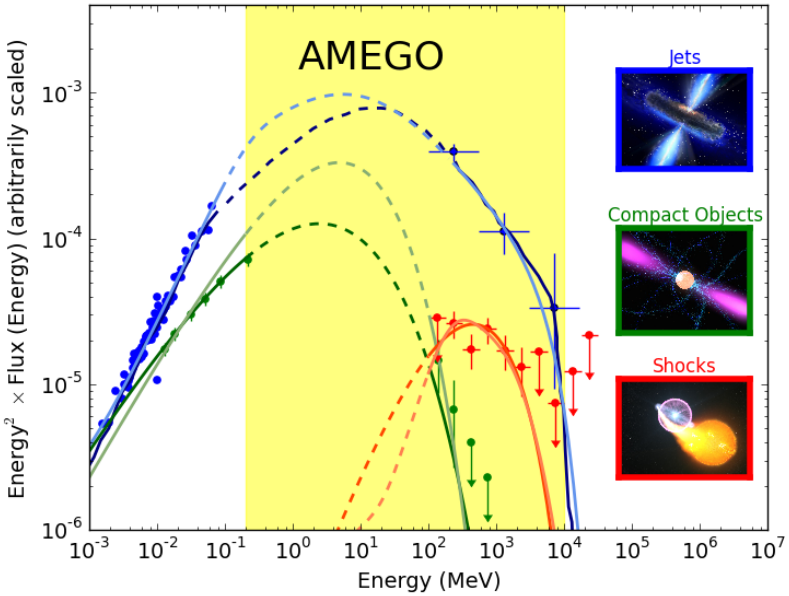
- Understanding how the Universe works requires observing astrophysical sources at the wavelength of **peak** power output **crucial for source energetics**
- Fermi, NuSTAR, and Swift BAT have uncovered source classes with peak energy output in the poorly explored MeV band

A critical energy band –
Transition between the thermal and non-thermal Universe

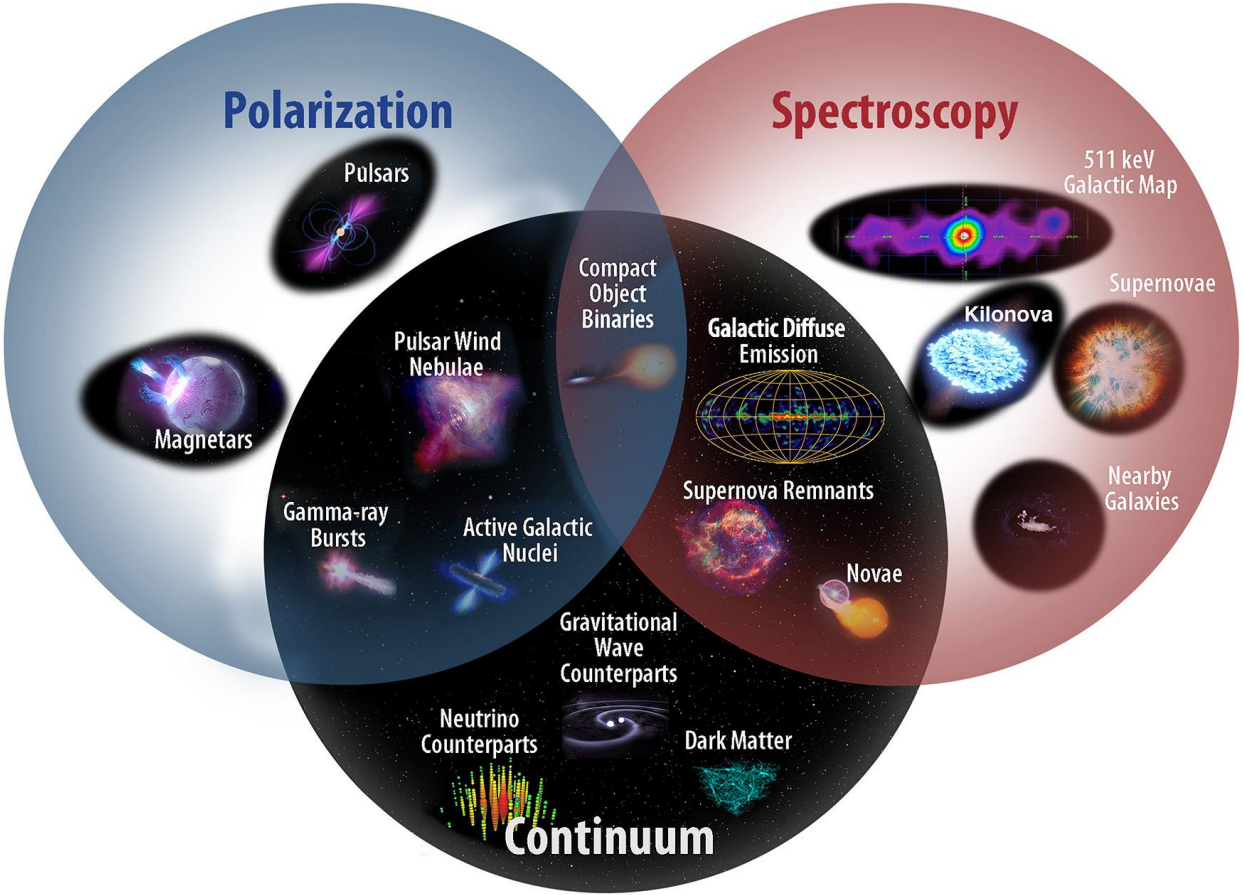
Only part of the EM spectrum where it is possible to directly observe nuclear processes (atomic nuclei de/excitations)

Covers positron annihilation line (511 keV)

Large population of known sources with peak power output in the MeV range



AMEGO opens huge discovery space!



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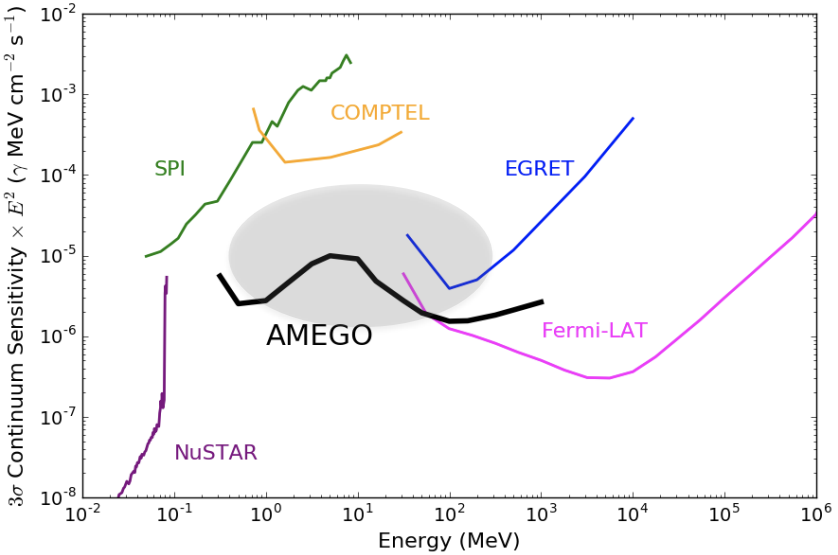
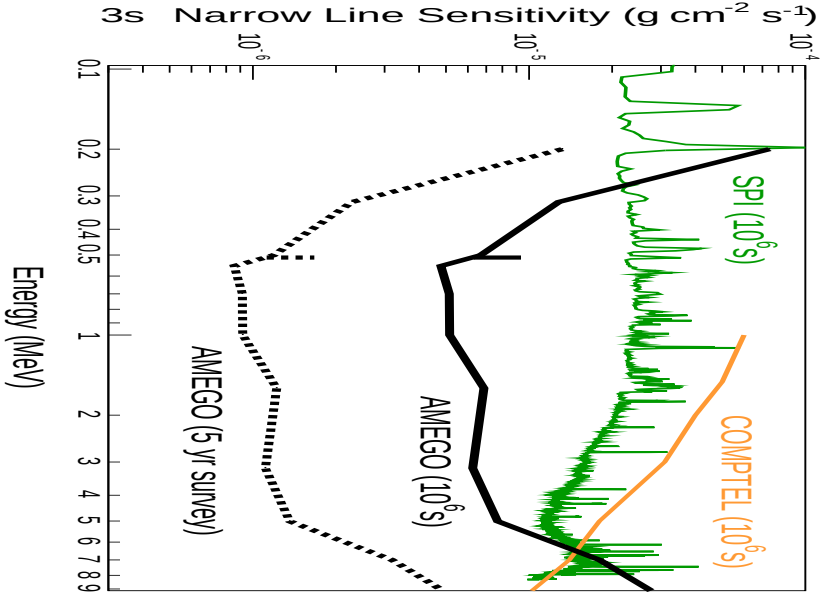
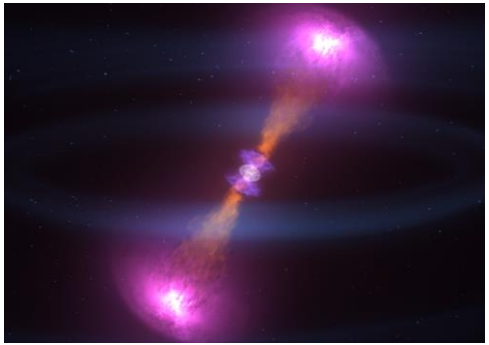




Huge field of view: 2.5 sr, survey full sky every 3 hours – explore time domain!
Broad Energy Range: 200 keV - >10 GeV
Angular Resolution: 2.5 deg@1 MeV, 1.5 deg@5 MeV, 2 deg@100 MeV
Energy Resolution: <1% (<2 MeV)
Polarization sensitivity: <20% MDP for a source 1% of the Crab flux observed for 10^6s

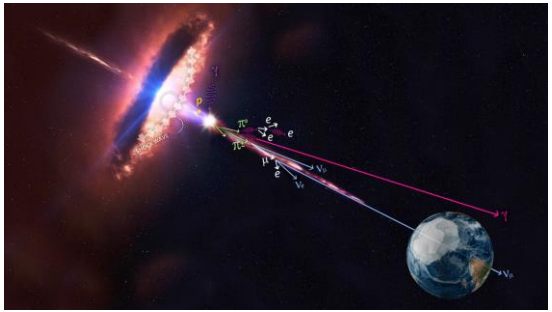
AMEGO is a Multimessenger Observatory

Extreme Explosions – GW counterparts



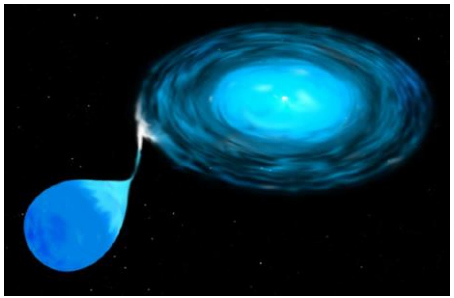
- High rate of well localized (~<1 deg) GRB
  - ~100 short GRB/year
  - ~450 long GRB/year
- Polarization probe GRB jets
- Direct observation of gamma-rays from nuclear processes in nearby kilonova

Extreme Accelerators – VHE Neutrino counterparts



- Gamma-rays are generated in the same physical process that produces neutrinos
- Continuous monitoring of hundreds of the most luminous blazars
- MeV flux good proxy for neutrino flux
- Polarization observations probe jet composition

Element formation – MeV Neutrino counterparts



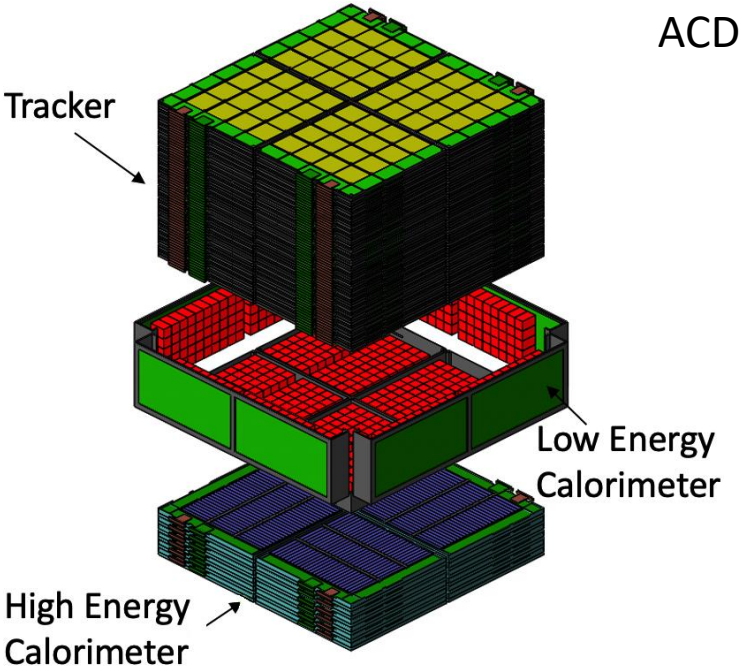
- Gamma-ray line flux as function of time provides good measure of geometry and total mass of Ni in SN1A
- AMEGO will detect SN1A out to 50 Mpc

All-sky Medium Energy Gamma-ray Observatory

Tracker (ANL, GSFC +)

Incoming photon undergoes pair production or Compton scattering. Measure energy and track of electrons and positrons

- 60 layer DSSD, spaced 1 cm
- Strip pitch 0.5mm



Low Energy Calorimeter (GSFC, BNL +)

Measure location and energy of Compton scattered photons

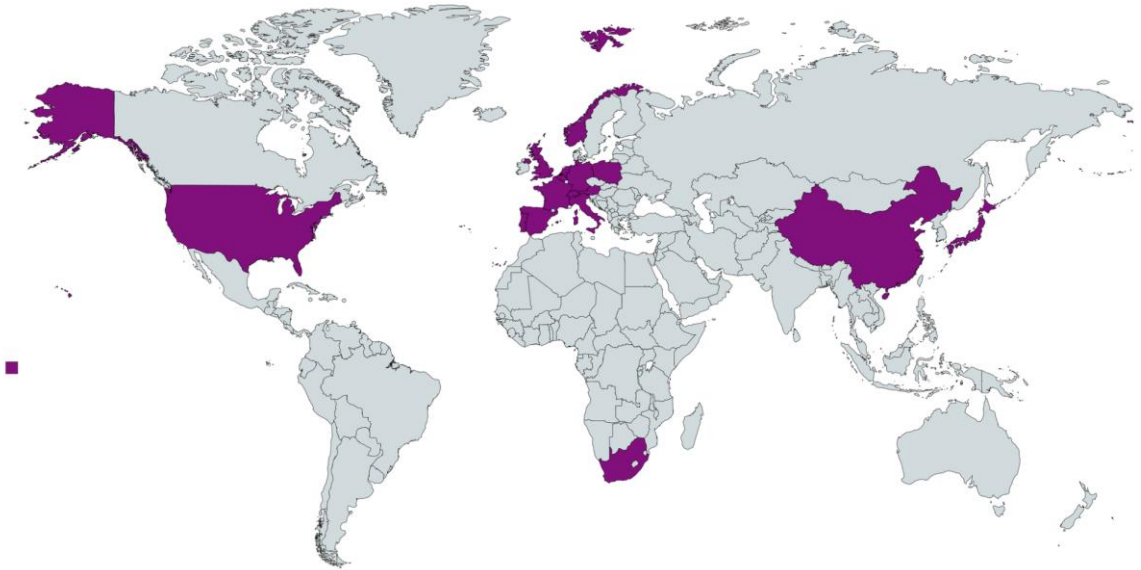
- Layer of 0.8x0.8 x 4cm bar CZT

High Energy Calorimeter (NRL)

Extend upper energy range

- 6 planes of 1.5cm x 1.5 cm CsI bars

AMEGO team and more information



Large international team
~200 scientists in >50 institutions

https://asd.gsfc.nasa.gov/amego

AMEGO Current Status

- Currently building prototype instrument
  - Beam test mid 2020
  - Balloon flight 2021
- Submitted set of science white papers to decadal survey
- Submitted mission white paper for consideration by the 2020 decadal survey
- Large, international collaboration

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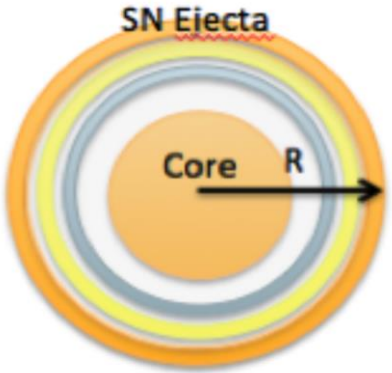
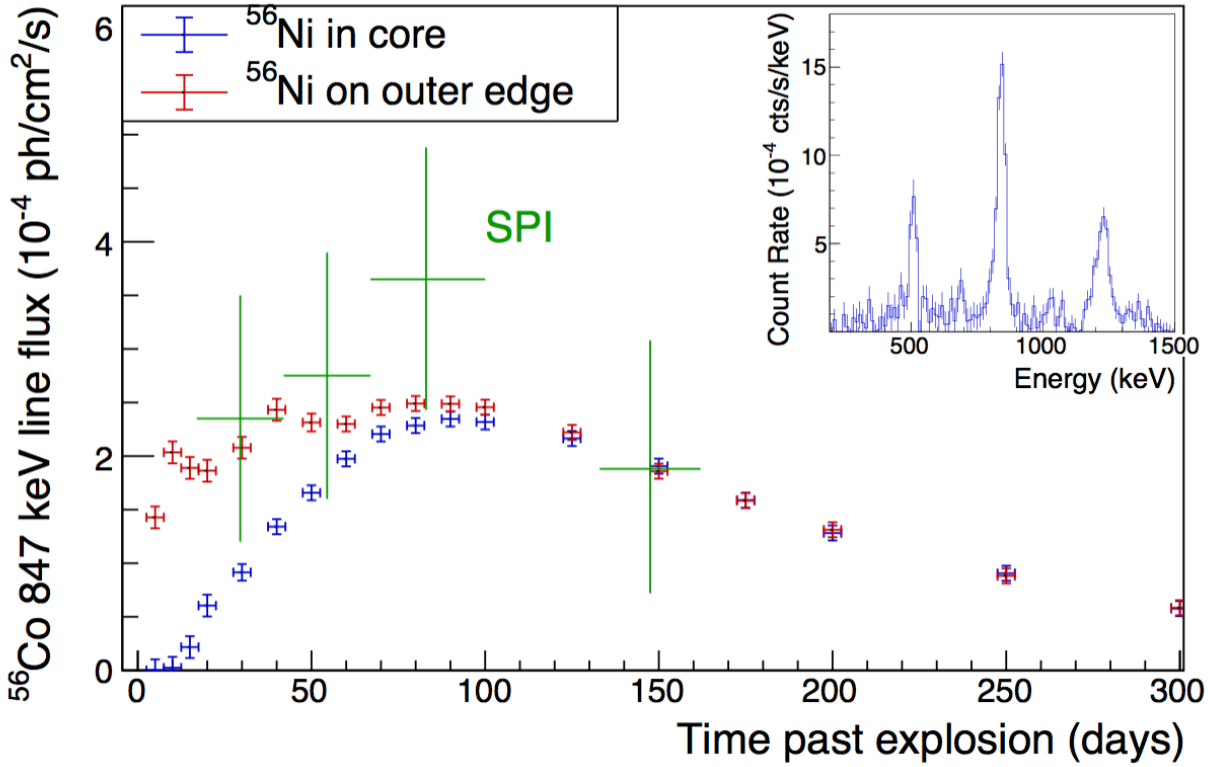
Supernova Ia





Gamma-ray Bursts and Gravitational Waves