AMEGO

All-sky Medium Energy Gamm—ray Observatory

深沢泰司（広島大学）

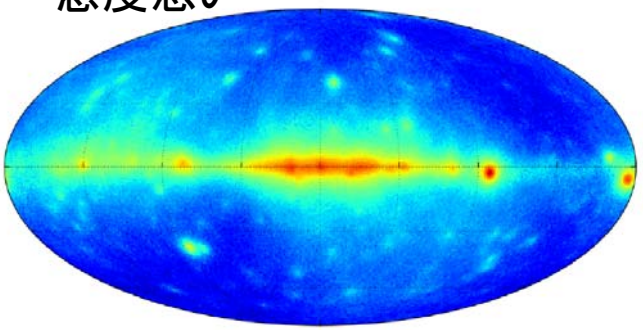
昨今のガンマ線天文学の発展

2000年代　TeVガンマ線望遠鏡観測の本格化（天体数200に迫る）
2008年以降　フェルミ衛星によるGeVガンマ線観測の飛躍（天体数5000以上）
2020年代　CTAによるTeVガンマ線観測の発展（天体数1000以上が期待）

一方、MeVガンマ線観測は.....
(数100 keV– 数10 MeV)

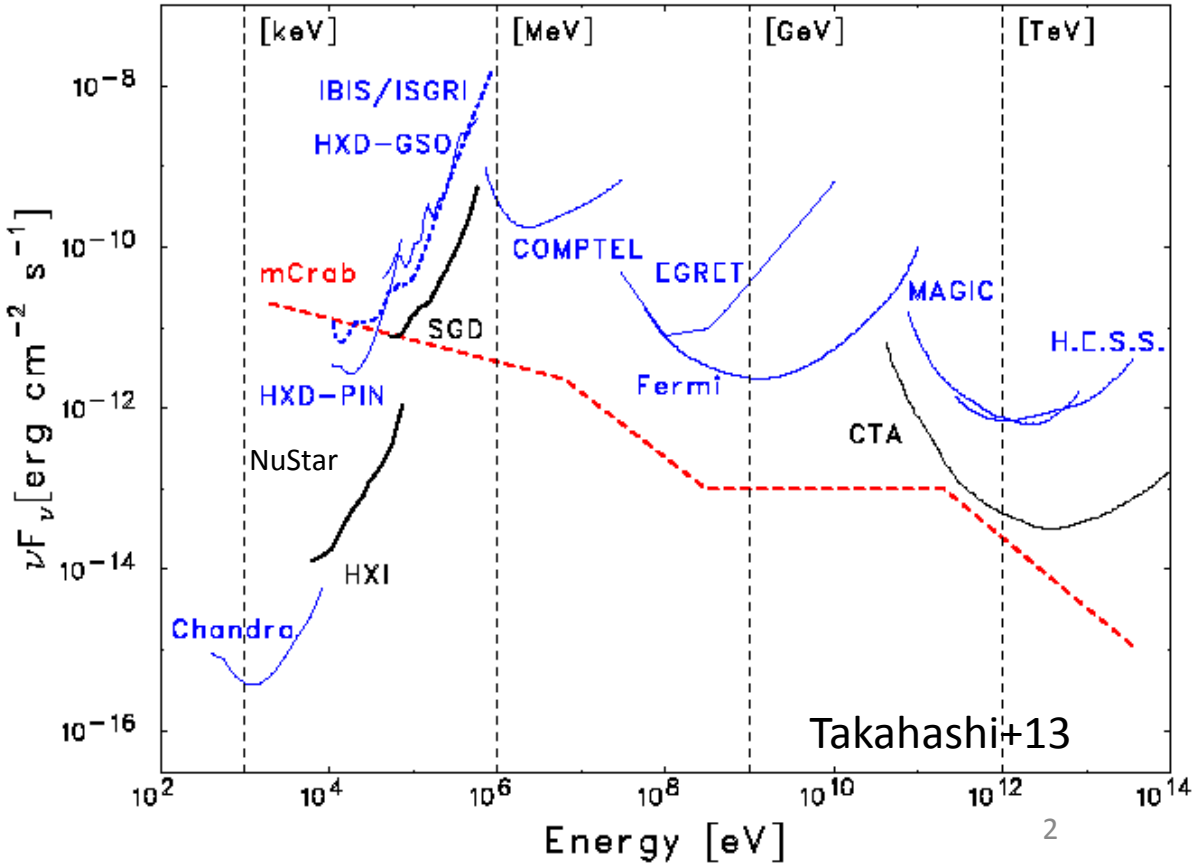
1990年代のCGRO衛星COMPTEL以降進展無し
（天体数 約30）

Fermiでも100MeV以下は
感度悪い



Fermi/LAT 30-100MeV

Principe+18



AMEGO

2014年ごろ　　ComPairとして、提案（アメリカ）
2017年ごろ　　AMEGOとなる
2019年 Astro2020 APC White paper 提出

PI: Julie McEnery (GSFC/NASA)

All-sky Medium Energy Gamma-ray Observatory:
Exploring the Extreme Multimessenger Universe an
Astro2020 White Paper

PI: Julie E. McEnery
NASA/GSFC

(AMEGO Collaboration)

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

arXiv190707558

AMEGO Team – growing and open for joining

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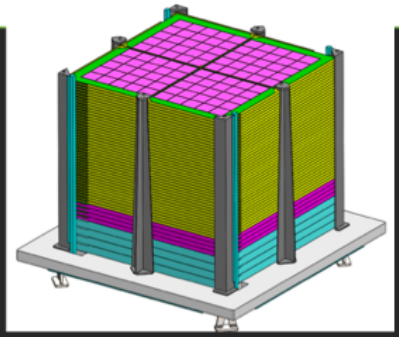
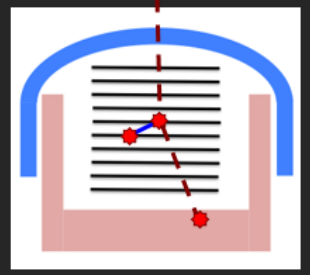
AMEGO Instrument Summary

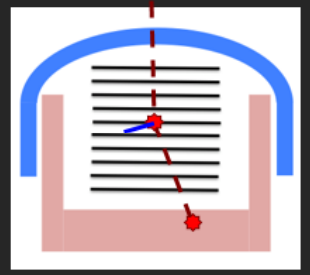
Energy Range	300 keV -> 10 GeV
Angular resolution	3° (3 MeV), 6° (10 MeV), 2° (100 MeV)
Energy resolution	<1% (< 1 MeV), 1-5% (1-100 MeV), ~10% 91 GeV)
Field of View	2.5 sr (20% of the sky)
Line sensitivity	$<6\times10^{-6}$ ph cm^{-2} s^{-1} for the 1.8 MeV ^{26}Al line in a 1-year scanning observation
Polarization sensitivity	<20% MDP for a source 1% the Crab flux, observed for 10^6 s
Continuum sensitivity (MeV cm^{-2} s^{-1})	3×10^{-6} (1 MeV), 2×10^{-6} (10 MeV), 8×10^{-7} (100 MeV)

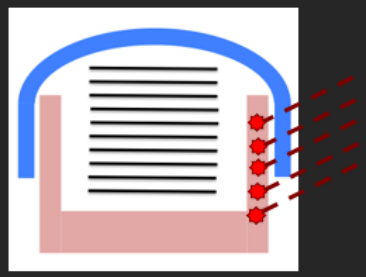


Science and Triggering

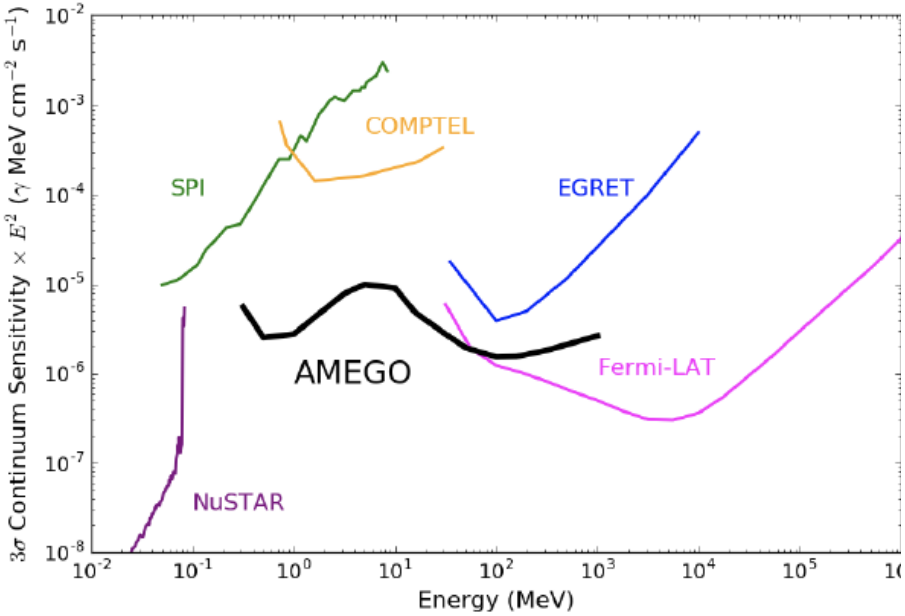
- Main trigger: coincidence of signals from 2 consequent layers of Si tracker (threshold 10-20 keV) + signal from CZT (any bar, threshold 50-100 keV)
  - evolves all science measurements in Compton and Pair-production modes, including polarization
- Compton untracked trigger: coincidence of signals from one layer (both X and Y readout) and CZT
  - provides detection of weak sources with low background
  - improves efficiency at low energy (below 500 keV) for Compton events
- CZT trigger: coincidence of signals from several (TBD) bars above 50-100 keV threshold
  - evolves more efficient line and GRB measurement, however with poorer localization



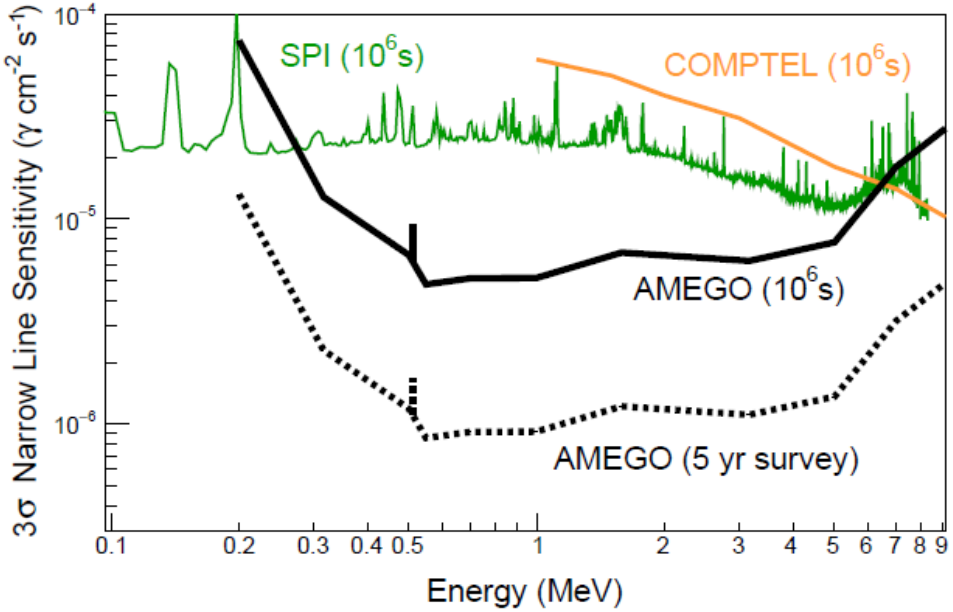




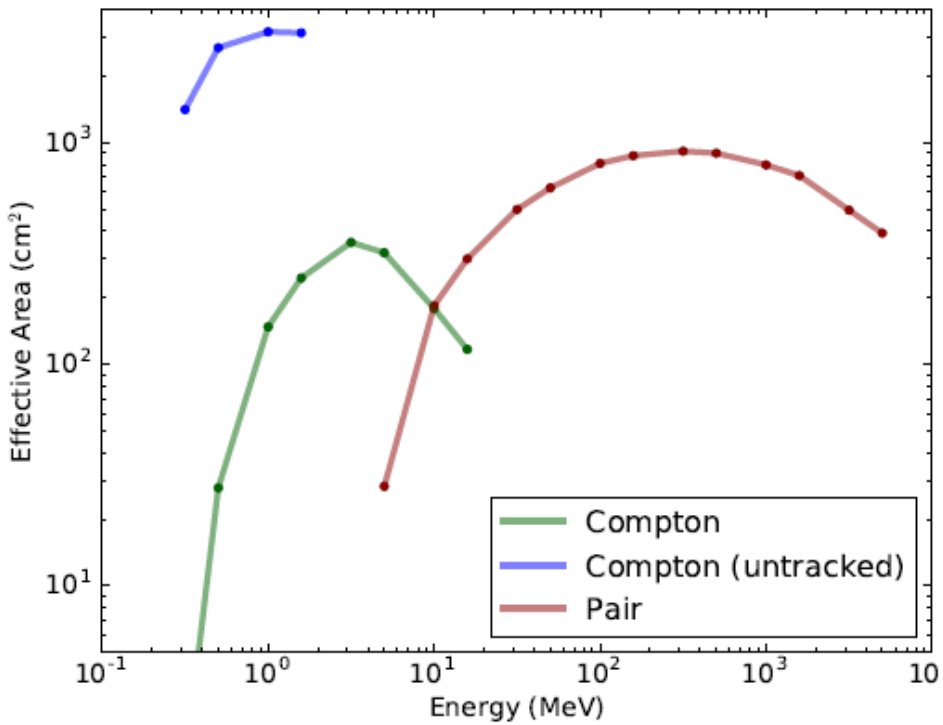
連続成分感度



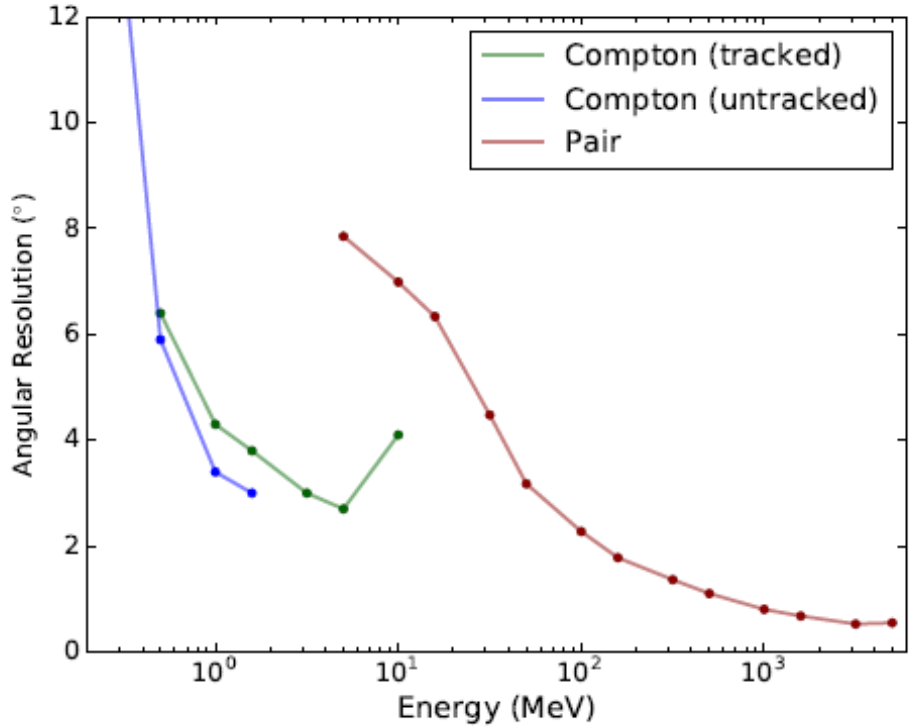
ライン感度



有効面積

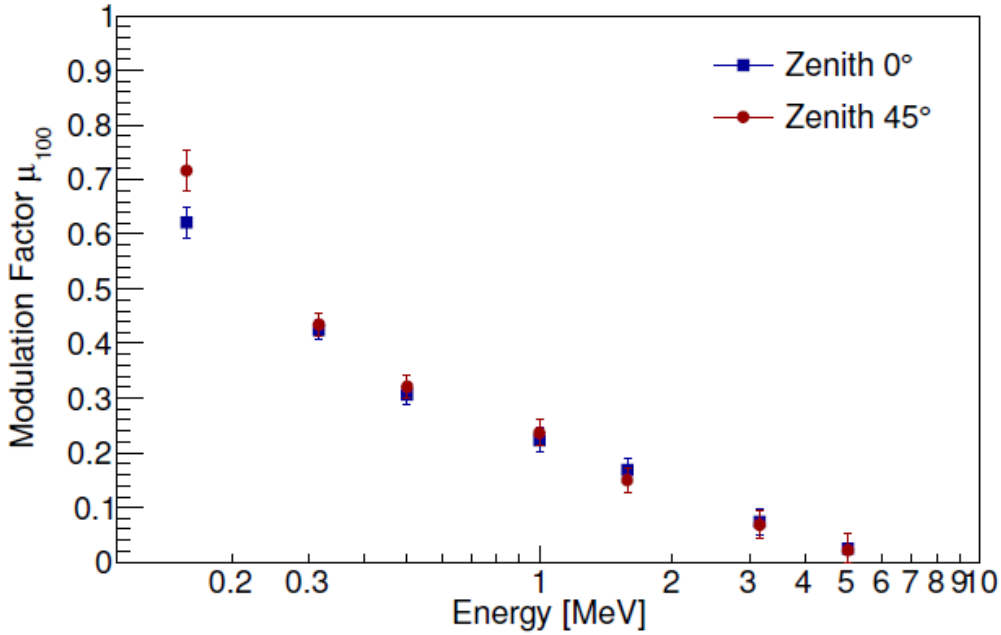


角度分解能



10MeV異常でFermi/LATより
角度分解能　良い

偏光観測
Modulation factor

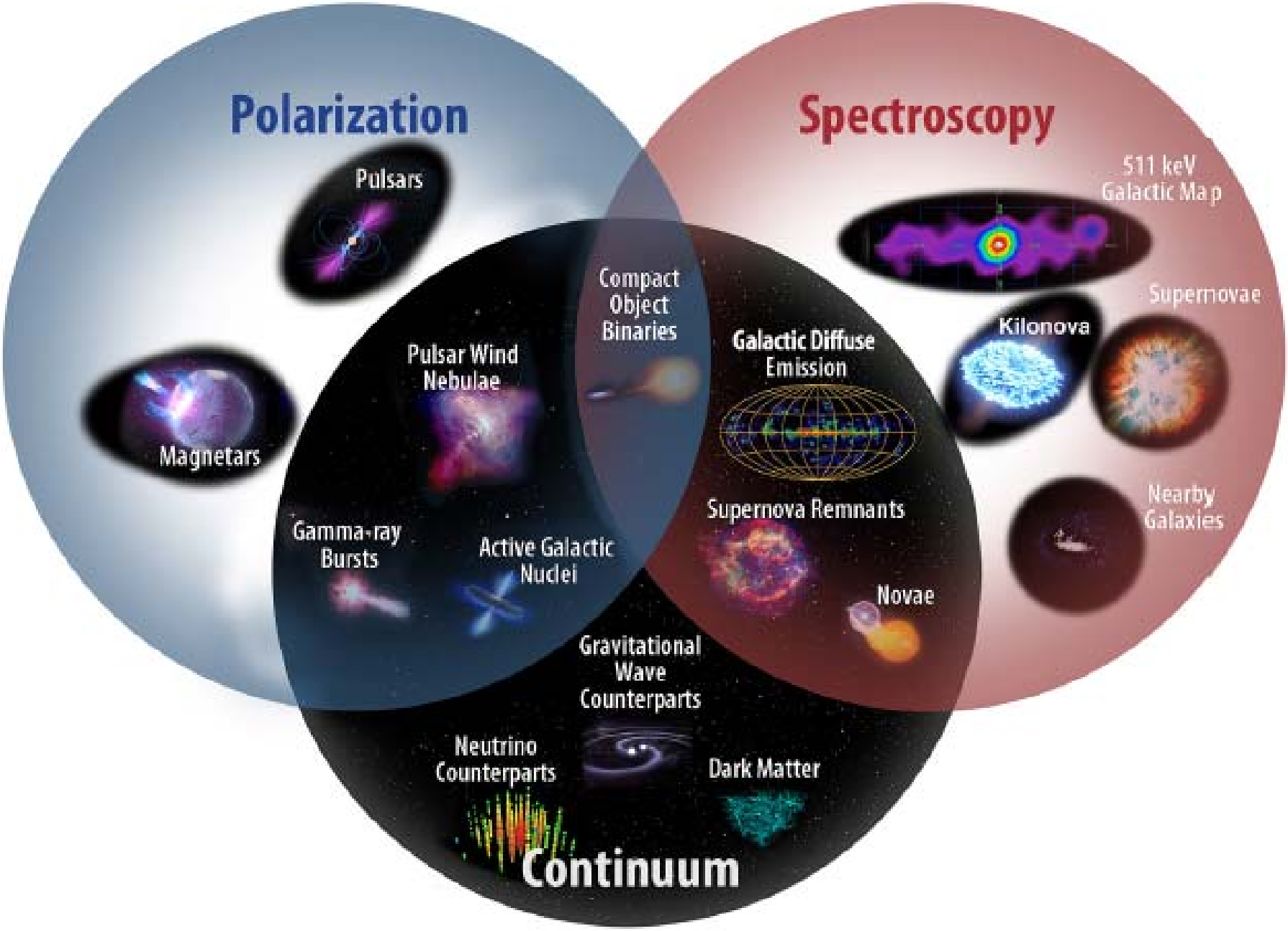


AMEGO

What Science is there?

Essentially all topics in high-energy astrophysics will benefit from the capabilities provided by AMEGO, including four broad scientific objectives:

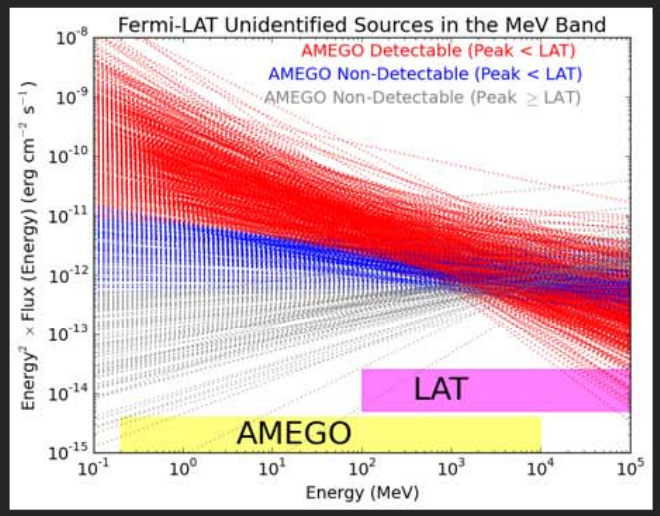
- **Astrophysical Jets:** Understand the formation, evolution, and acceleration mechanisms in astrophysical jets;
- **Compact Objects:** Identify the physical processes in the extreme conditions around compact objects;
- **MeV Spectroscopy:** Measure the properties of element formation in dynamic systems;
- **Dark Matter:** Test models that predict dark matter signals in the MeV band.


Polarization
Pulsars
Magnetars
Spectroscopy
511 keV
Galactic Map
Supernovae
Kilonova
Nearby
Galaxies
Compact
Object
Binaries
Pulsar Wind
Nebulae
Galactic Diffuse
Emission
Supernova Remnants
Gamma-ray
Bursts
Active Galactic
Nuclei
Novae
Gravitational
Wave
Counterparts
Neutrino
Counterparts
Dark Matter
Continuum

Mystery of Unidentified Sources

About one third (or > 1,000) of Fermi-LAT sources remain unidentified

- WHO ARE THEY ?
  - Localization error
  - Dark Matter clumps
  - New source class
- Below 200 MeV, AMEGO with highly improved sensitivity, will discover many new sources and source classes



>50% of Fermi-LAT catalog sources have a peak below the Fermi-LAT band

気球実験に対するメリット

全天サーベイ　:　多数の天体、新種の天体の発見
連続モニター　:　GW/high-e ニュートリノ対応天体、
突発天体のフレア

既存の技術が多いので、検出器TRLがそこそこのレベルで、
見通しがよい

他のメリット

フェルミ衛星のメンバーが多く、日本側の顔も知られている