Advanced Scintillator Compton Telescope (ASCOT)

Tejaswita Sharma (Teji)

University of New Hampshire

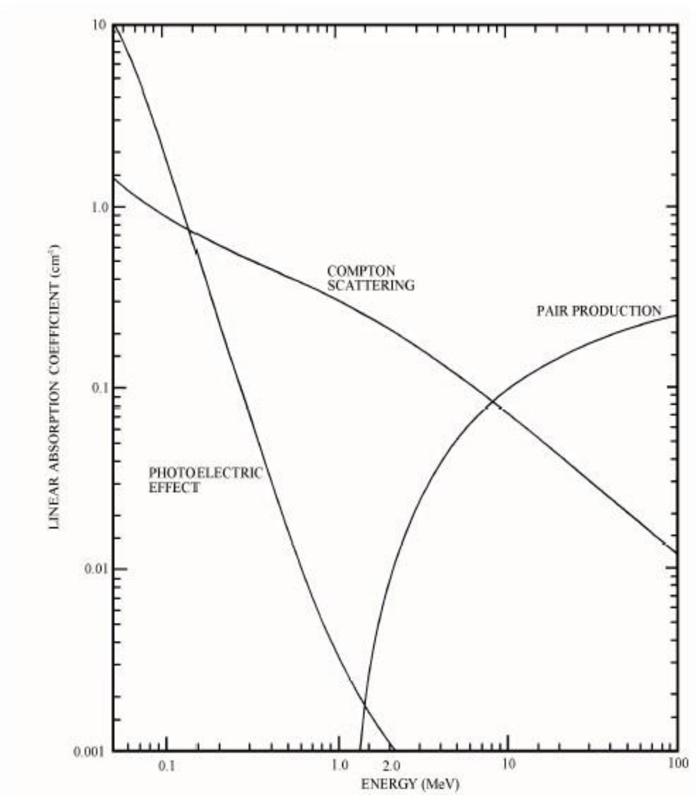
(NH, USA)

Advisor: Dr. Peter Bloser

University of New Hampshire

FERMI SUMMER SCHOOL 2017

Medium Energy Gamma Ray Observations



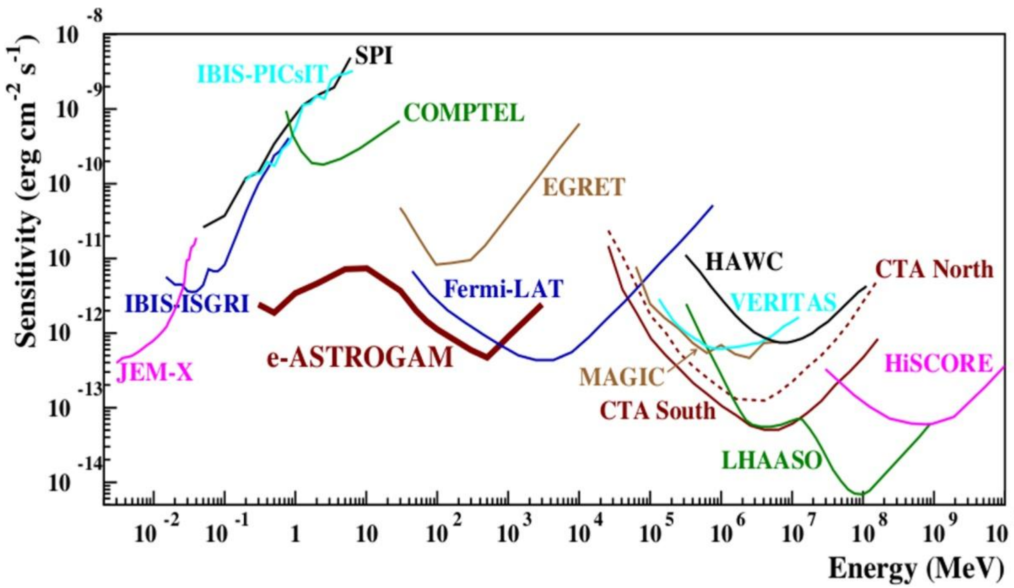


Image Courtesy:Lucchetta et al. 2017

Need for MeV mission with improved sensitivity

COMPTON TELESCOPE

- First Detector plane (D1) made of low Z material for high Compton scattering probability

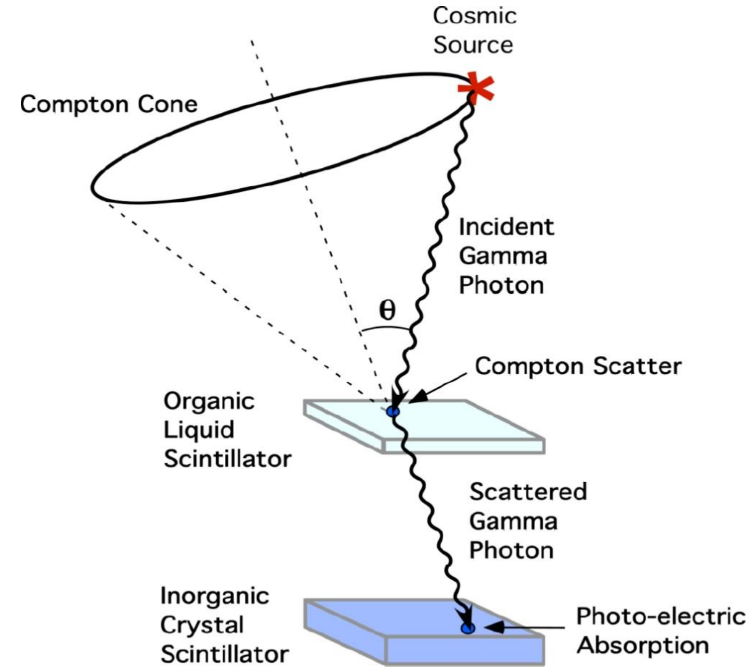
- Second Detector plane (D2) for the absorption of scattered photon made of high Z material

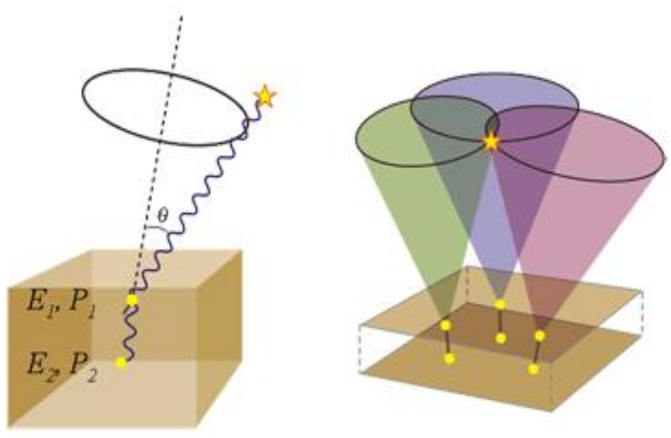
- From the locations of both interactions the direction of the scattered γ-ray is determined

- From the energy losses in both detectors (E1, E2), the scattering angle θ can be derived

- The arrival direction of the primary γ-ray is thus known to lie on a circle defined by a cone with opening angle θ around the direction of the scattered γ-ray

- From the overlap of multiple cones, source location can be found





Advanced Scintillator Compton Telescope (ASCOT)

- ASCOT is based on the legacy of COMPTEL using relatively robust, low-cost, off-the-shelf technologies

- Advanced scintillator materials, **P-terphenyl** (D1) and **Cerium Bromide ($CeBr_3$)** (D2) are combined with compact readout devices such as **silicon photomultipliers (SiPMs)**

WHY P-TERPHENYL?

- Low Z
- High light output
- Fast Decay Time
- Mechanically more robust

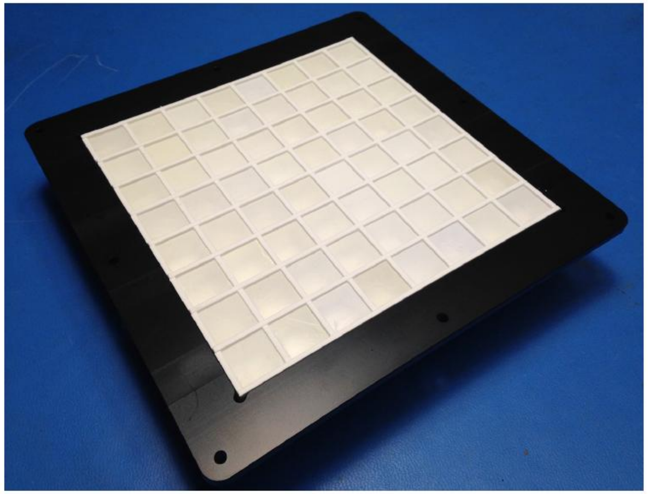
WHY $CeBr_3$?

- High stopping power
- Better energy resolution
- Easily available than $LaBr_3$
- Very fast timing
- Better detection efficiency
- Lower internal background

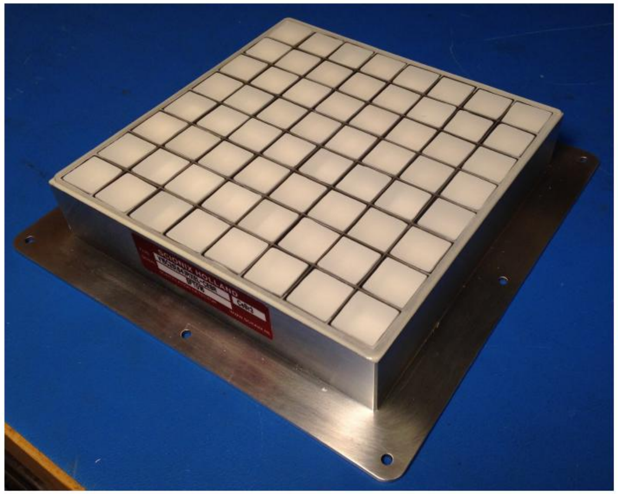
WHY SiPMs ?

- Reduced passive mass and volume within the instrument
- Increased efficiency
- Reduced likelihood of incorrectly reconstructed events

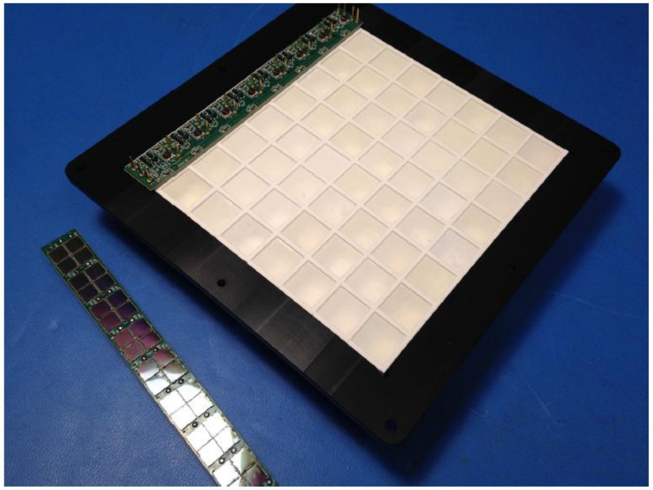
ASCOT



D1 Module with 64 p-terphenyl crystals

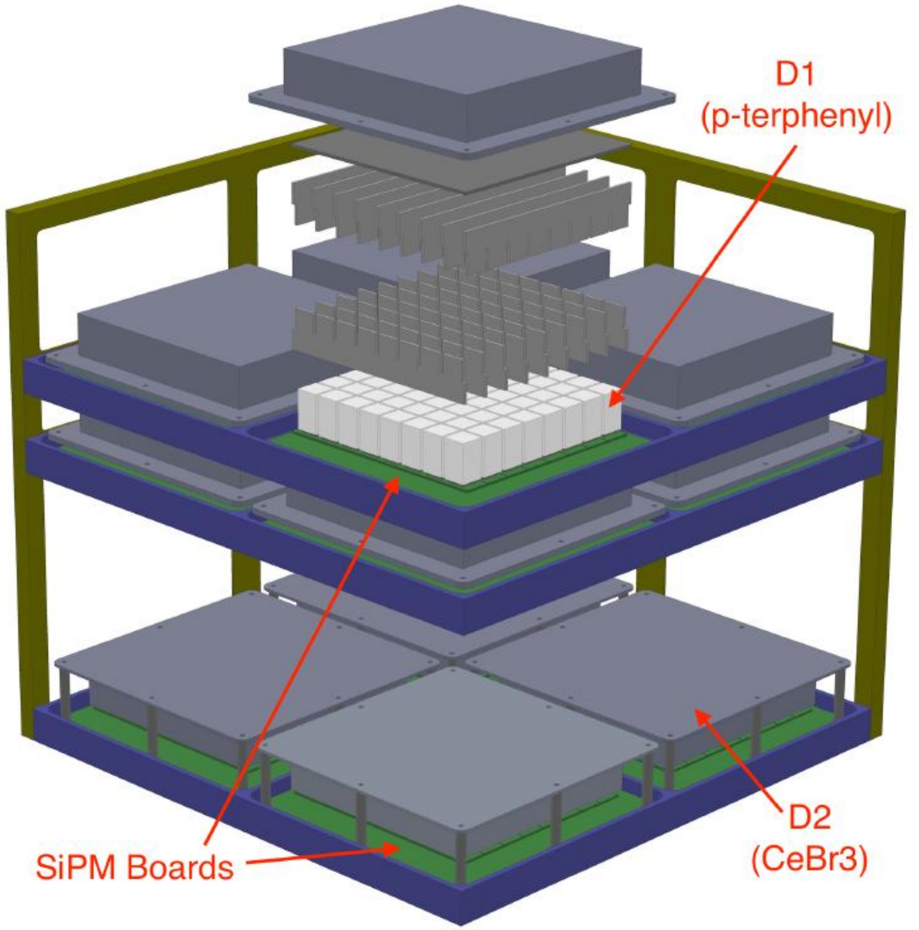


D2 module, with 64 hermetically sealed CeBr3 crystals



SiPM strip boards shown together with the D1 module scintillator array. Each strip will read out a row of crystals

ASCOT



University of New Hampshire

OBJECTIVES

• The instrument will be built and flown on a high altitude (40km) balloon flight from Palestine, Texas in June 2018

• Our goal is to image the Crab Nebula and we expect a ~4-sigma detection in the 0.2 - 2 MeV energy band in a single transit (one day).

• If successful, the project will demonstrate that the energy, timing, and position resolution of this technology are sufficient to achieve an order of magnitude improvement in sensitivity in the medium-energy gamma-ray band, were it to be applied to a ~1 cubic meter instrument on a long-duration balloon or Explorer platform.

GRAPE launch,2014

THANK YOU