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# Unfolding the Crab Nebula Flux with Gammapy\*

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## Outline

Astroparticle Physics

Cherenkov Astronomy

Imaging Air Cherenkov Telescopes

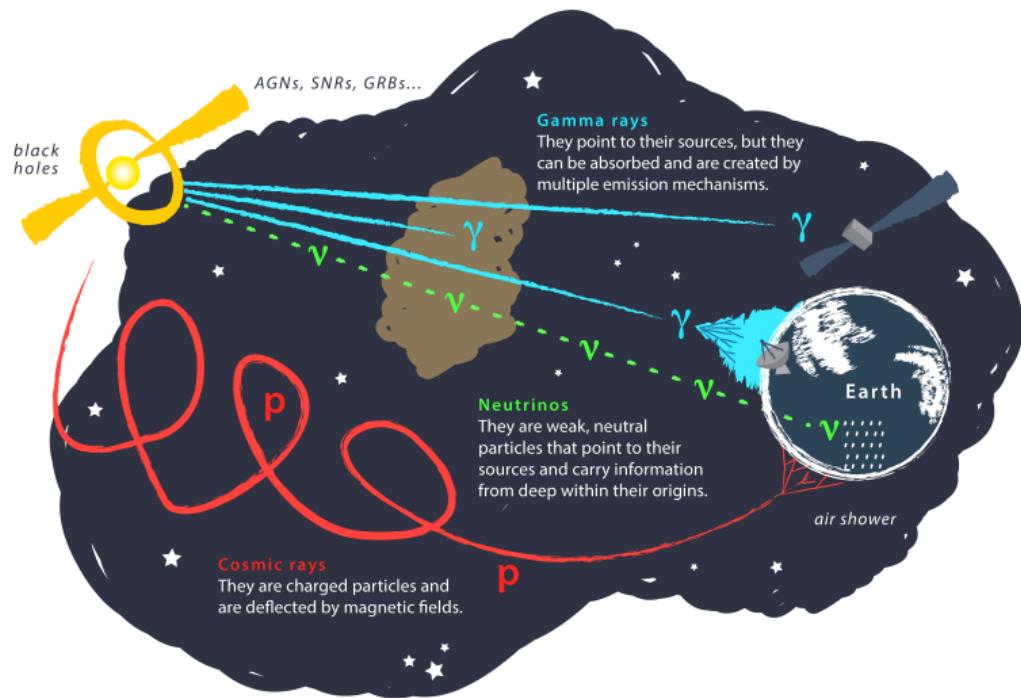
Gammaphy

Joint Crab Analysis

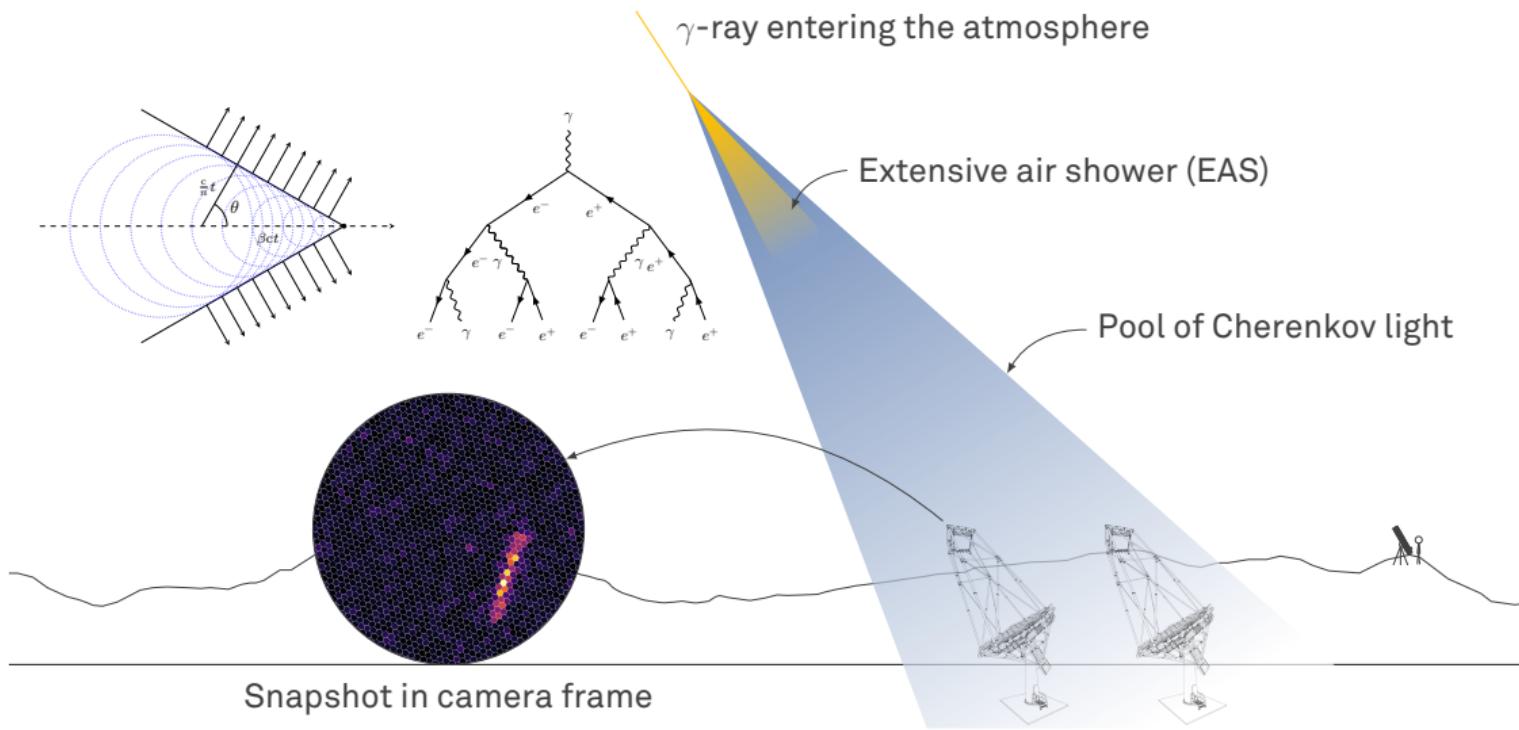
Unfolding

Results

## Astroparticle Physics



## Cherenkov Astronomy





## Gammappy

**DL3**  
 $\gamma$ -like events

**DL4**  
Binned data

**DL5**  
Science products

Data reduction

Likelihood fitting



DataStore  
Observations  
Observation  
GTI



MapDatasetMaker  
SafeMaskMaker  
FoVBackgroundMaker  
RingBackgroundMaker  
etc.



Datasets  
MapDataset  
MapDatasetOnOff  
etc.



Fit, Models, SkyModel  
FoVBackgroundModel  
etc.

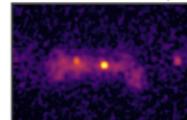


FluxPointsEstimator  
FluxMapEstimator  
etc.

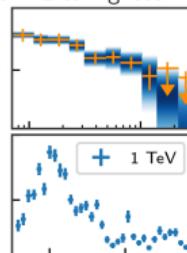
Source Catalogs

Name	Flux	Size
SNR	1e-12	1 deg
PWN	1e-11	0.2 deg
GRB	1e-10	0 deg

Flux & TS Maps



SEDs & Lightcurves

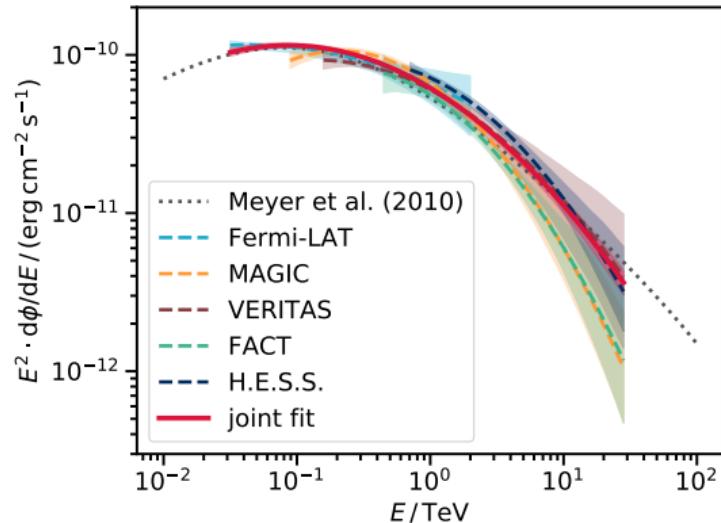
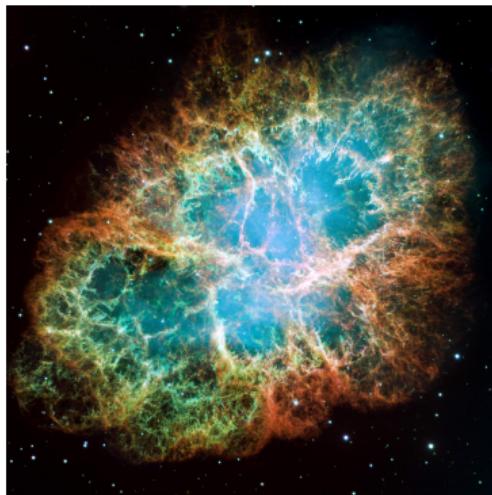


A **Python** package for  
**gamma-ray** astronomy



## Joint Crab Analysis

<https://github.com/open-gamma-ray-astro/joint-crab>

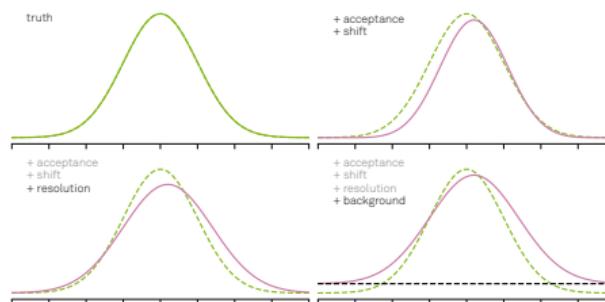


## Unfolding

$$g(y) = \int_a^b A(x, y)f(x)dx + b(y)$$

$$g_i = \sum_{j=1}^n A_{ij}f_j + b_i \quad (\text{discrete})$$

Infer true distribution  $f(x)$  from measured distribution  $g(y)$ : *inverse, stochastic, ill-conditioned problem*



Model  $g$  with a Poisson-Likelihood → Maximum Likelihood Approach for Unfolding

## Results

