Gammapy plugin for 3ML

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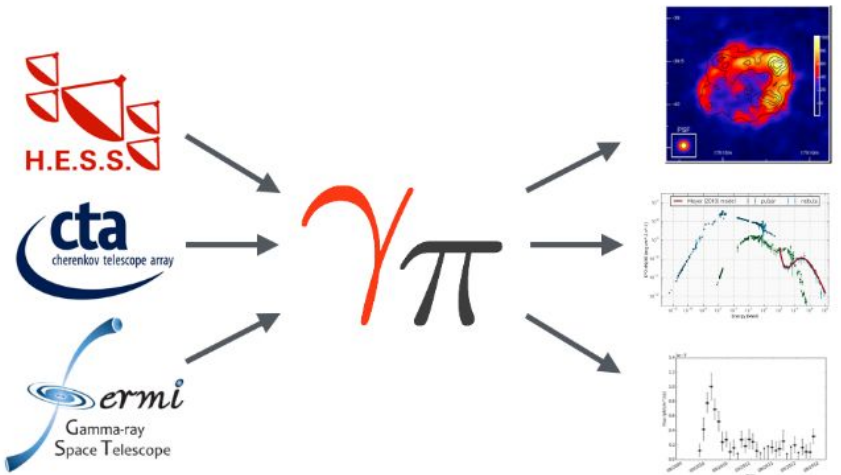
What is Gammapy?

- Open source community driven python package for gamma-ray astronomy
- Developed to analyse data from Cherenkov Telescope Array (CTA)
- Already used by existing ground based gamma-ray telescopes such as VERITAS, MAGIC and HESS (**DL 3 format**)

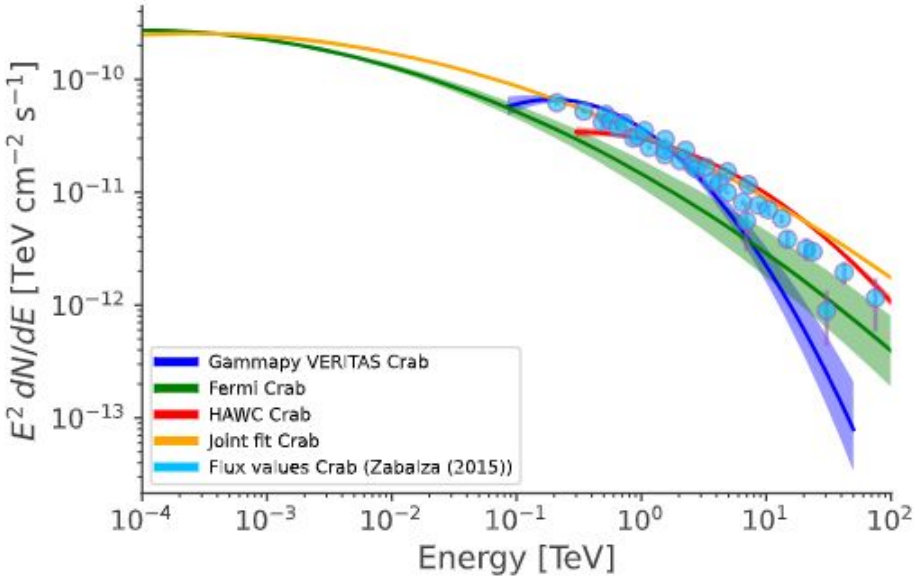


https://arxiv.org/pdf/1509.07408.pdf

Status of Gammapy plugin for 3ML

- Tested for VERITAS Crab data only
- Point source analysis is working to perform joint 1D spectral analysis
- Likelihood model is defined using ***astromodels***
- GammapyLike wrapper used astromodels and translate it into gammapy model
- GammapyLike used gammapy functions to read in data (VERITAS) and calculate likelihood value
- Likelihood value is returned from gammapy which then can be used by 3ML to do minimization and estimate model parameters
- This likelihood can also be combined with likelihood values from other plugins (instruments) and allow us to do multi-instrument analysis

Example of Crab nebula data



Courtesy: Anjana Kaushik Talluri

To do list for future

- Need to make it generalize so that any IACT instrument can work out of the box if their high level data is in right format required by gammapy
- Test it on extended gamma-ray sources such as IC 443, MGRO J1908+06, and SNR G106.2+2.7
- I am also interested in performing joint morphological analysis specially for IC 443 using Fermipy/gammapy/HAWC plugins

VERITAS fitting through gammapy-3ML plugin using 80 mins of crab data

parameter	result	unit
crab.spectrum.main.Powerlaw.K	(3.23 -0.13 +0.14) x 10^-20	1 / (cm2 keV s)
crab.spectrum.main.Powerlaw.index	-2.57 +/- 0.04	

Correlation matrix:

1.00	0.72
0.72	1.00