

# The Starburst Galaxy M82 at Very High Energy (100GeV>)

Use of the FERMI LAT high energy data with  
VERITAS Imaging Atmospheric Cherenkov Telescope  
observations of M82 to constrain the broad band spectrum

Analysis performed with FERMI Science Tools Binned  
Likelihood Method



Alisha Chromey for FERMI Summer School 2015

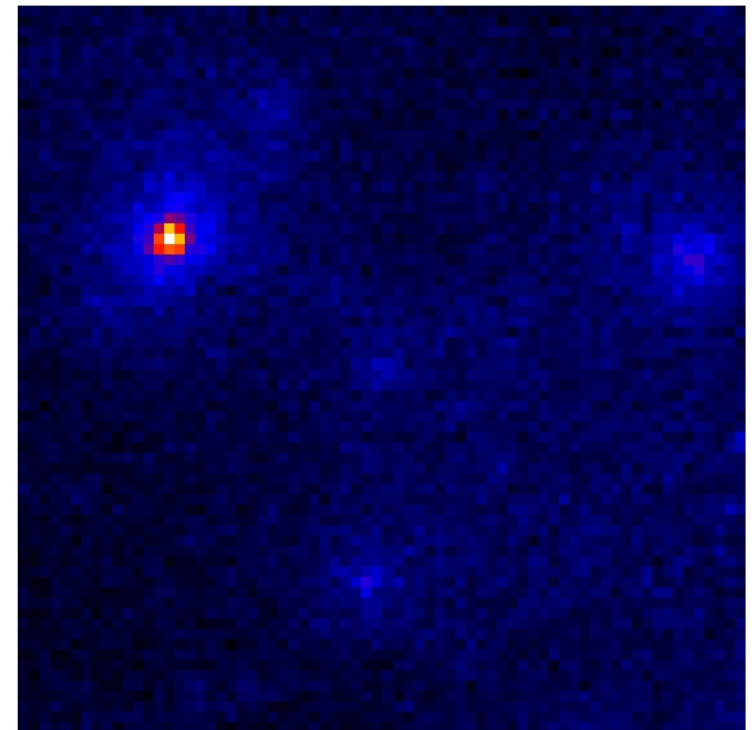
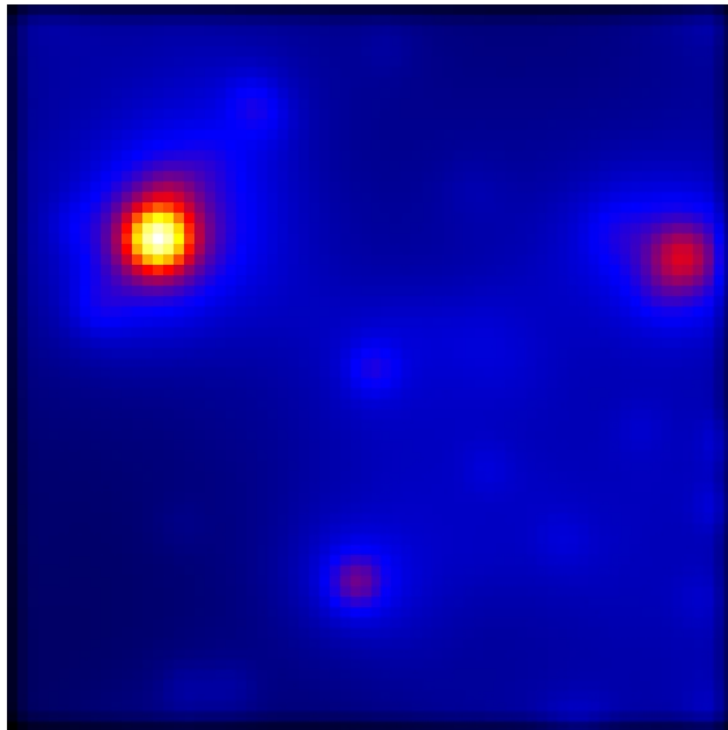


*NASA, ESA, and The Hubble Heritage Team (STScI/AURA)*

- FERMI has detected four sources coincident with star burst galaxies as of the 3FGL catalog(M82, NGC 253, NGC 1068, and NGC 4945)  
3FGL, Acero et al. 2015
- Gamma rays from star burst galaxies possibly originate due to cosmic rays from vigorous star formation

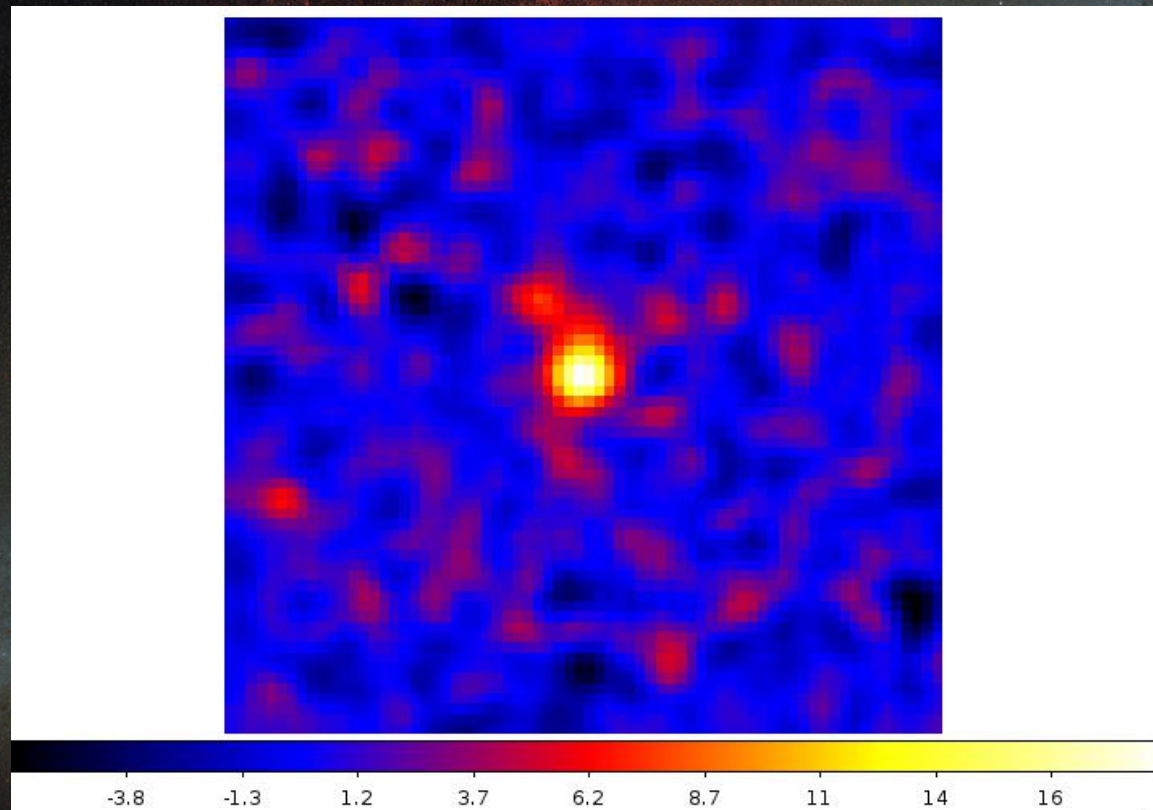


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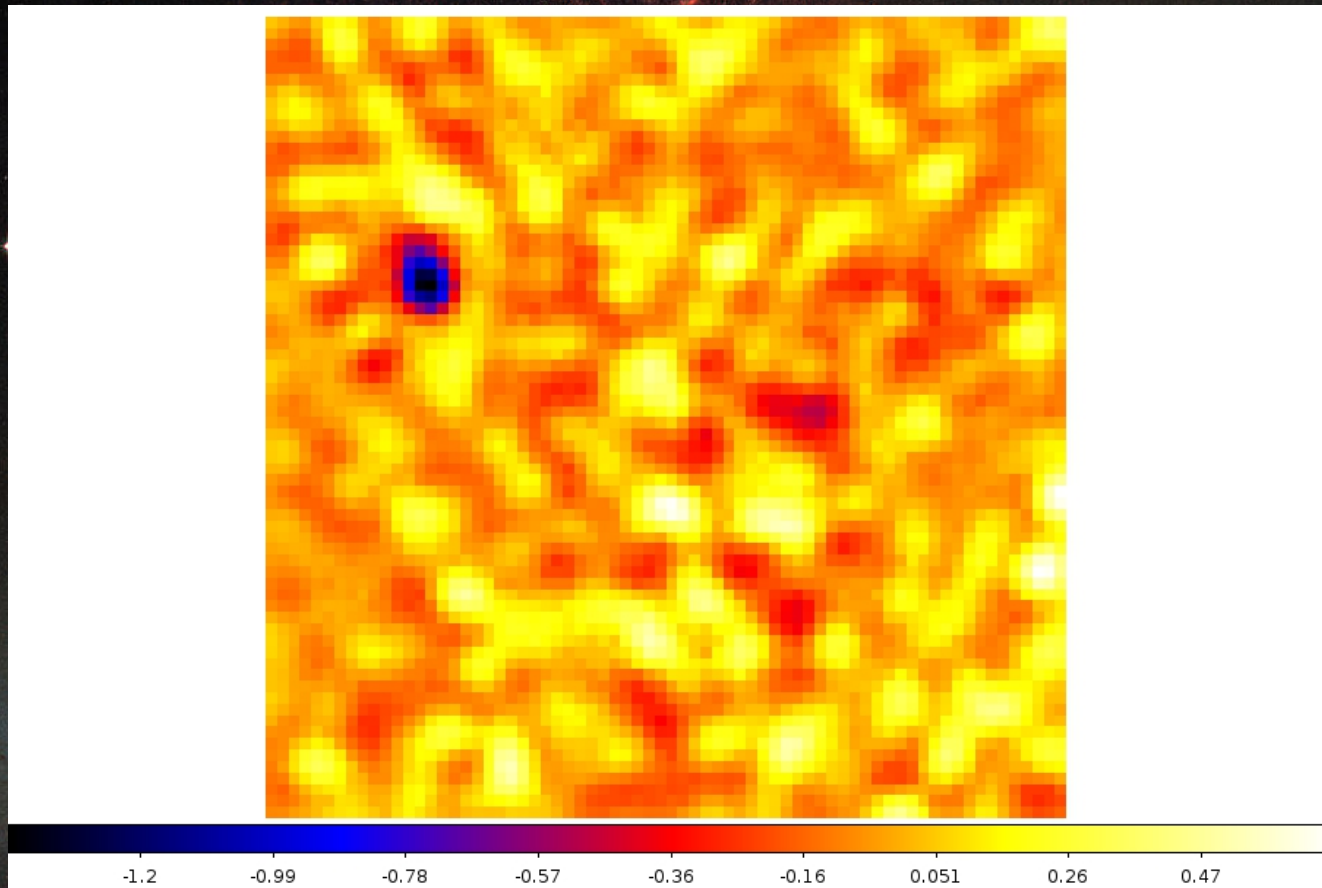
Background Source Model vs. Counts Map  
(100MeV – 300GeV) (08/14/2008 – 01/19/2015)

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Residual of Counts Map vs. Background Source Model  
(100MeV – 300GeV) (08/14/2008 – 01/19/2015)

## Creating Energy Bins Residual Map for $E > 3\text{GeV}$



- Use different spectral models in the likelihood analysis
- Separate data between time eras

## 3FGL Catalog J0955.4+6940

- Spectral Index: 2.21003
- Spectral Index Error: 0.05857
- Flux: 1-100 GeV 9.34374e-10 (photon/cm<sup>2</sup>/s)
- Flux Error: 8.27854e-11
- Flux: 100-300 MeV 7.79228e-09 (photon/cm<sup>2</sup>/s)
- Flux Error: 2.16458e-09

## Fermi Analysis(6 ½ years)

3FGL J0955.4+6940

Spectrum: PowerLaw

Index: 2.189e+00 9.731e-04 0.000e+00 1.000e+01 (-1.000e+00)

Flux = 1.03872320302e-08 [s<sup>-1</sup> cm<sup>-2</sup>] 100-300 MeV

Flux Error = 2.30384331379e-11

Flux= 9.19453146415e-10 [s<sup>-1</sup> cm<sup>-2</sup>] 1-100 GeV

Flux Error = 1.35496497742e-12

Flux= 1.4e-08 +/- 2.7e-11 cm<sup>-2</sup> s<sup>-1</sup> 0.1-300.0 GeV

