

COMPTEL Reloaded – An updated View on the MeV Sky

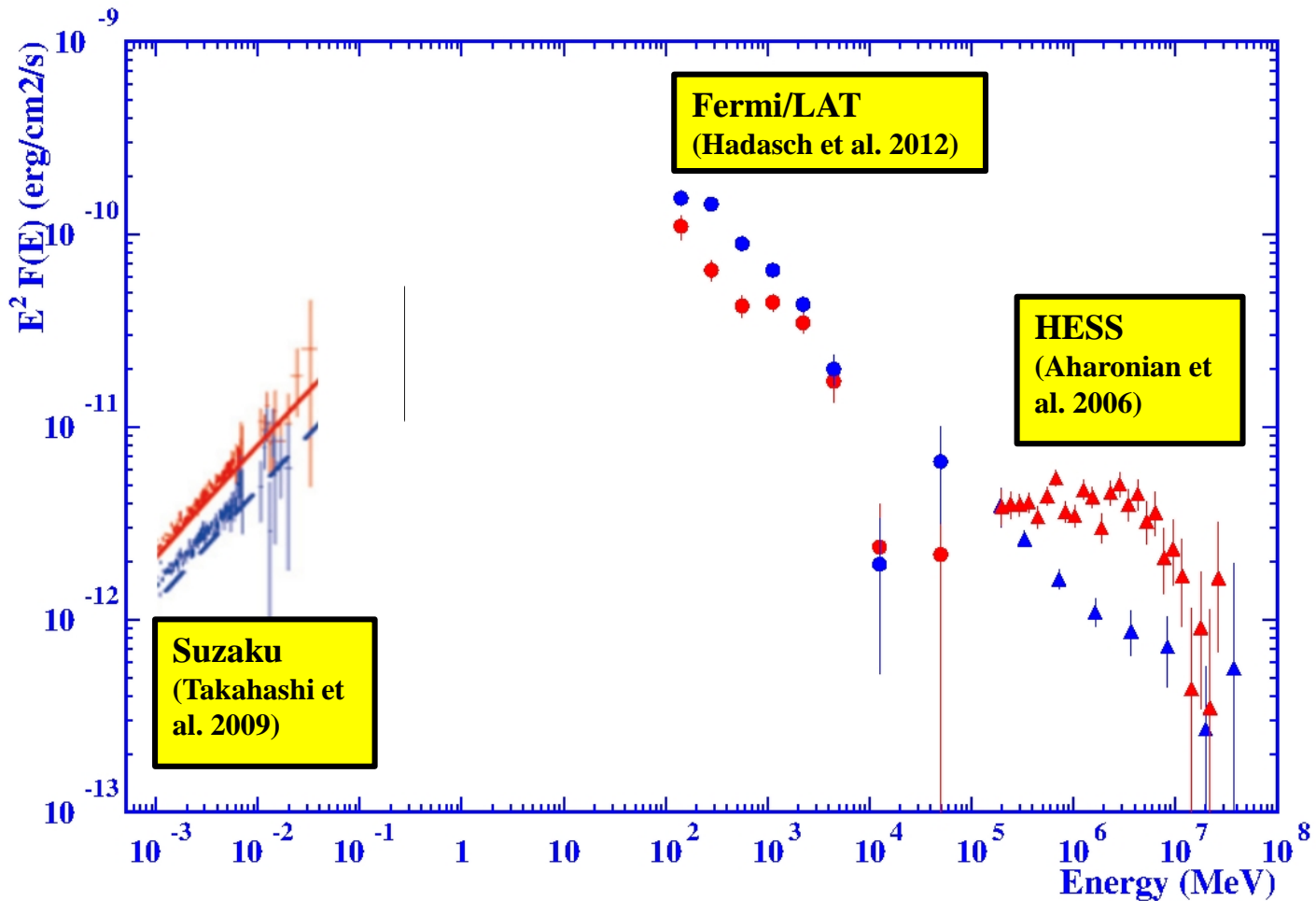
Werner Collmar & Andrew Strong

MPE Garching

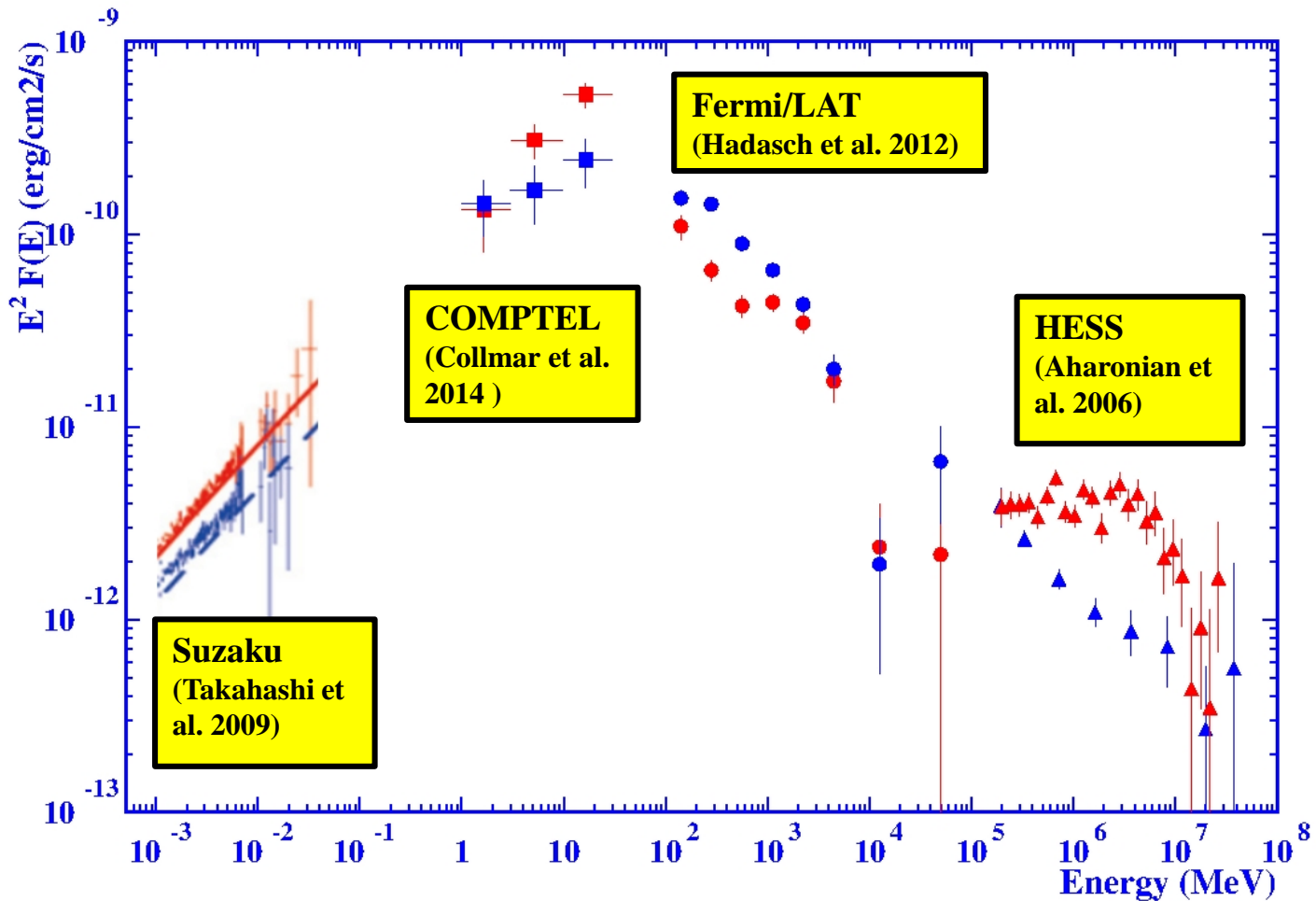
Outline

- 1) COMPTEL on CGRO**
- 2) Recent Data/Software Developments
(COMPTEL Reloaded)**
- 3) All-Sky Imaging**
- 4) Outlook: Fermi-LAT “1FLE” Catalog**
- 5) Summary**

LS 5039 High-Energy SED



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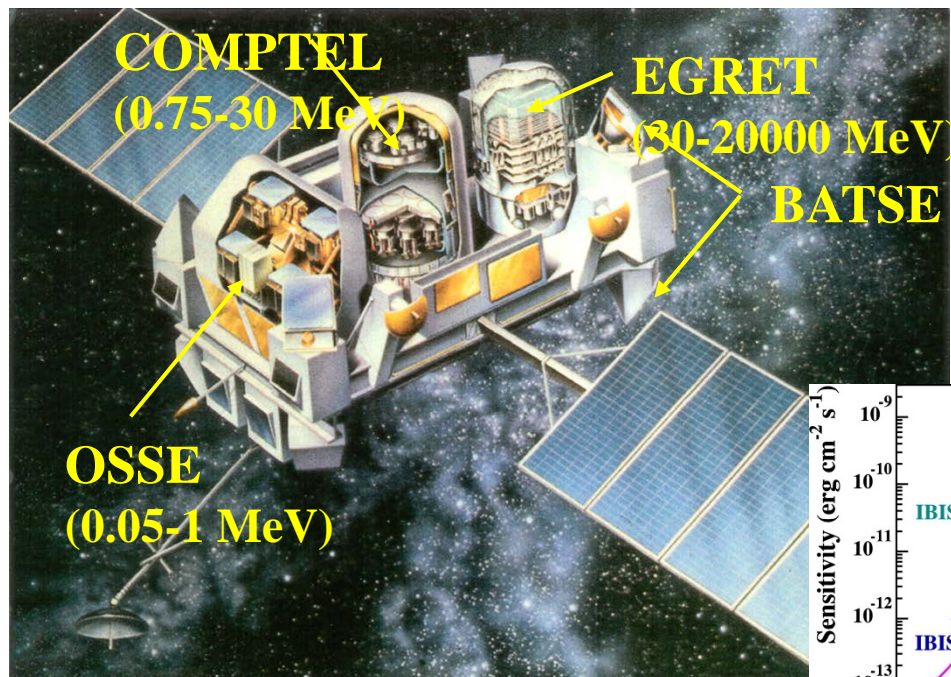


Current Worldwide COMPTEL Team



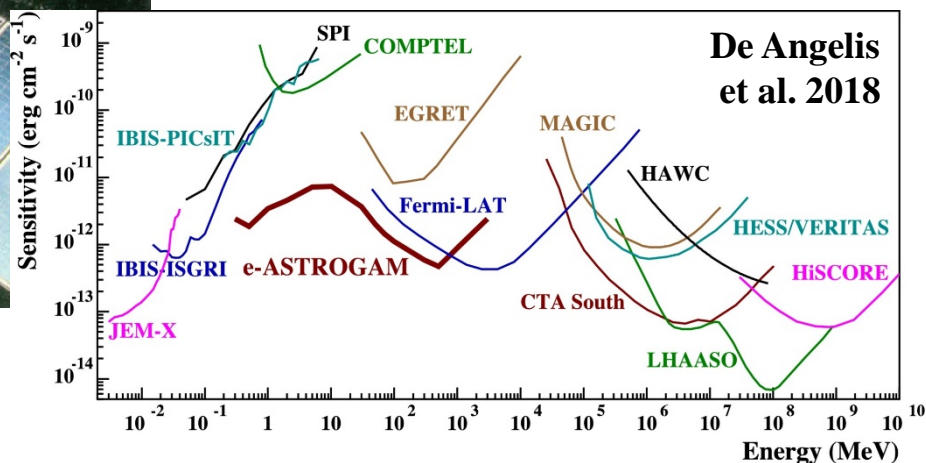
Andy: COMPTEL „Imaging & Diffuse Emission “ expert
Werner: has all the COMPTEL data, software, knowledge ...
occasionally plus a master student (e.g. machine learning)

COMPTEL on CGRO

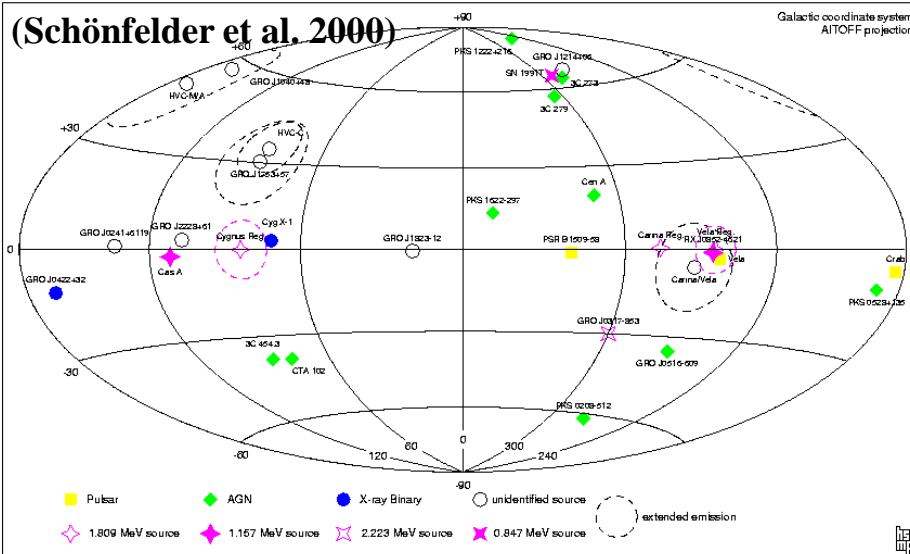


COMPTEL (Compton Telescope)

- mission: Apr. 91 – June 2000
- energy range: 0.75 – 30 MeV
- mounted parallel to EGRET
- “first-generation” experiment
- **pioneered MeV band**



Summary First COMPTEL Source Catalog



- contains published results of first 5.5 years (April '91 – October '96)
- 32 Sources (different nature)
- 31 GRBs / 21 solar flares
- upper limits for various types of objects (e.g. AGN, gal. BHs)

Source Type	#
Pulsars	3
Stellar Binaries	2
SNR (continuum)	1
AGN	10
Unidentified Sources	
- $ b < 10^\circ$	3
- $ b > 10^\circ$	5
γ -line sources	
- 1.809 MeV (^{26}Al)	3
- 1.157 MeV (^{44}Ti)	2
- 0.847/1.238 MeV (^{56}Co)	1
- 2.223 MeV (n-capt.)	1

COMTEL Reloaded: Analysis / Data

COMPTEL Energy Bands

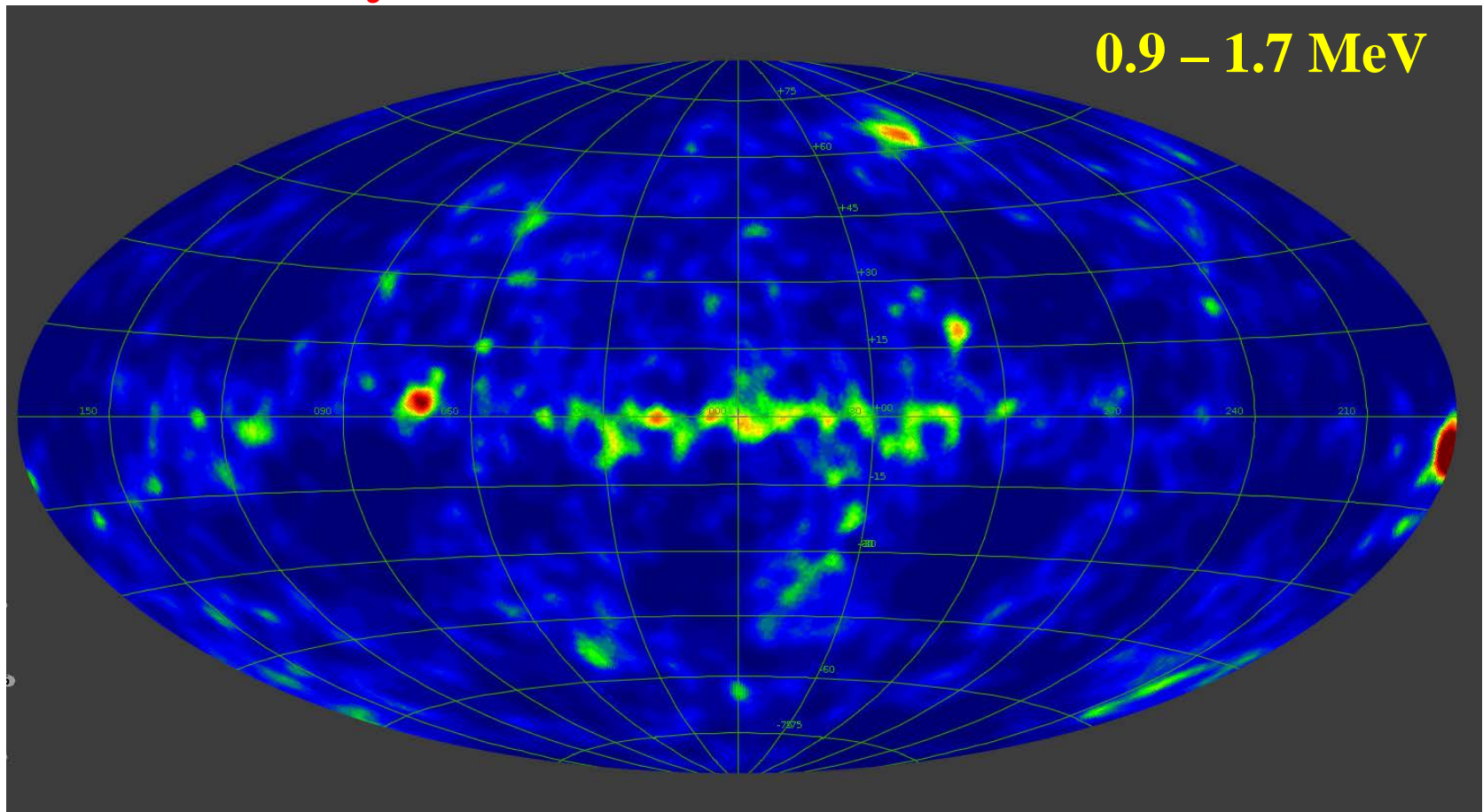
- „Classic“ Bands („by numbers“)
0.75 – 1 MeV
1 – 3 MeV
3 – 10 MeV
10 – 30 MeV
all published results yet !
- „New“ Bands („by physics“)
0.9 – 1.7 MeV
1.7 – 4.3 MeV
4.3 – 9.0 MeV
9.0 – 30 MeV
fit better to mission and
instrumental background

Analysis Software / Data

- **COMPASS Tools -> Linux**
-> fast modern computers
- **SKYMOS: Bayesian Maximum Entropy Deconvolution Method**
(A. Strong, M. Reineke, T. Ensslin)
 - HealPix: equal-area all-sky projection for data and image
- **Revised COMPTEL Data**
ToF IV: used in COMPTEL era
ToF VI: Reprocessing 2002
-> new event selections / calibrations

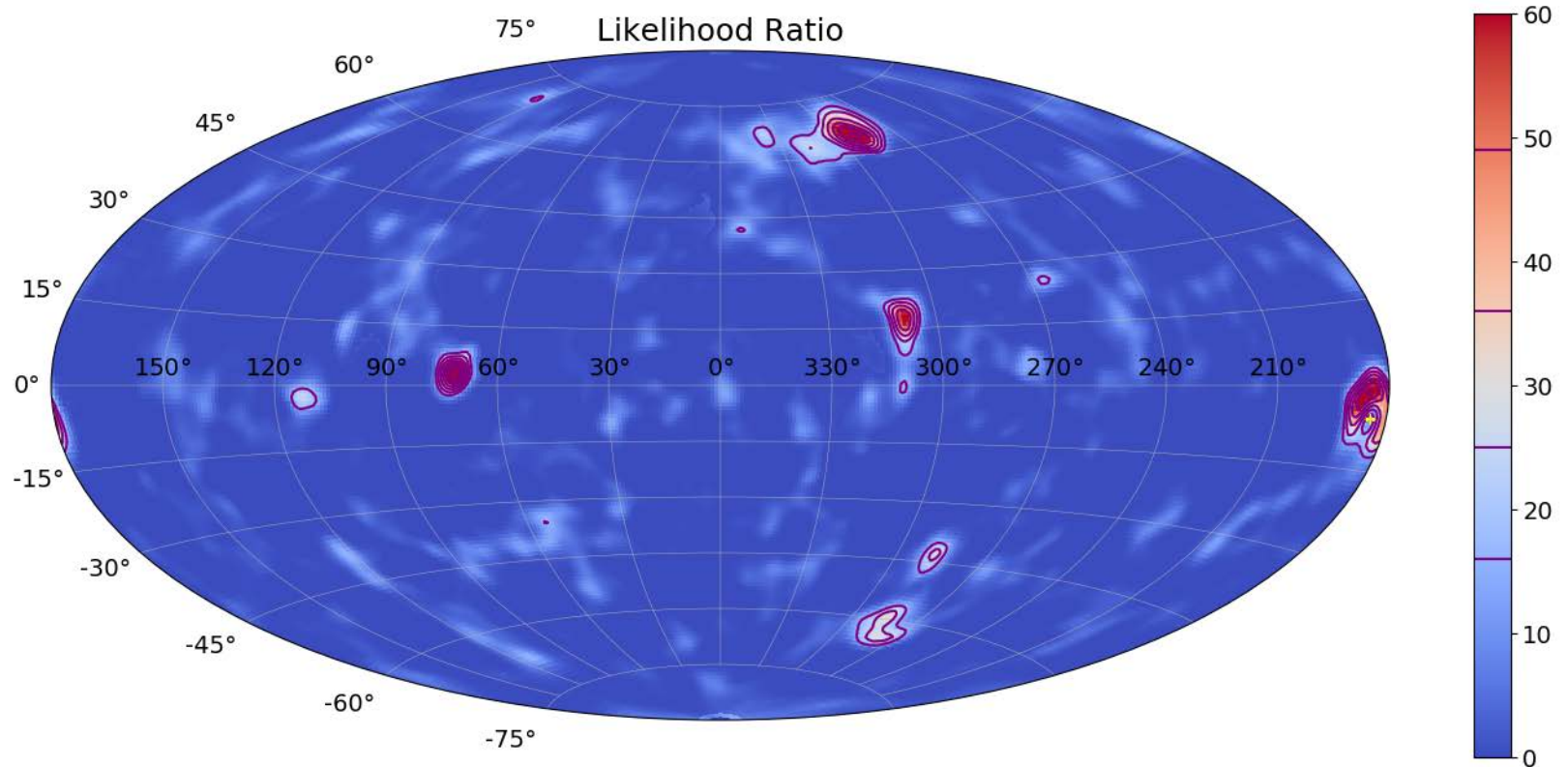
All-Sky All-Mission Imaging (Work in progress)

Preliminary



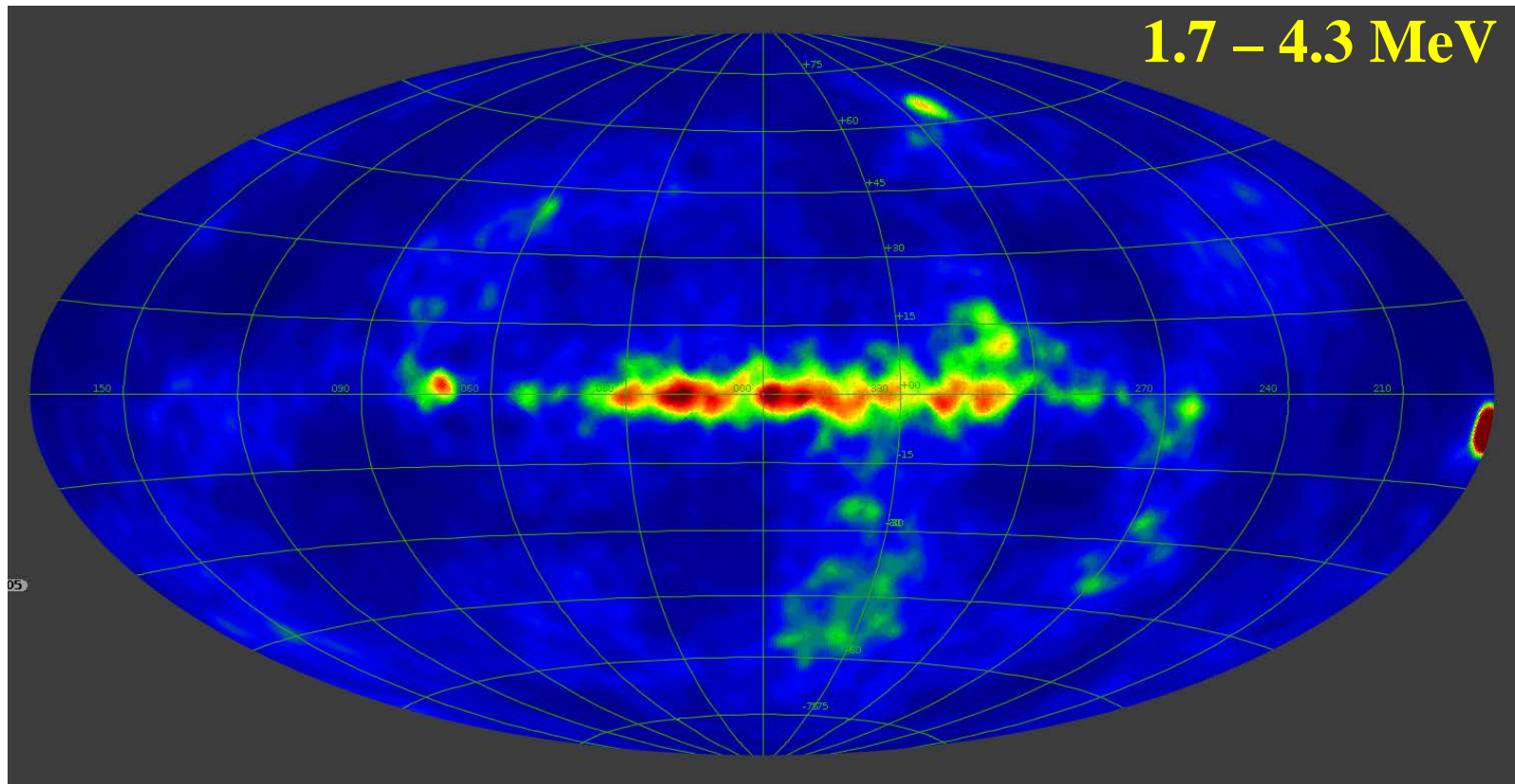
All-Sky Source Significance Map (until 2. Reboost)

0.9 – 1.7 MeV



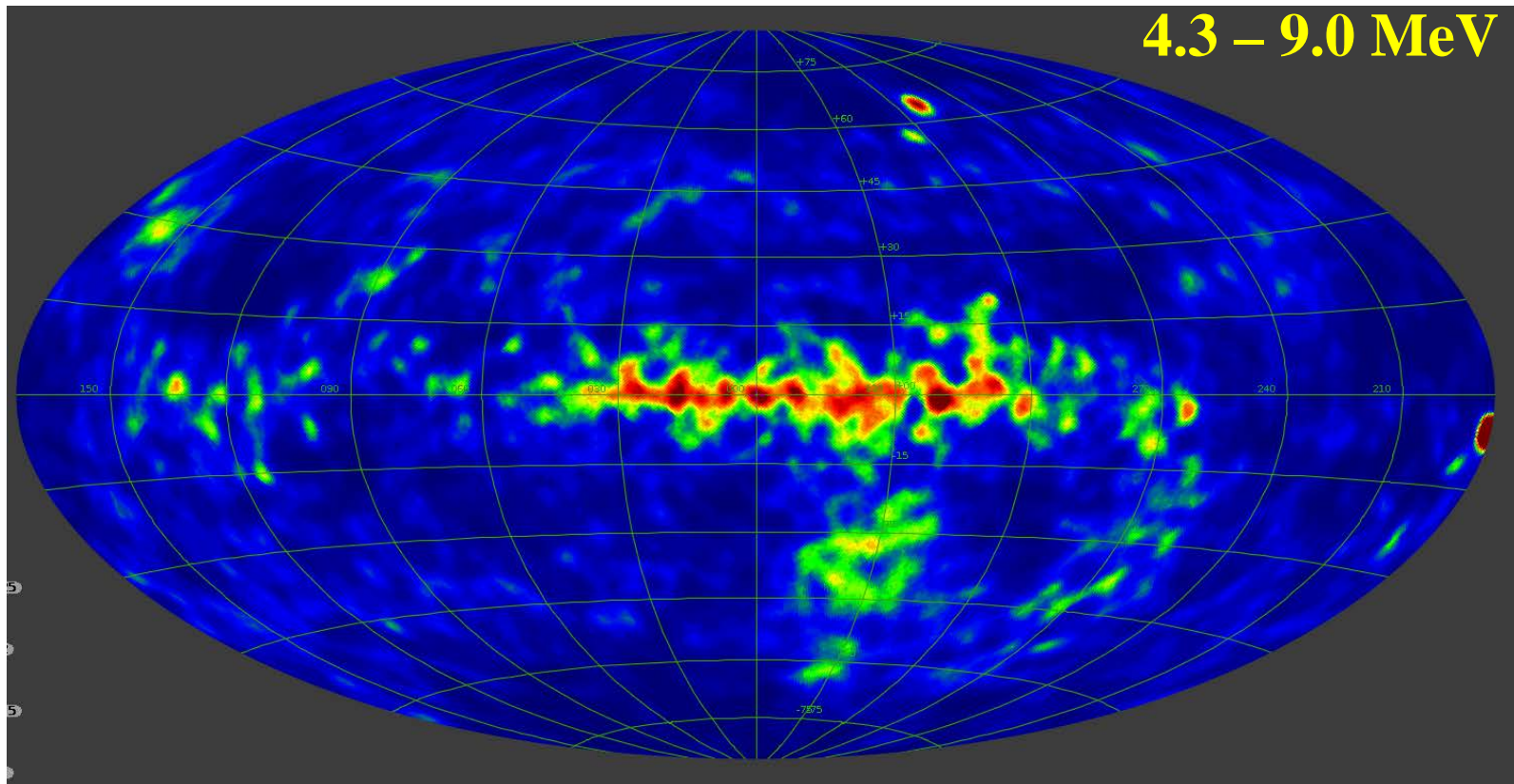
All-Sky All-Mission Imaging (Work in progress)

Preliminary



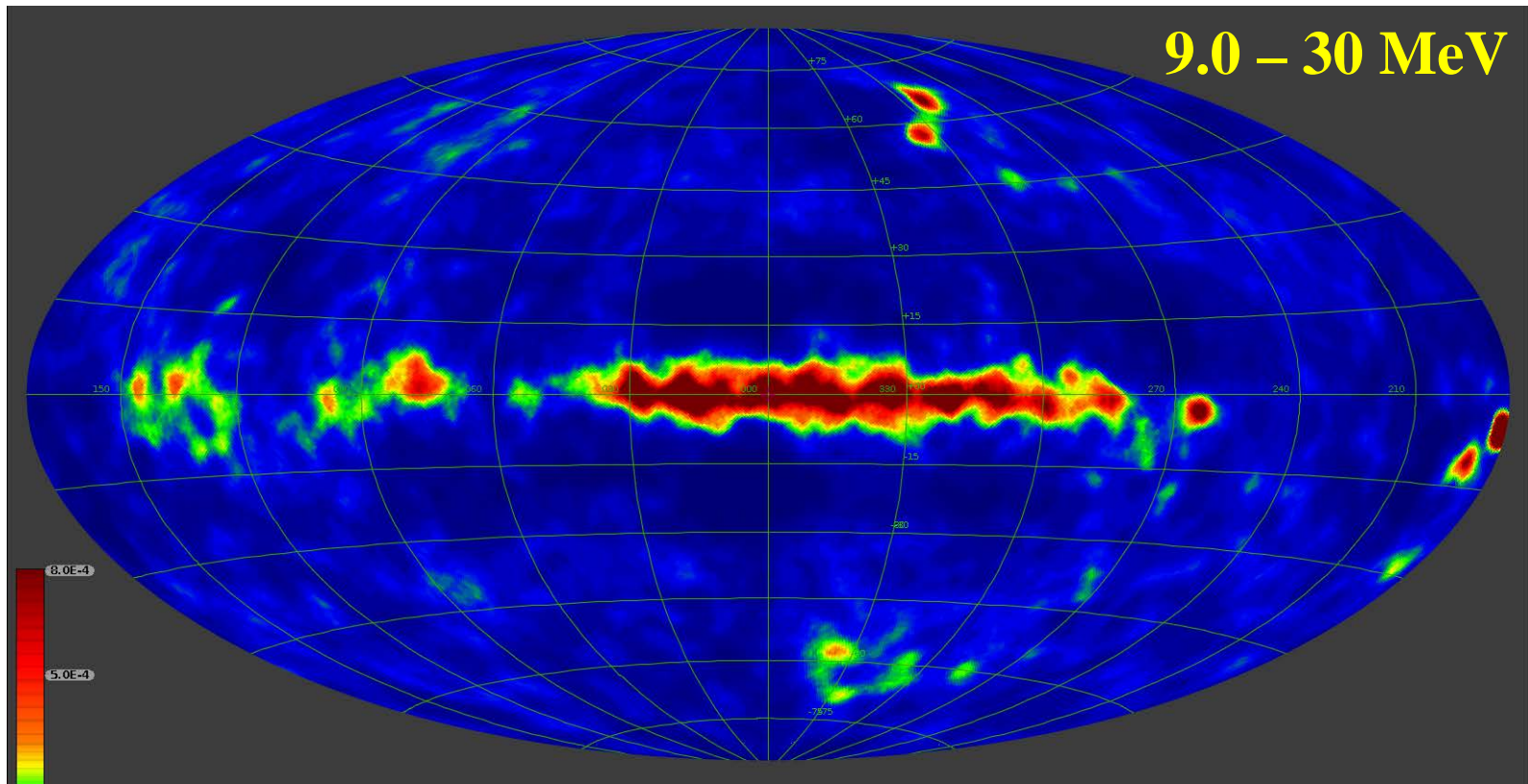
All-Sky All-Mission Imaging (Work in progress)

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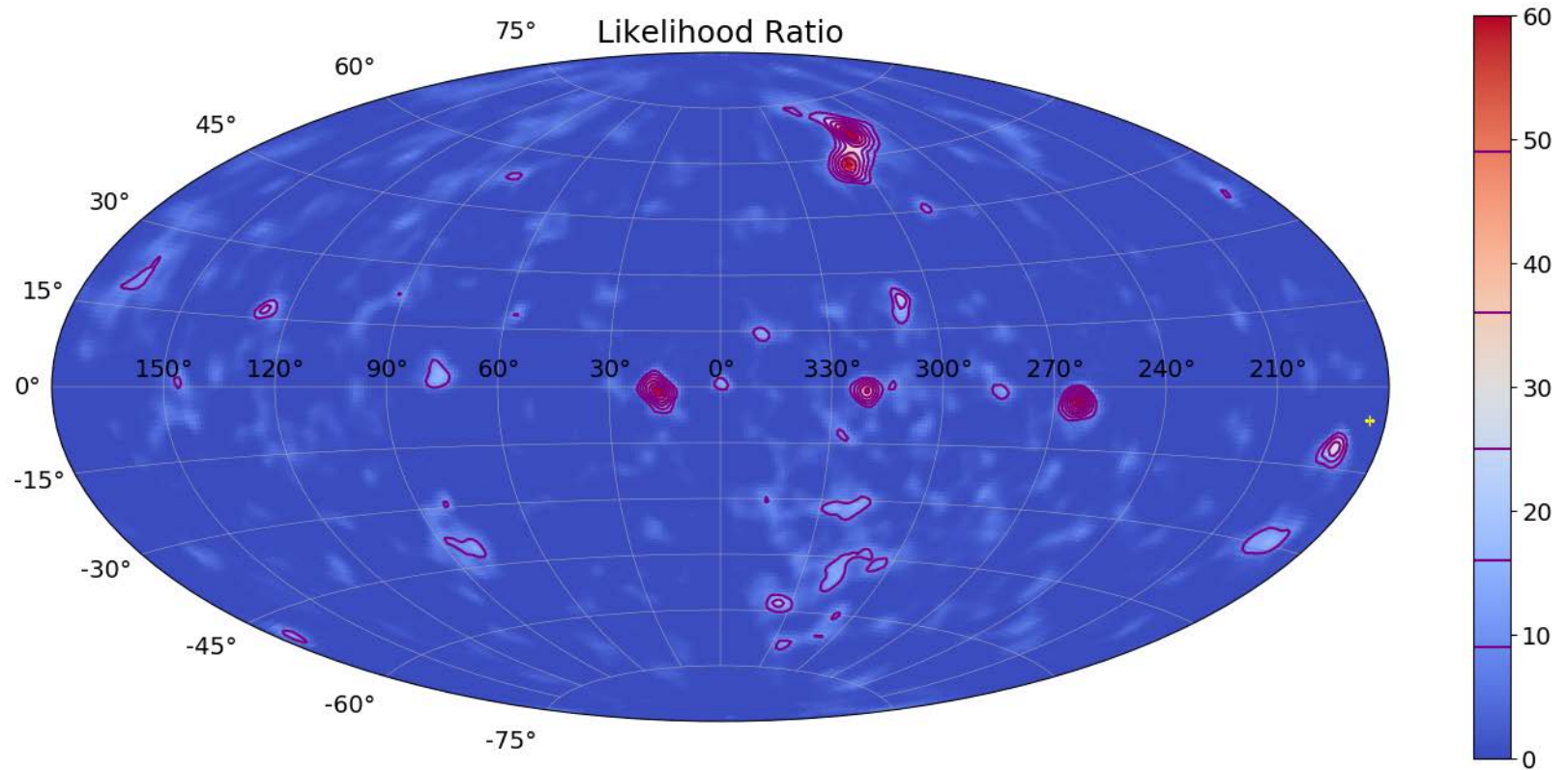
All-Sky All-Mission Imaging (Work in progress)

Preliminary



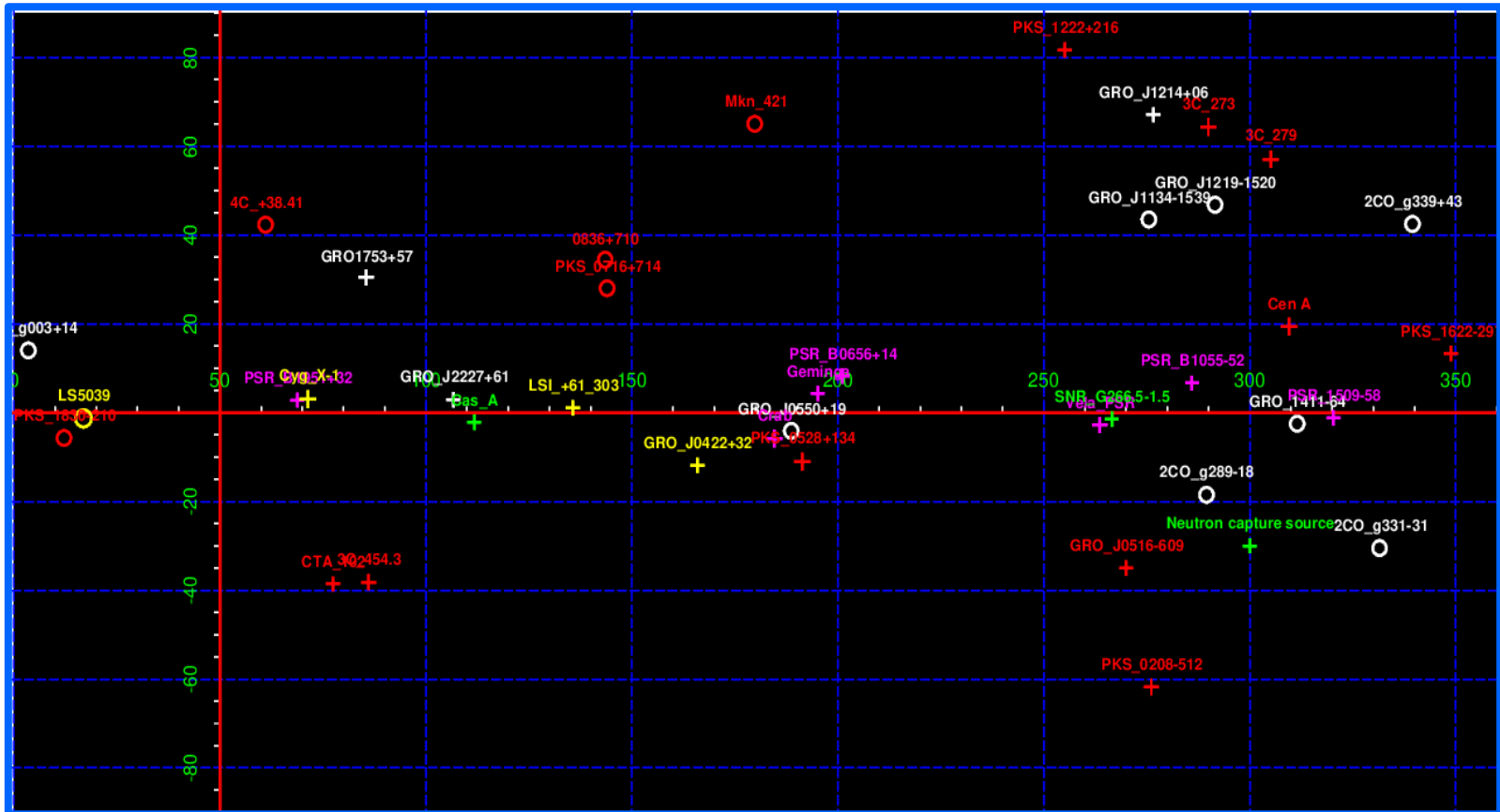
All-Sky Source Significance Map (All Mission)

9 – 30 MeV

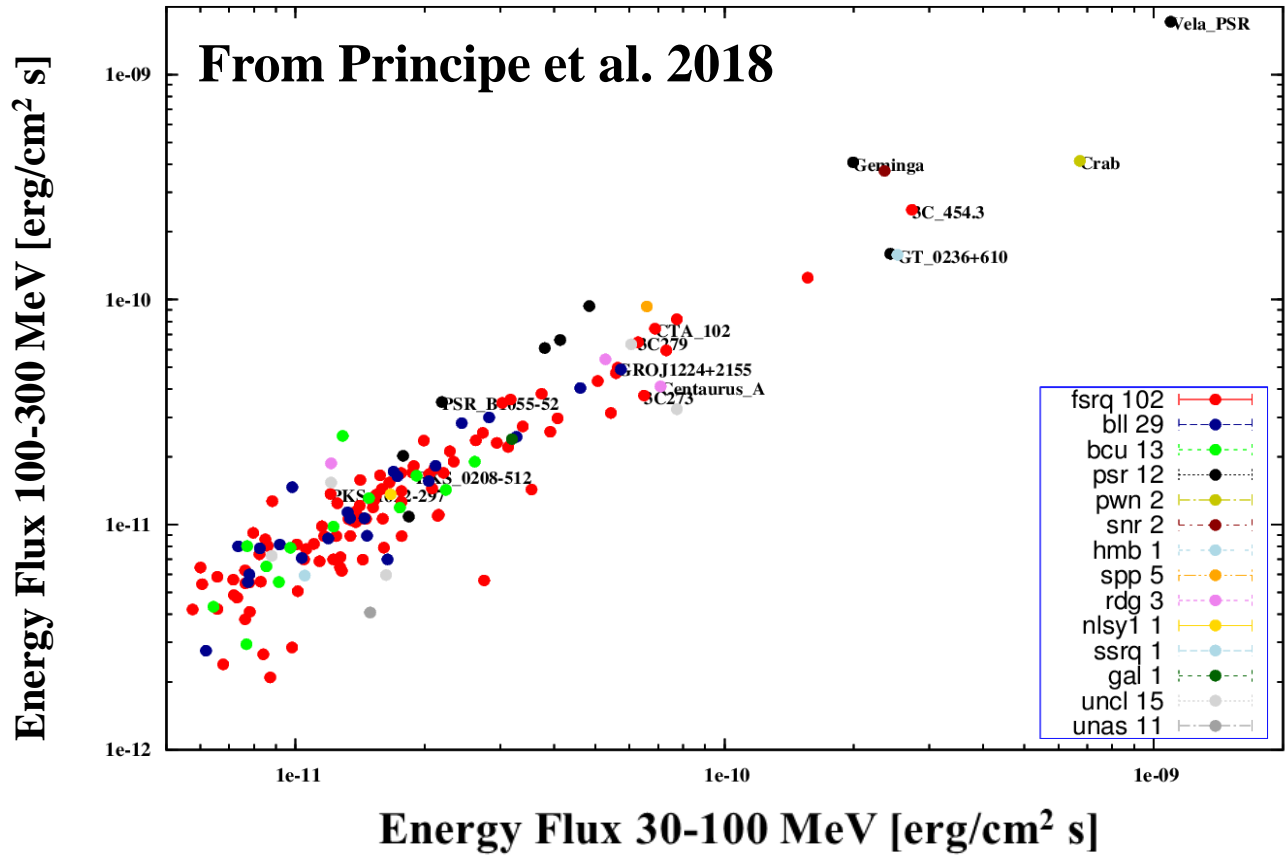


COMPTEL updated Source Catalog

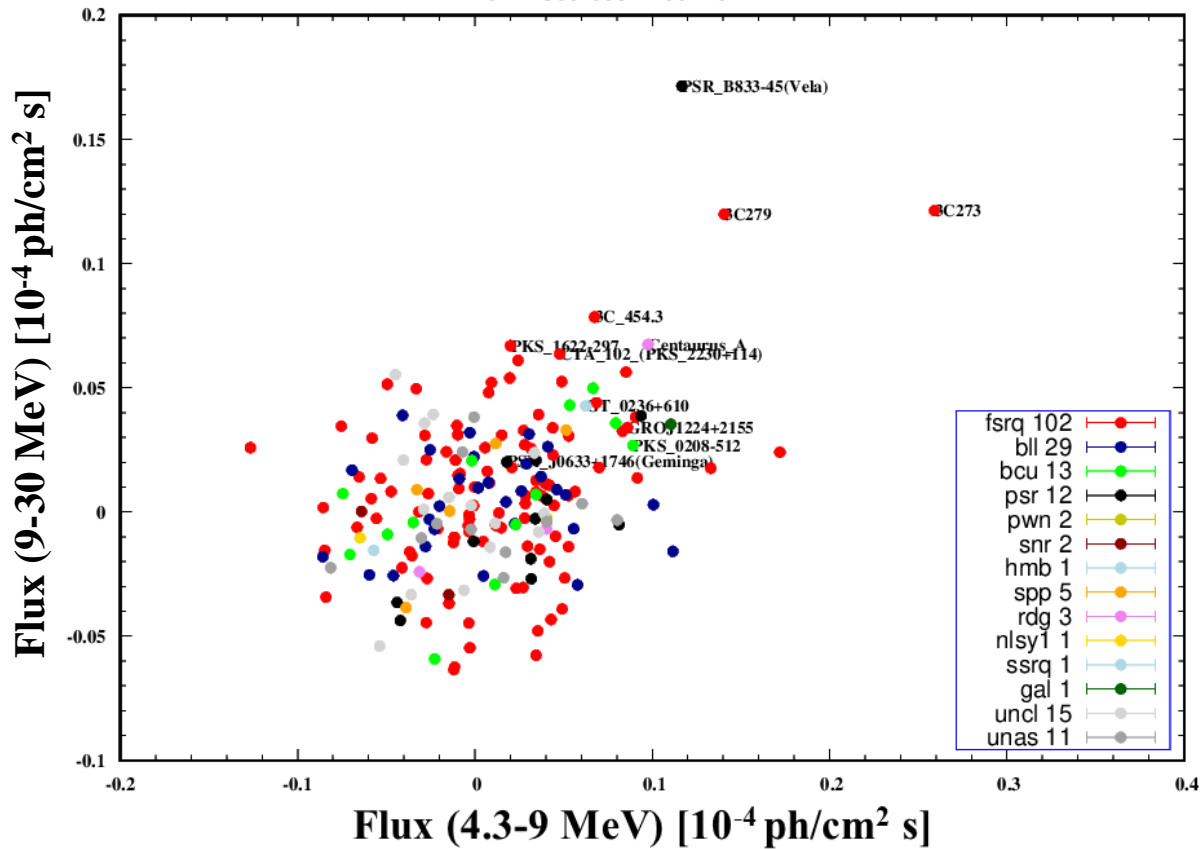
in progress ...



Work in Progress: Fermi-LAT “1FLE” Catalog (Principe et al. 2018)



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Summary/Conclusions

- **COMPTEL opened the soft γ -ray sky (0.75/0.9 – 30 MeV) for science**
- **COMPTEL data are still the most sensitive existing MeV data, though large parts (in particular late mission) are still unexplored**
- **Current activities**
 - **investigate background in COMPTEL data (e.g. in time)**
 - **apply “modern” imaging techniques (e.g. incl. “HEALPIX”)**
- **Science Goals**
 - **generate a 2. COMPTEL source catalog (cur. ~45 sources)**
 - **supplement SED infos on sources by filling the spectral ‘MeV gap’**
- **Science Perspectives**
 - **analyse and publish yet unpublished data (e.g. Cyg X-1, 3C 273)**
 - **find more sources -> population studies (if succ. Bgd reduction)**
 - **gamma-ray lines (e.g. ^{26}Al , ^{44}Ti)**
 - **galactic & extragalactic gamma-ray background**