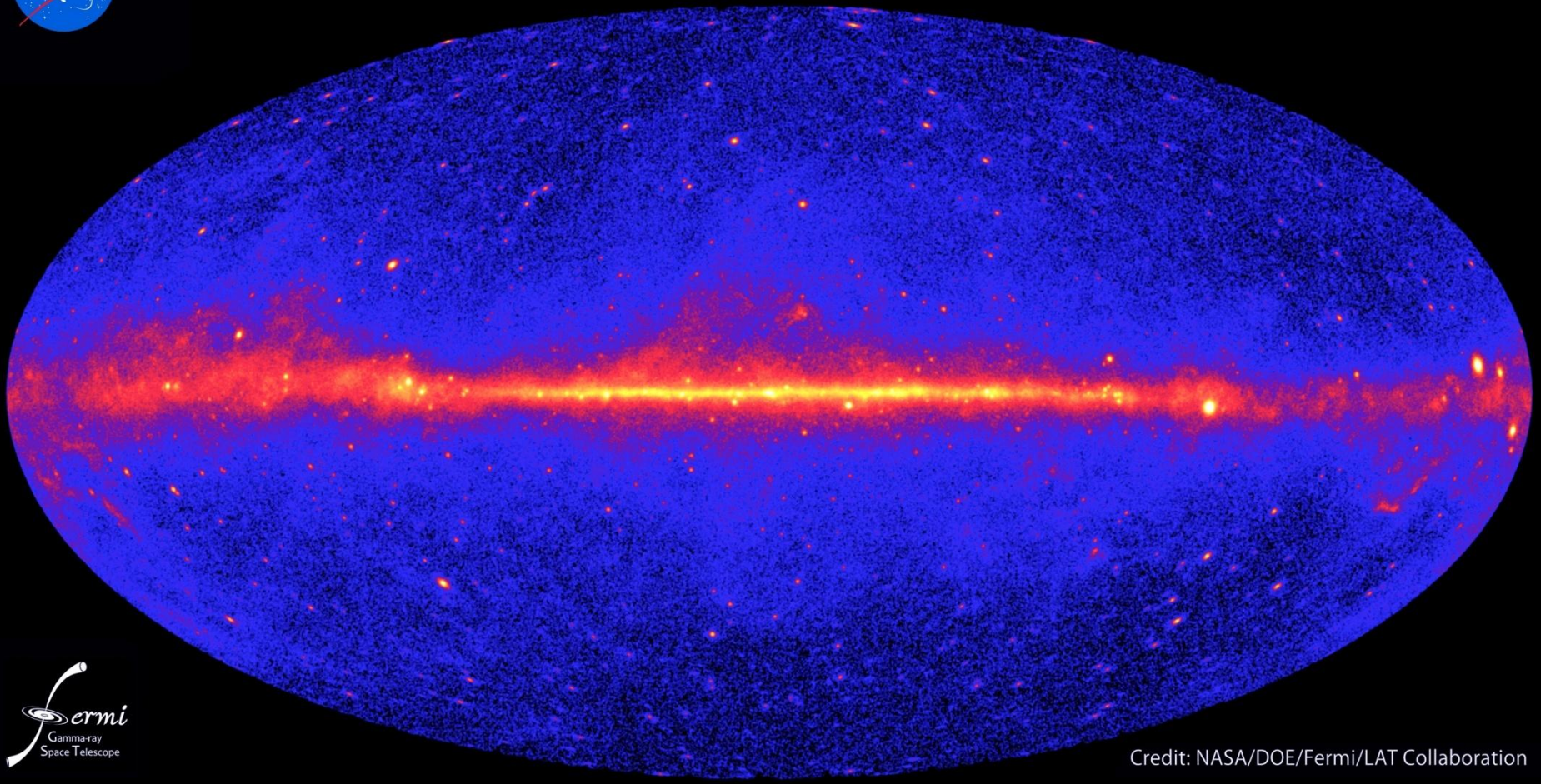
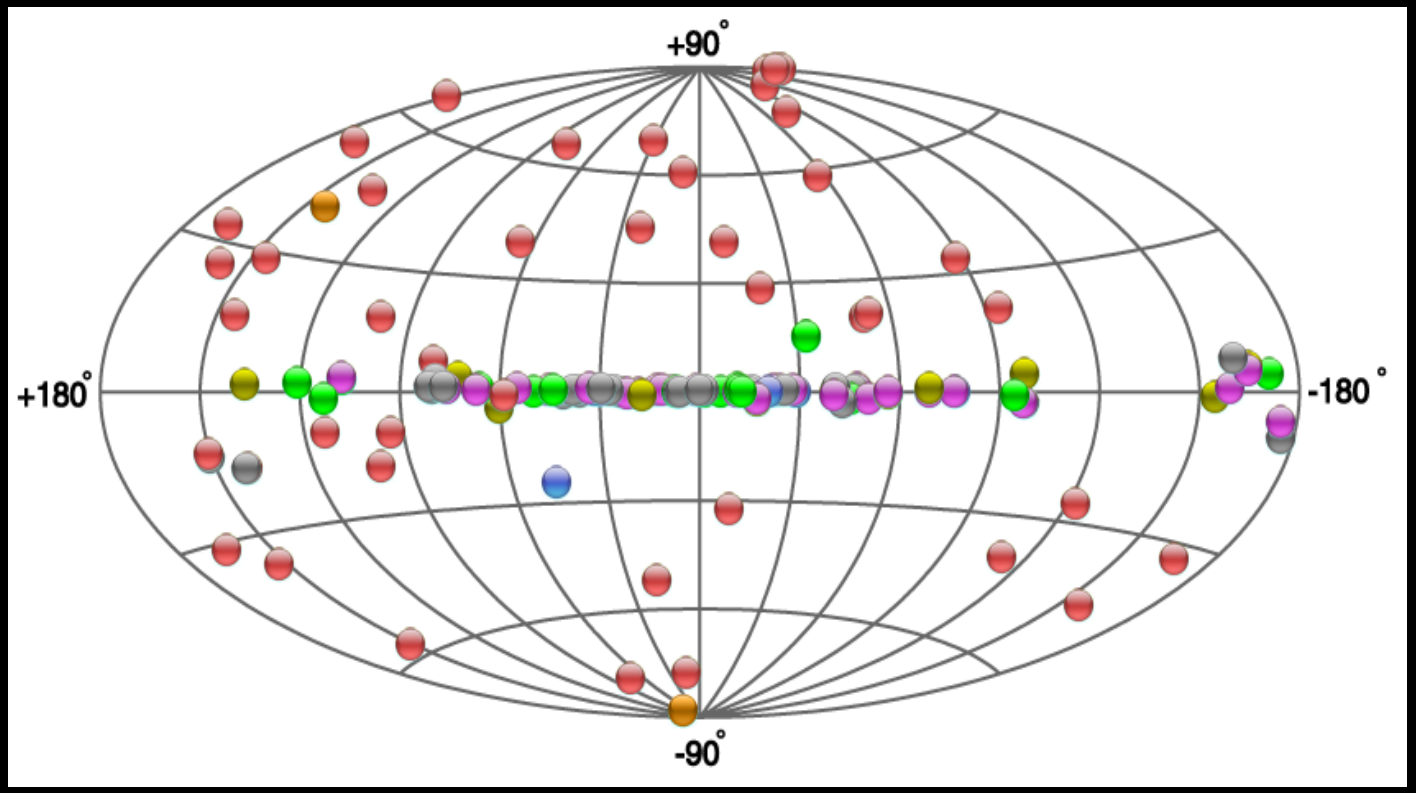
Galactic sources

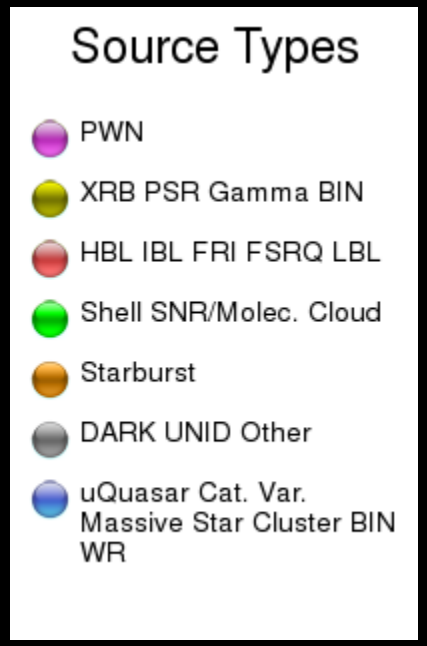
Fermi two-year all-sky map



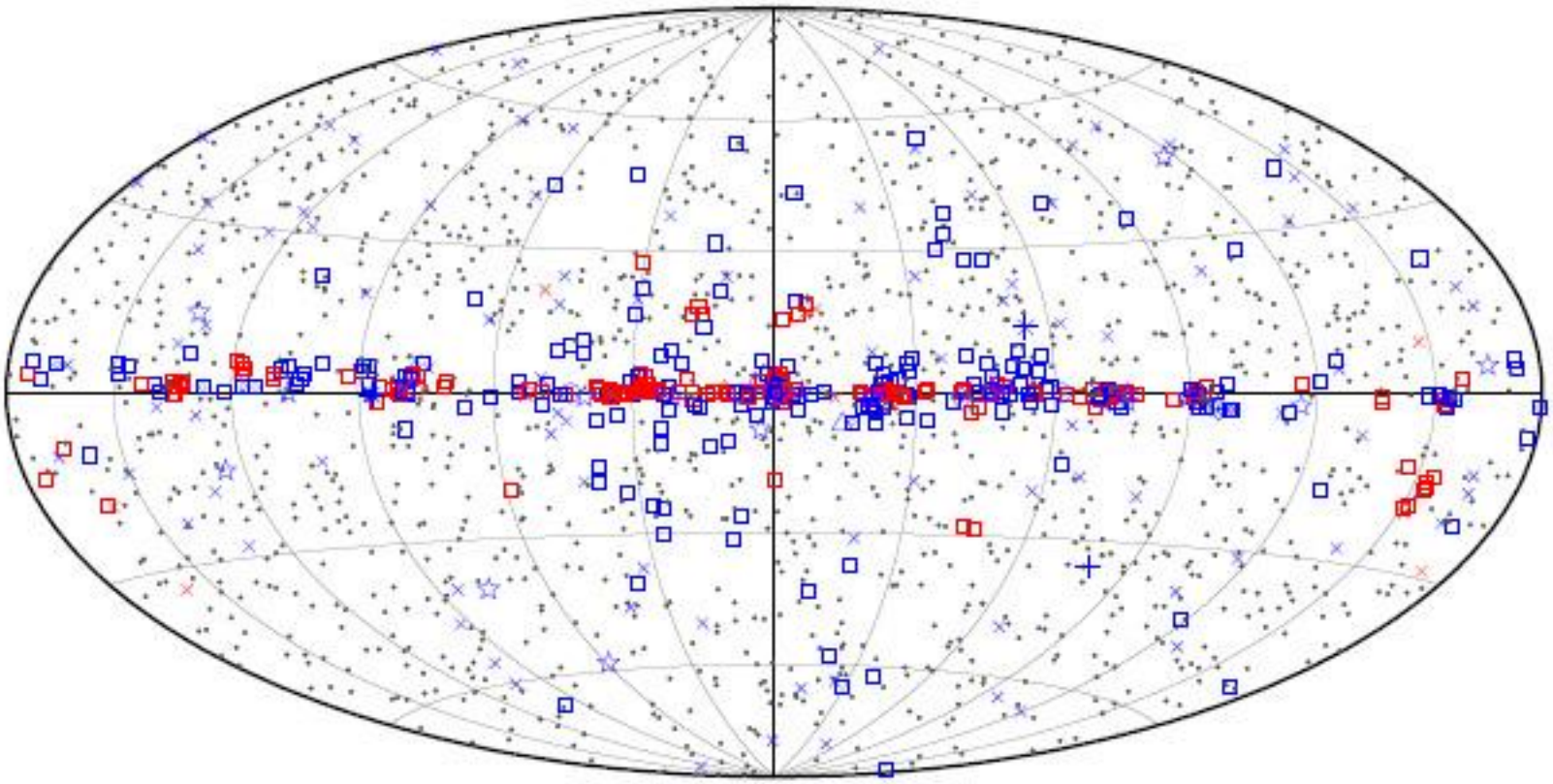
Credit: NASA/DOE/Fermi/LAT Collaboration

The TeV gamma-ray sky according to TeVCAT



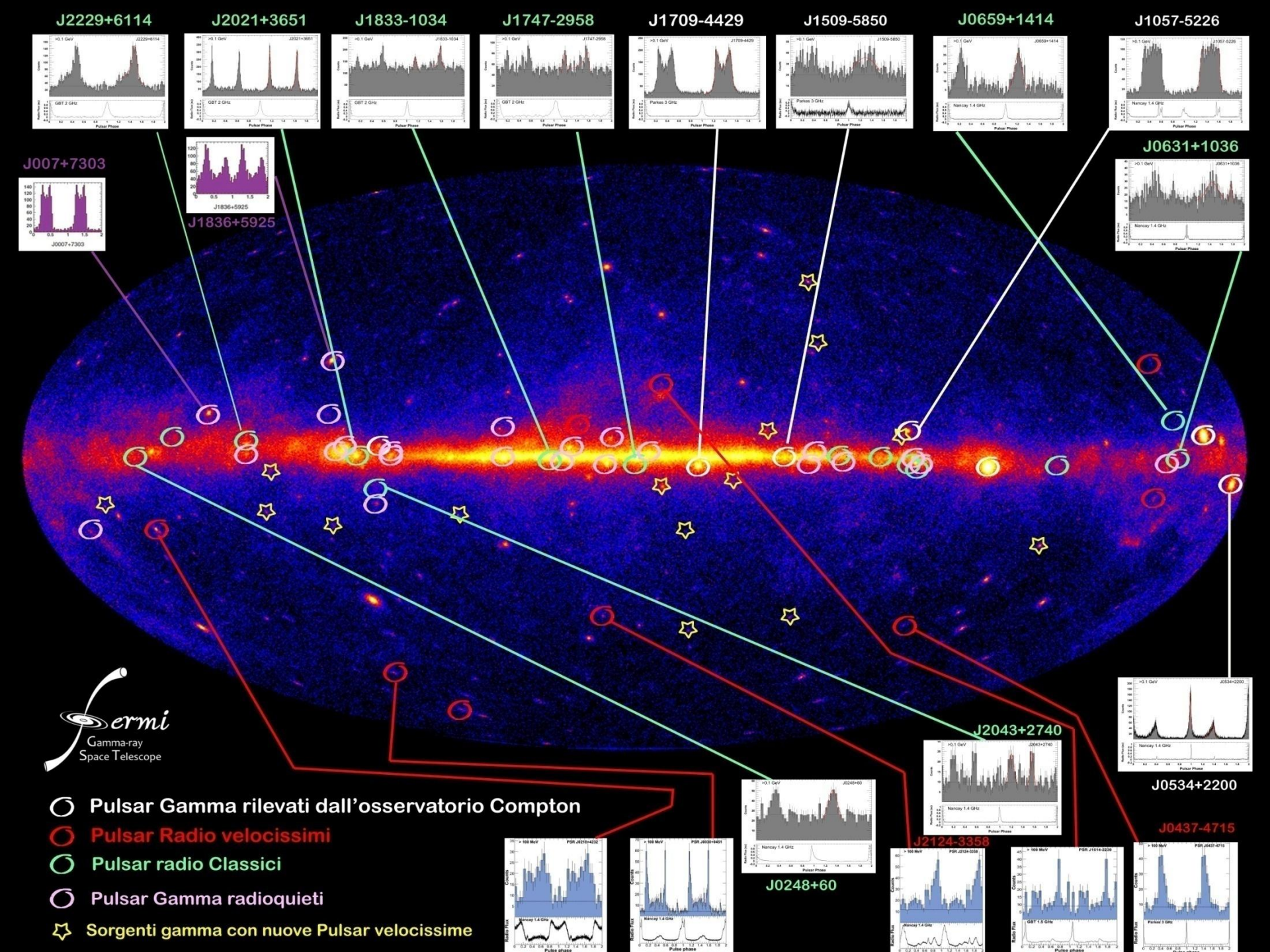


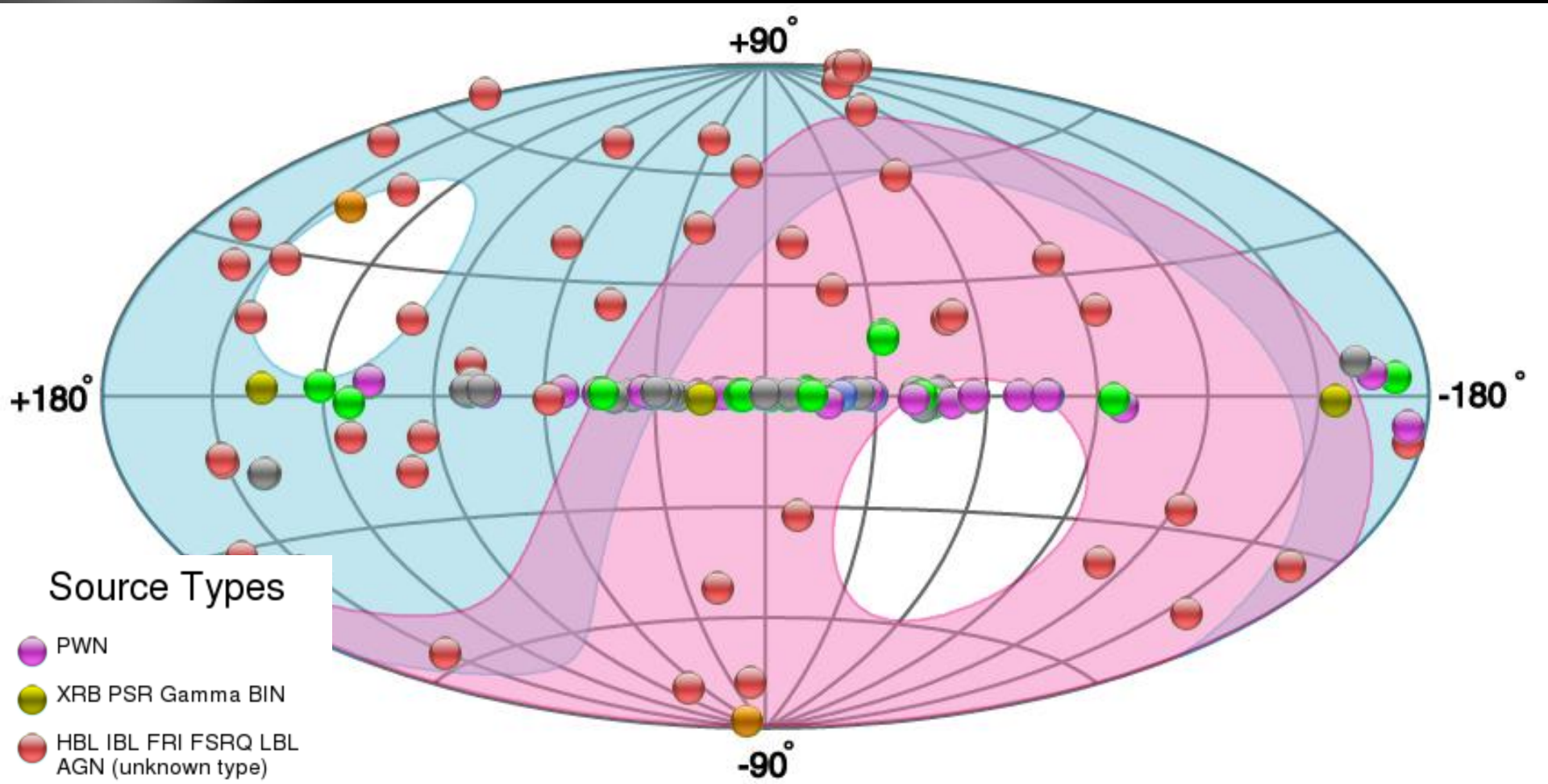
140 Sources: 91 from default catalogue
29 from newly announced catalogue
10 from candidates catalogue
10 from other catalogue (less secure)


No association
Possible association with SNR or PWN
AGN
Pulsar
Globular cluster
Starburst Gal
PWN
HMB
Galaxy
SNR
Nova

What has Fermi found: The LAT two-year catalog

Credit: NASA/Goddard Space Flight Center


J2229+6114
J2021+3651
J1833-1034
J1747-2958
J1709-4429
J1509-5850
J0659+1414
J1057-5226
J007+7303
J1836+5925
J0631+1036
J0534+2200
J2043+2740
J0248+60
J2124-3358
J0437-4715
Fermi
Gamma-ray
Space Telescope
Pulsar Gamma rilevati dall'osservatorio Compton
Pulsar Radio velocissimi
Pulsar radio Classici
Pulsar Gamma radioquieti
Sorgenti gamma con nuove Pulsar velocissime


+90°
+180°
-180°
-90°
Source Types
PWN
XRB PSR Gamma BIN
HBL IBL FRI FSRQ LBL AGN (unknown type)
Shell SNR/Molec. Cloud
Starburst
DARK UNID Other
uQuasar Star Forming Region Cat. Var. Massive Star Cluster BIN WR

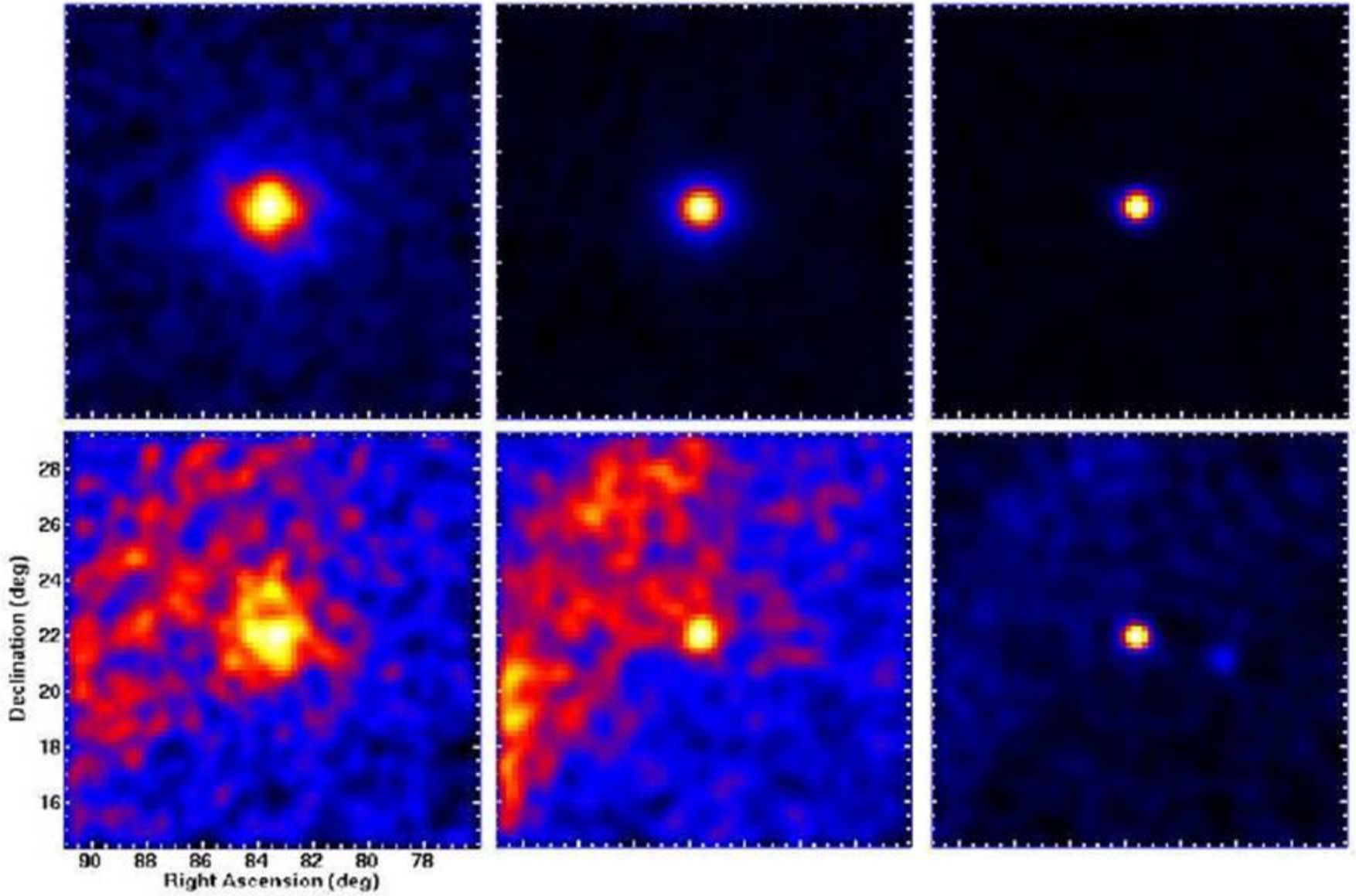
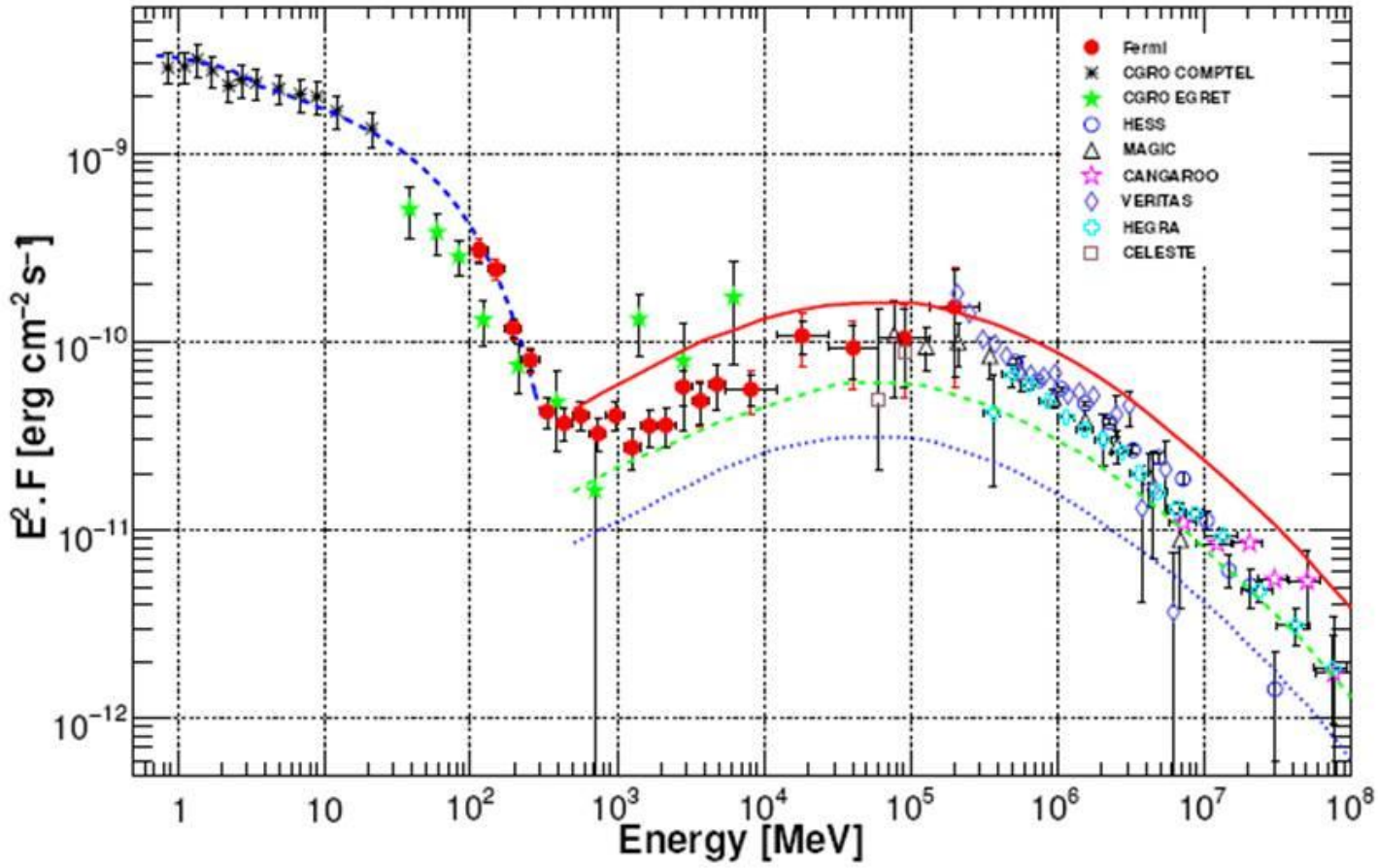
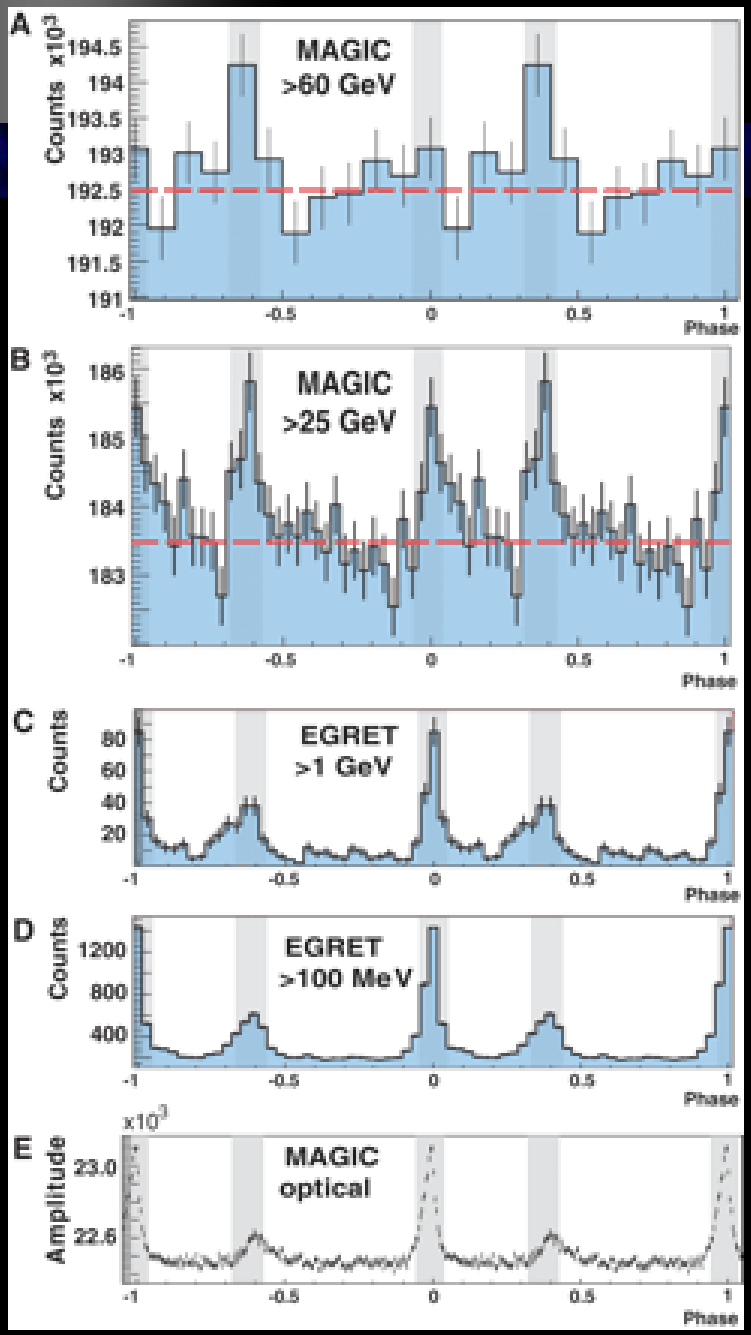
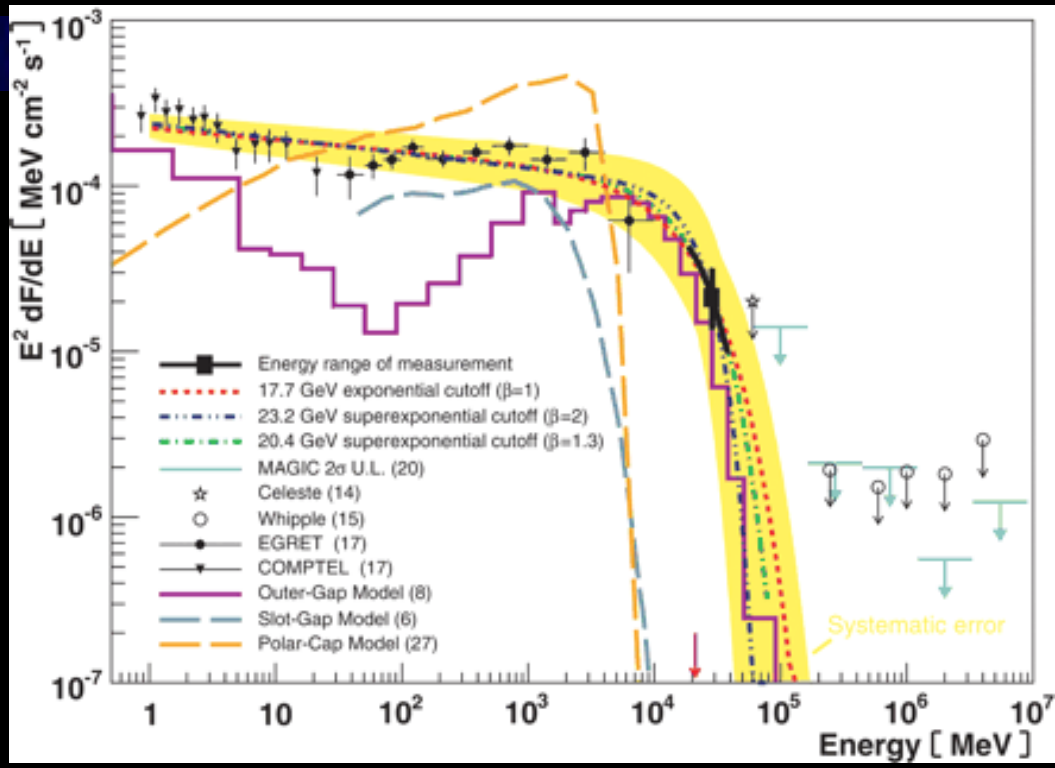


FIG. 4.— Counts maps (arbitrary units) presenting the pulsed (top row) and nebular (bottom row) emission, in three energy bands. Each panel spans 15° × 15° in equatorial coordinates and is centered on the pulsar radio position. *Left*: 100 MeV < E < 300 MeV; *Middle*: 300 MeV < E < 1 GeV; *Right*: E > 1 GeV.

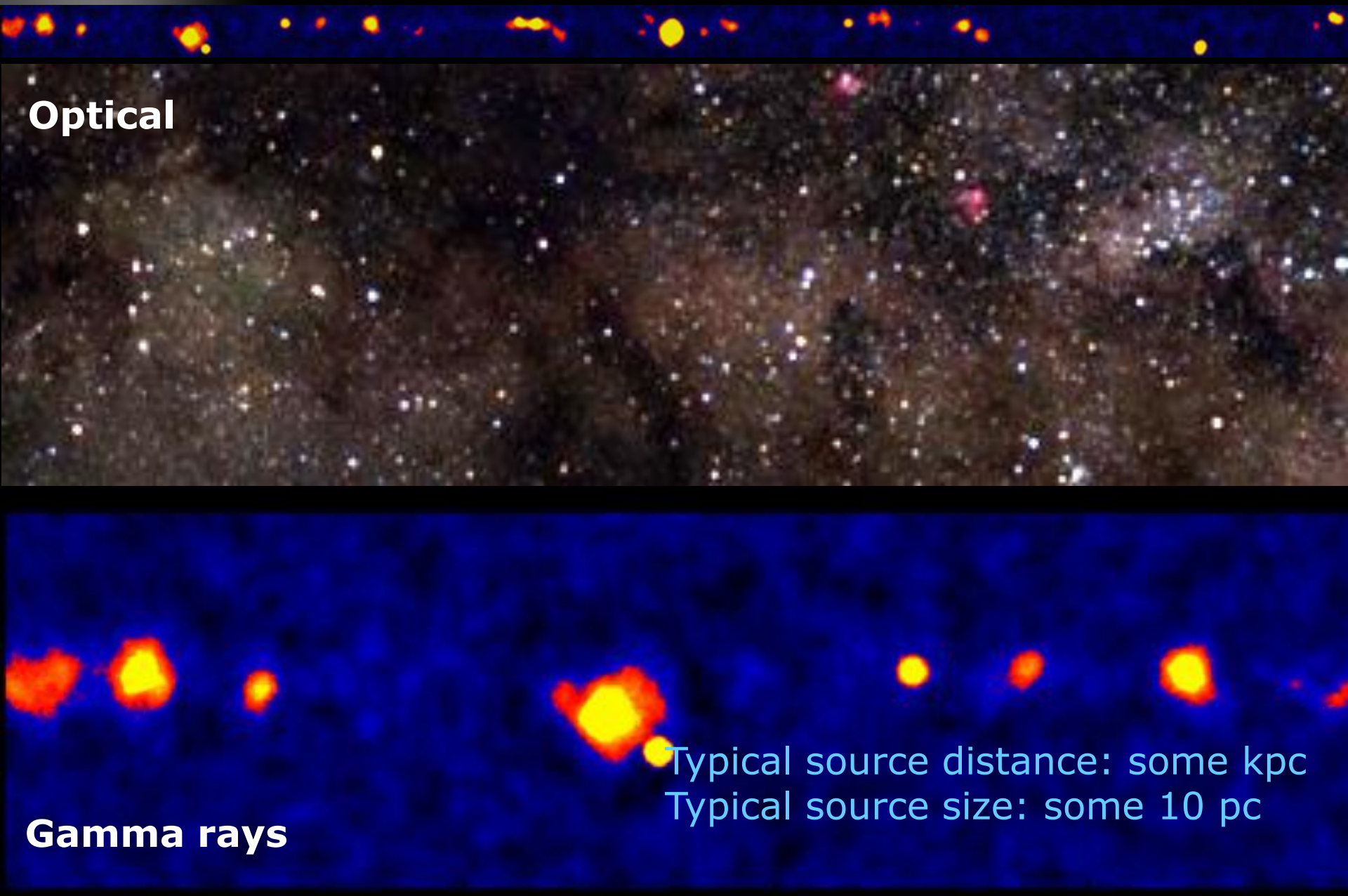
Crab nebula spectrum




A
MAGIC
>60 GeV
Counts x10^{-3}
194.5
194
193.5
193
192.5
192
191.5
191
-1
-0.5
0
0.5
1
Phase
B
MAGIC
>25 GeV
Counts x10^{-3}
186
185
184
183
Phase
C
EGRET
>1 GeV
Counts
80
60
40
20
Phase
D
EGRET
>100 MeV
Counts
1200
800
400
Phase
E
MAGIC
optical
x10^{-3}
Amplitude
23.0
22.6
Phase

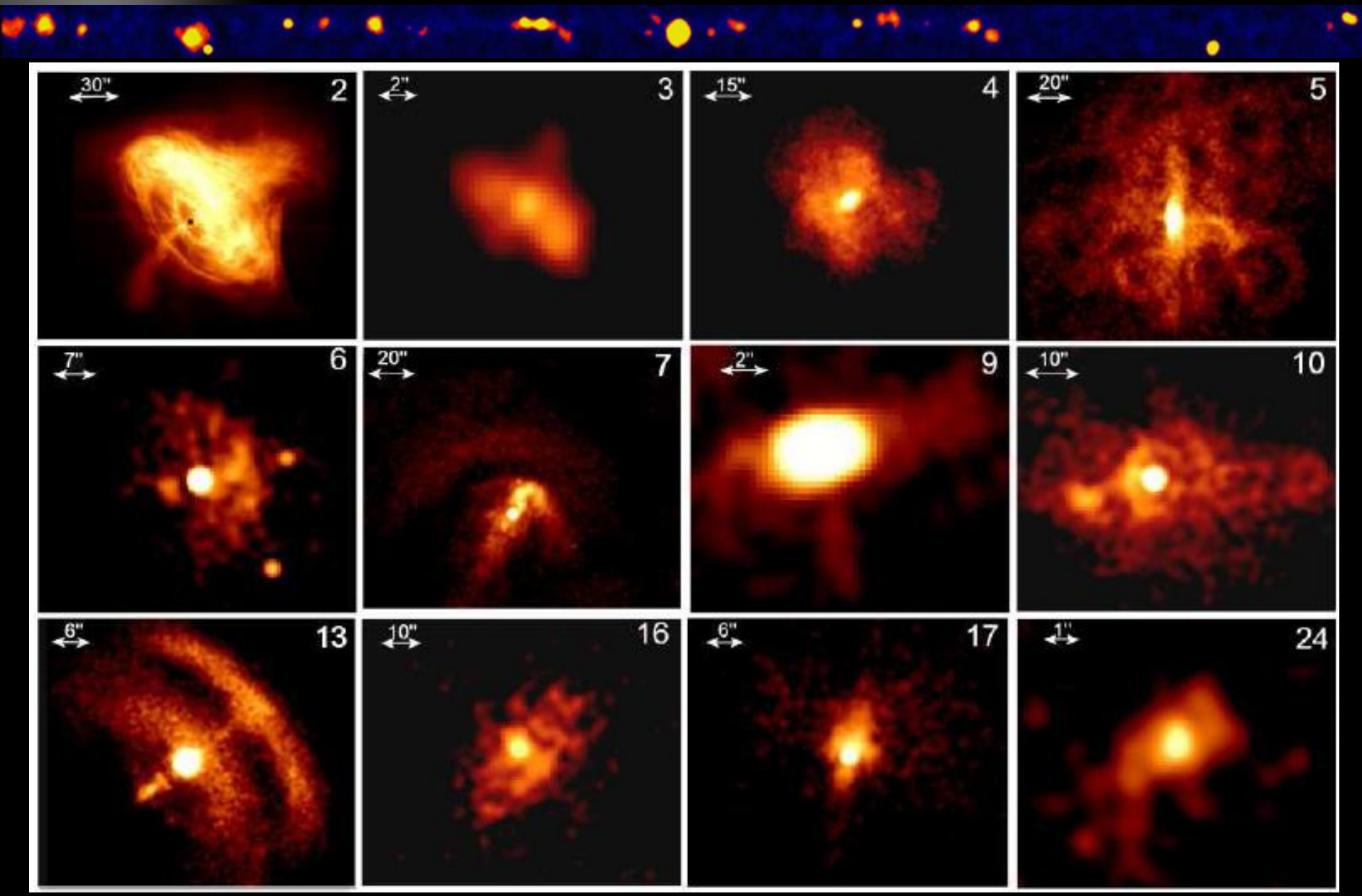

E^2 dF/dE [MeV cm^{-2} s^{-1}]
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
Energy range of measurement
17.7 GeV exponential cutoff (β=1)
23.2 GeV superexponential cutoff (β=2)
20.4 GeV superexponential cutoff (β=1.3)
MAGIC 2σ U.L. (20)
Celeste (14)
Whipple (15)
EGRET (17)
COMPTEL (17)
Outer-Gap Model (8)
Slot-Gap Model (6)
Polar-Cap Model (27)
Systematic error
1
10
10^2
10^3
10^4
10^5
10^6
10^7
Energy [MeV]

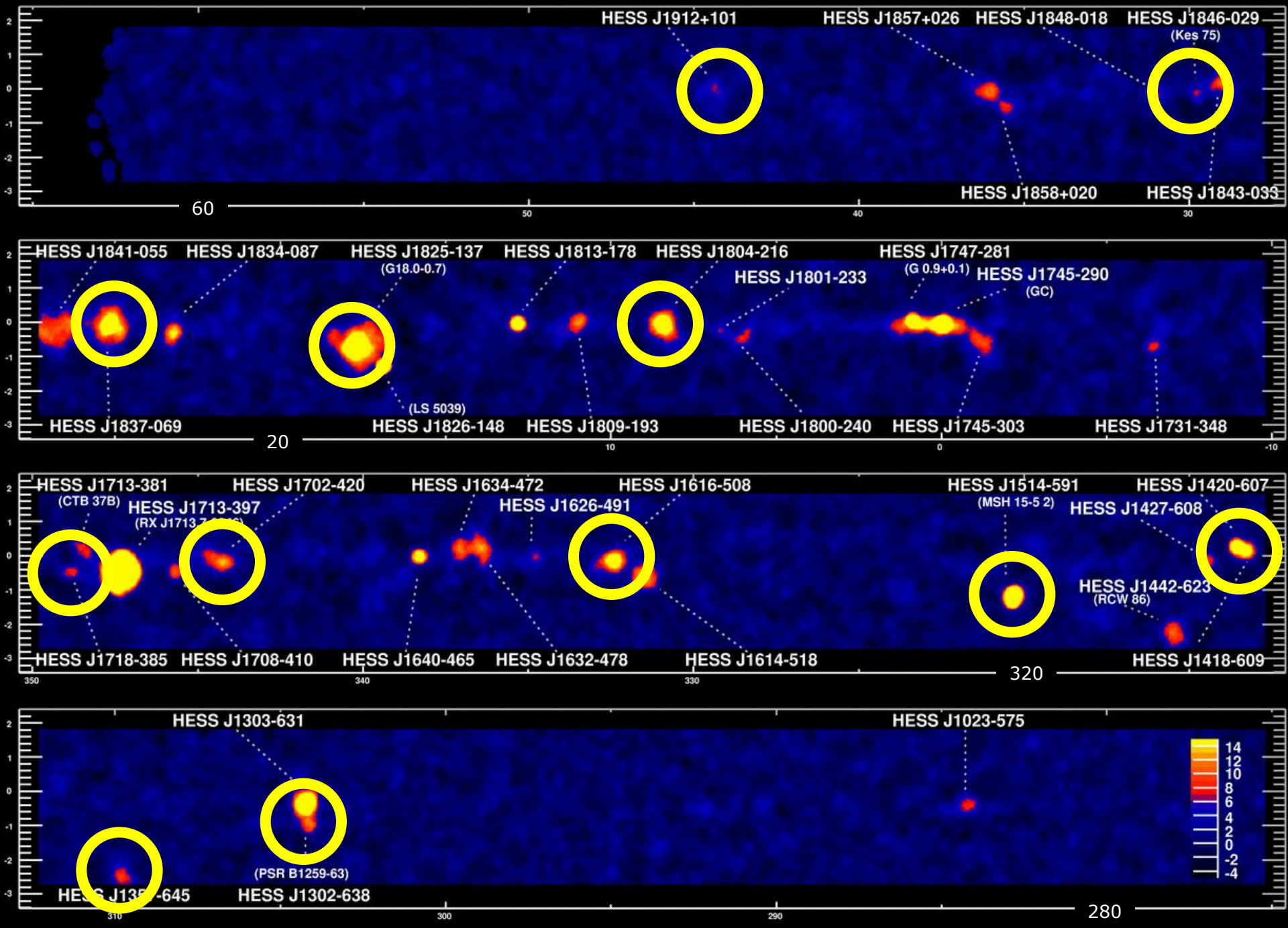
The Milky Way

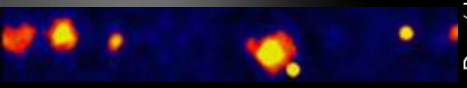


X-ray pulsar wind nebulae

Kargaltsev & Pavlov 2008




HESS J1912+101
HESS J1857+026
HESS J1848-018
HESS J1846-029
(Kes 75)
HESS J1858+020
HESS J1843-033
60
50
40
30
HESS J1841-055
HESS J1834-087
HESS J1825-137
(G18.0-0.7)
HESS J1813-178
HESS J1804-216
HESS J1747-281
(G 0.9+0.1)
HESS J1801-233
HESS J1745-290
(GC)
(LS 5039)
HESS J1837-069
HESS J1826-148
HESS J1809-193
HESS J1800-240
HESS J1745-303
HESS J1731-348
20
10
0
-10
HESS J1713-381
(CTB 37B)
HESS J1713-397
(RX J1713.7-3946)
HESS J1702-420
HESS J1634-472
HESS J1626-491
HESS J1616-508
HESS J1514-591
(MSH 15-5 2)
HESS J1427-608
HESS J1420-607
HESS J1442-623
(RCW 86)
HESS J1718-385
HESS J1708-410
HESS J1640-465
HESS J1632-478
HESS J1614-518
HESS J1418-609
350
340
330
320
HESS J1303-631
HESS J1023-575
(PSR B1259-63)
HESS J1302-638
310
300
290
280
14
12
10
8
6
4
2
0
-2
-4

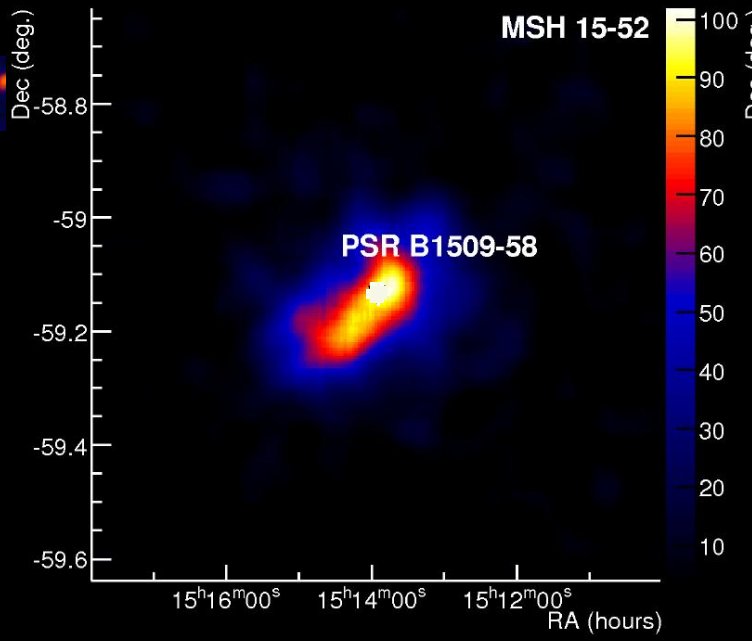


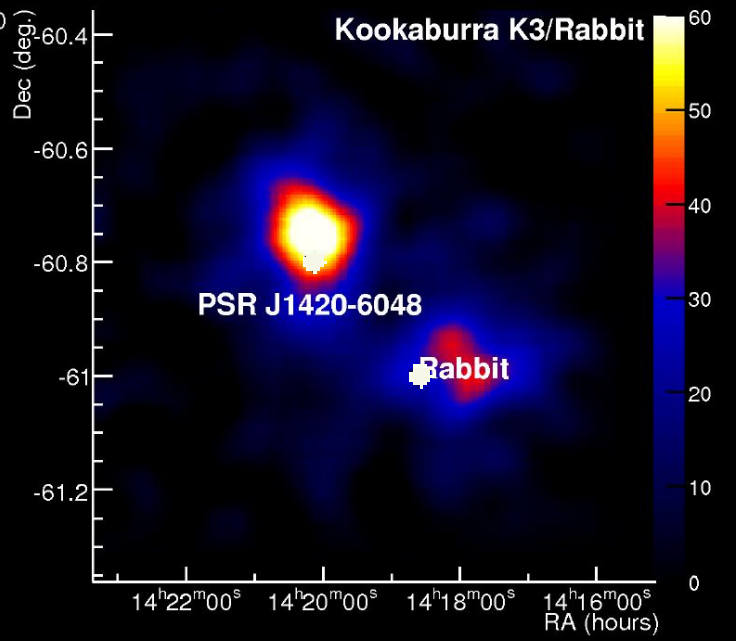
PWN

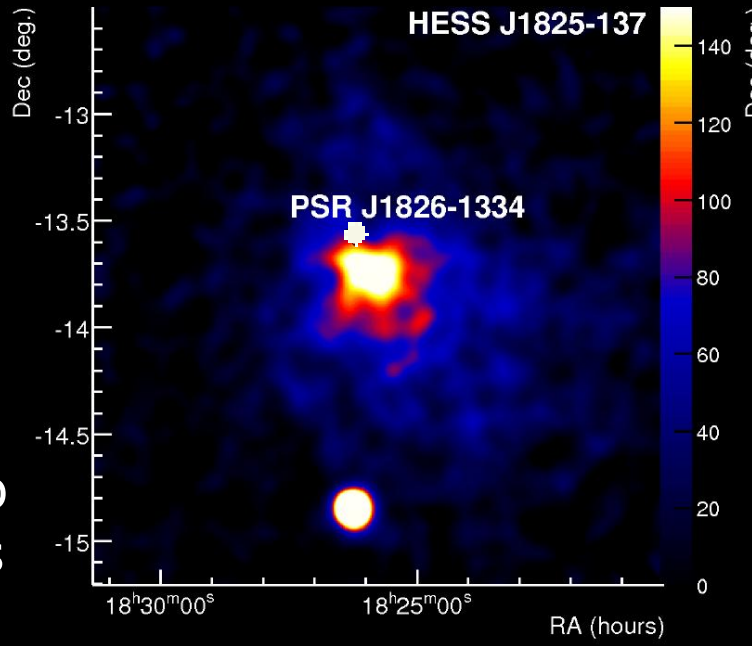
γ-ray sources are

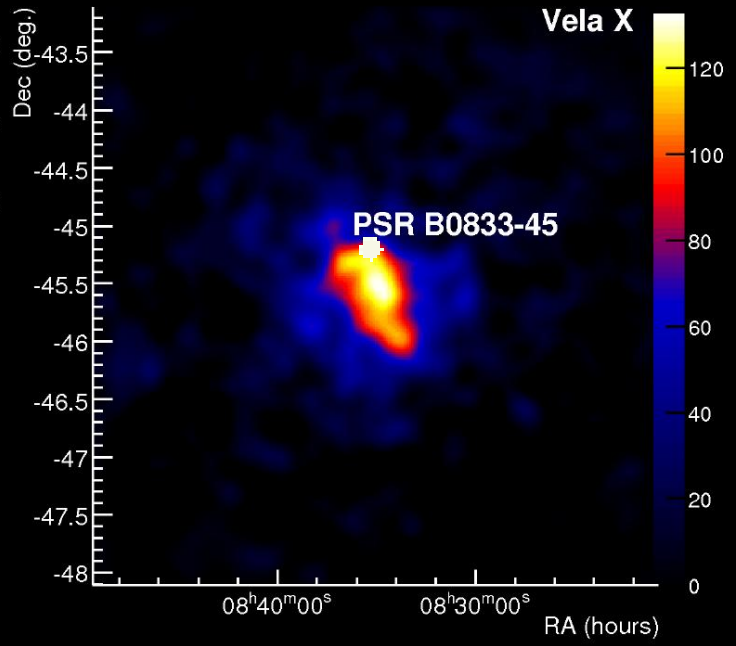
- extended
- displaced from pulsar

- O(1%) of spin-down energy loss converted to gamma rays



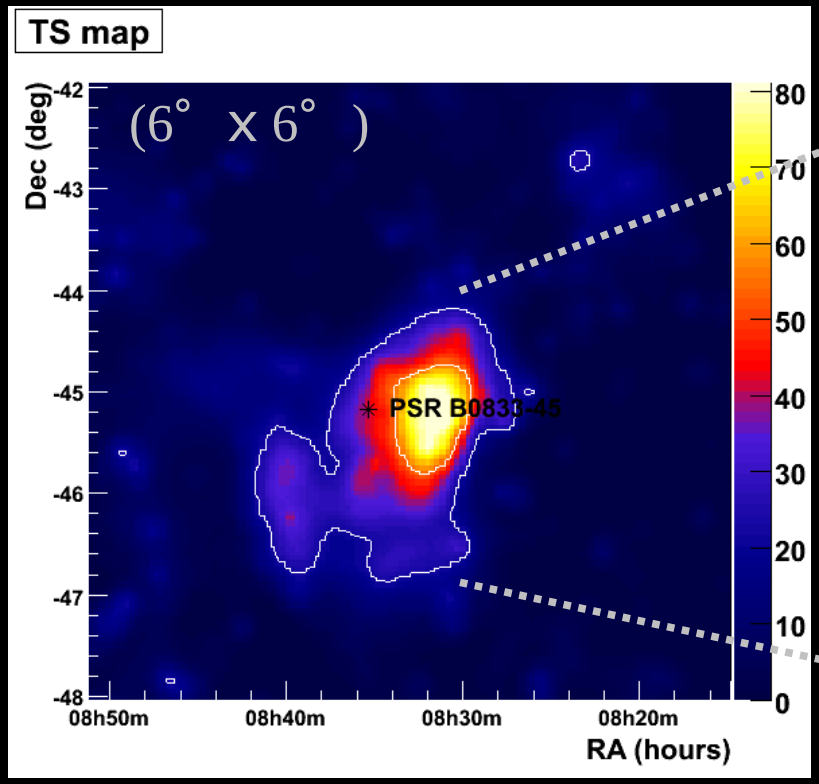


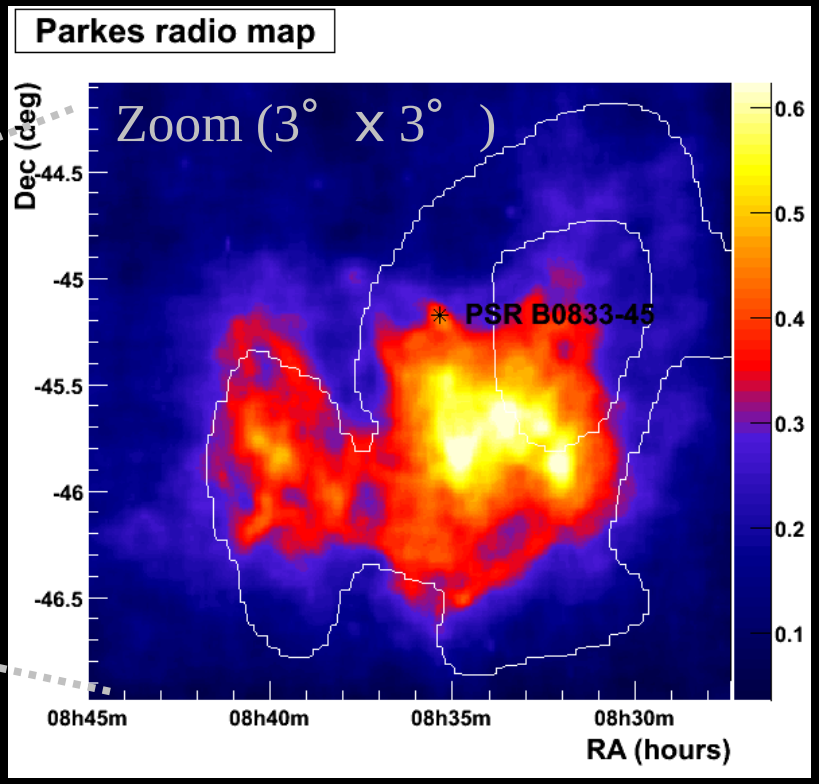




extended emission from the Vela-X PWN

9 months of FERMI survey data. Off-pulse events:
TS ~80 (i.e ~9σ) for E > 800 MeV. Correlates with HESS morphology.





Inside the 8° -diameter Vela SNR shell, closest SNR to contain an active pulsar (D ~290 pc)

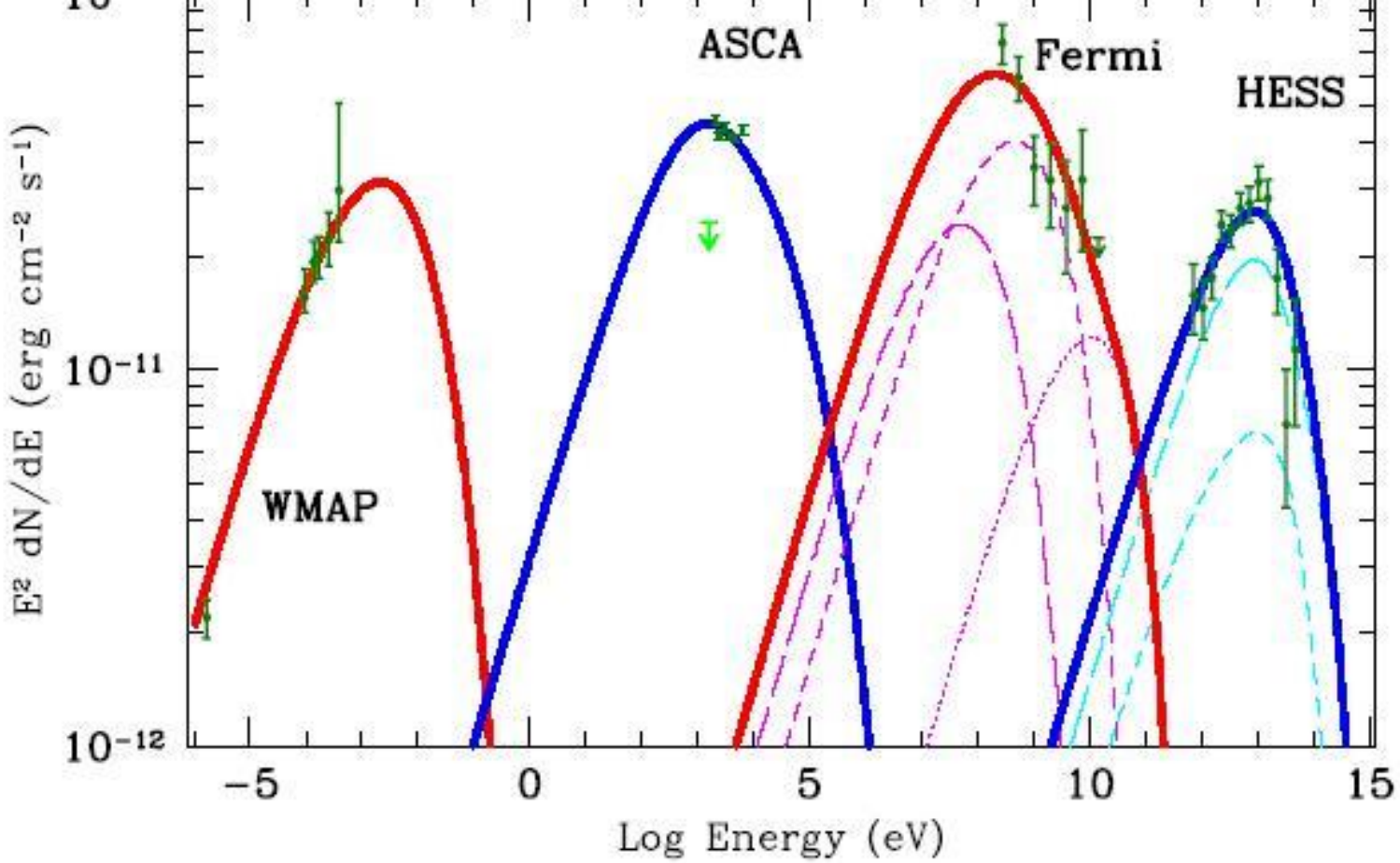
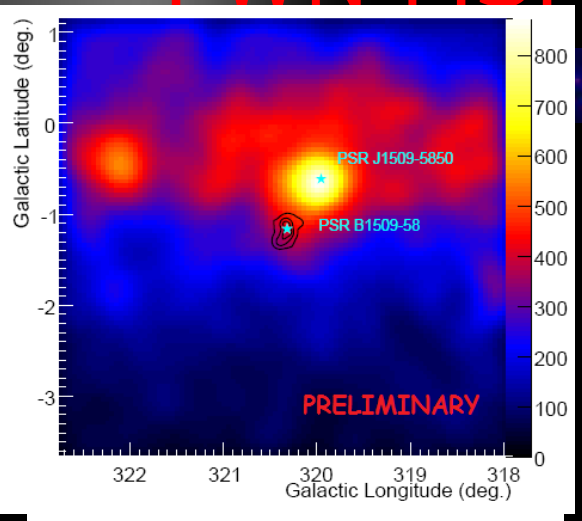


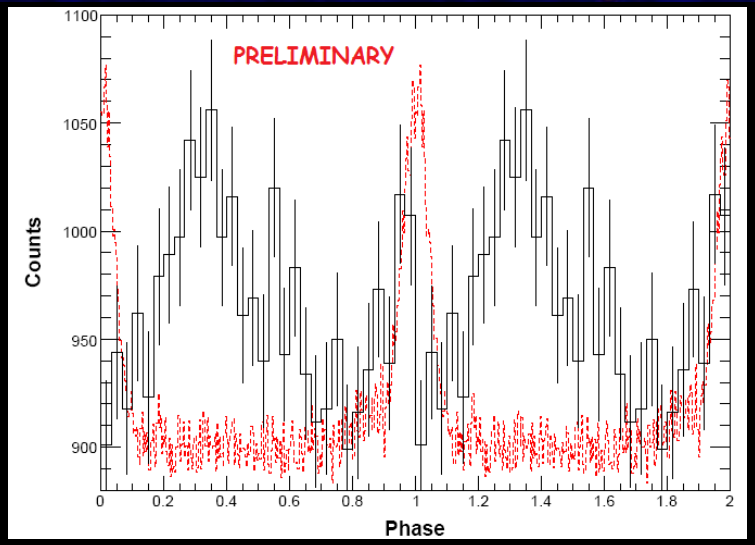
Fig. 5.— Spectral energy distribution of regions within Vela-X from radio to very high energy gamma-rays. X-ray (ASCA observations, this paper) and very high energy gamma-ray (Aharonian et al 2006) points are from the *cocoon* region. WMAP and GeV gamma-ray points (this paper) are for the larger radio-bright portion of Vela-X. An upper limit on the soft X-ray flux of this region is also shown. Blue and red curves show the synchrotron and Compton emission from the high energy electron (*cocoon*) and low energy electron (*halo*) populations, respectively. The Compton components from various seed fields (low to high: CMB, dust emission and starlight) are shown for the GeV-peaked emission. For the TeV-peaked emission,

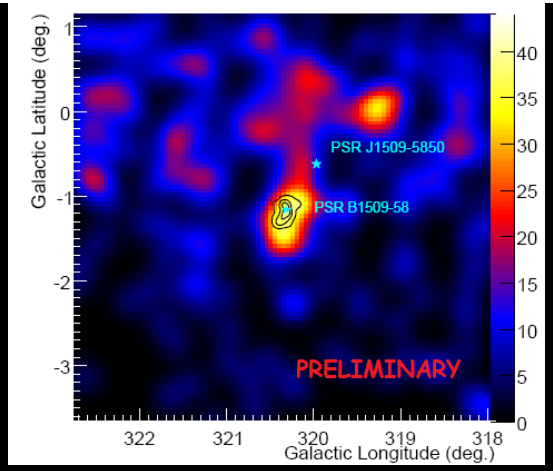
PWN MSH 15-52 and PSR B1509-58



>1 GeV

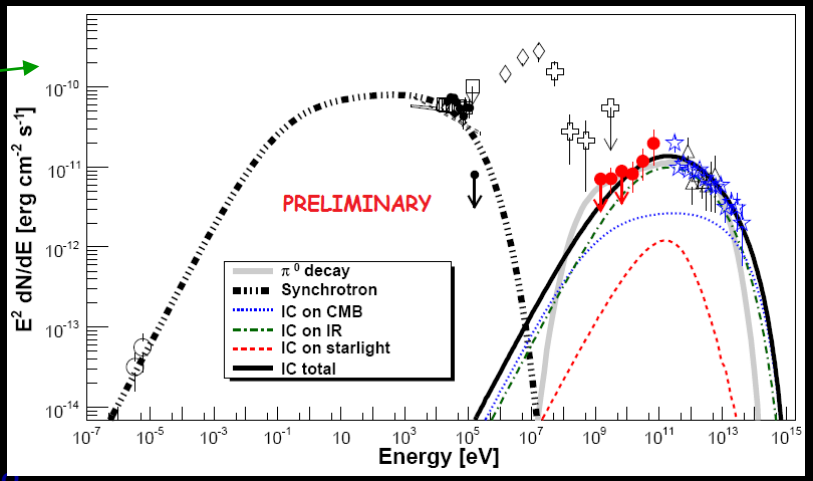
Pulsations visible only *below* 1 GeV





>10 GeV

The nebula



Fermi LAT observations of MSH 15-52 and PSR B1509-58