Some new results of SNRs with the Fermi-LAT data

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Outline

1 : Background of SNRs with Fermi-LAT observations

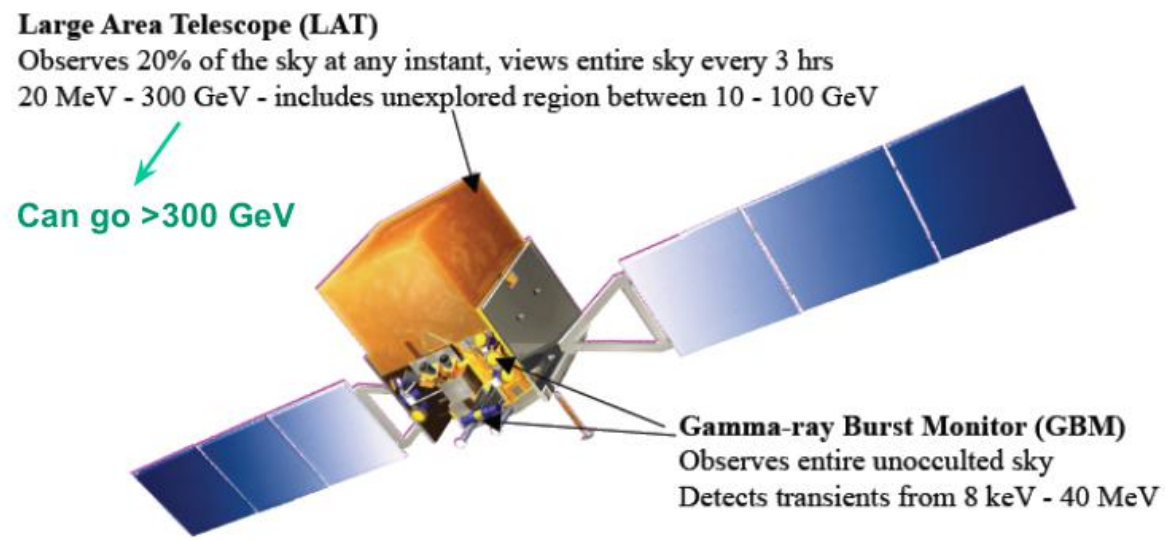
2 : The GeV emission from SNR CTB 37B

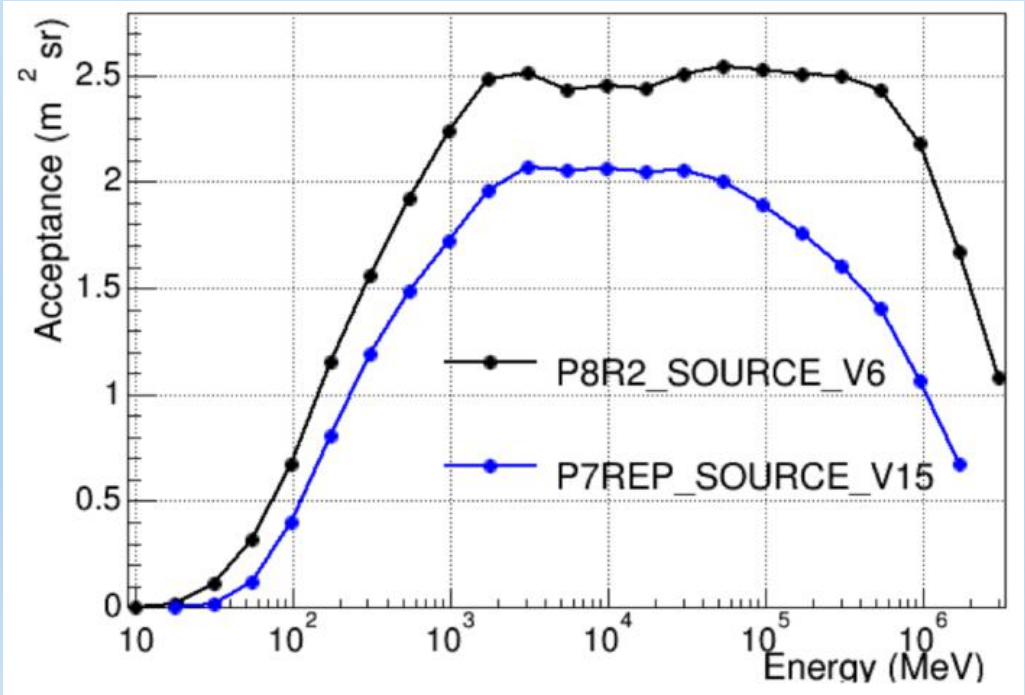
3 : The GeV-break in the spectrum of SNR Puppis A

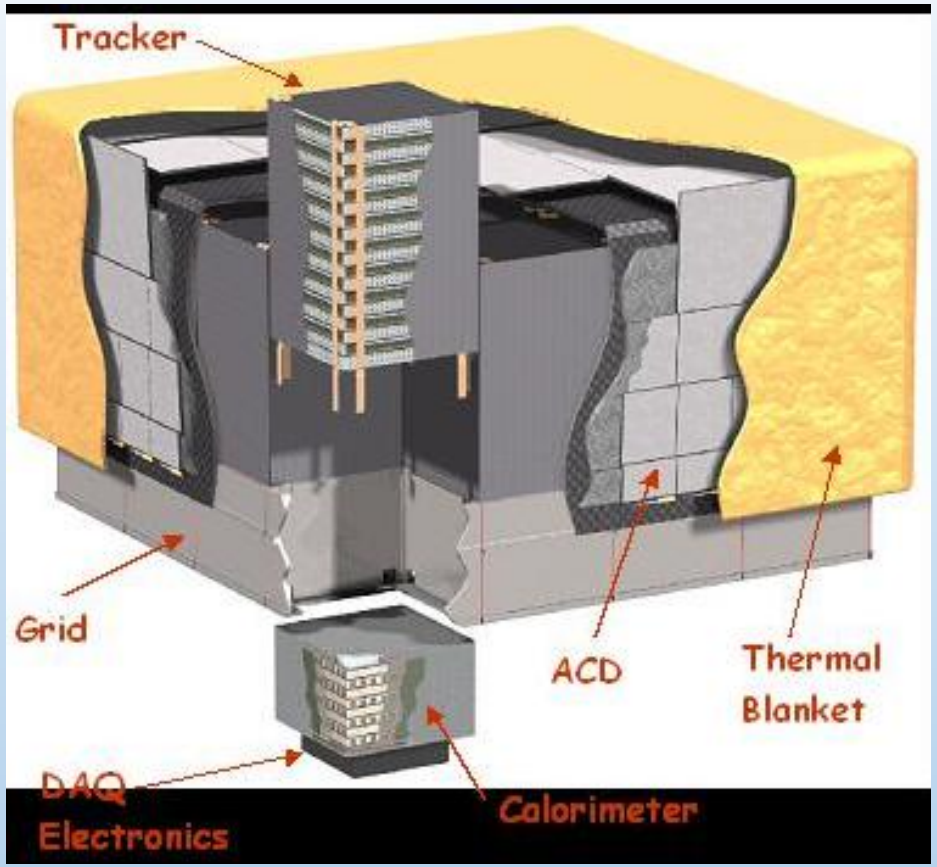
4 : An unusual hard unbroken γ−ray spectrum of HESS J1427-608

5 : Conclusion

1： Background of SNRs with Fermi-LAT observations

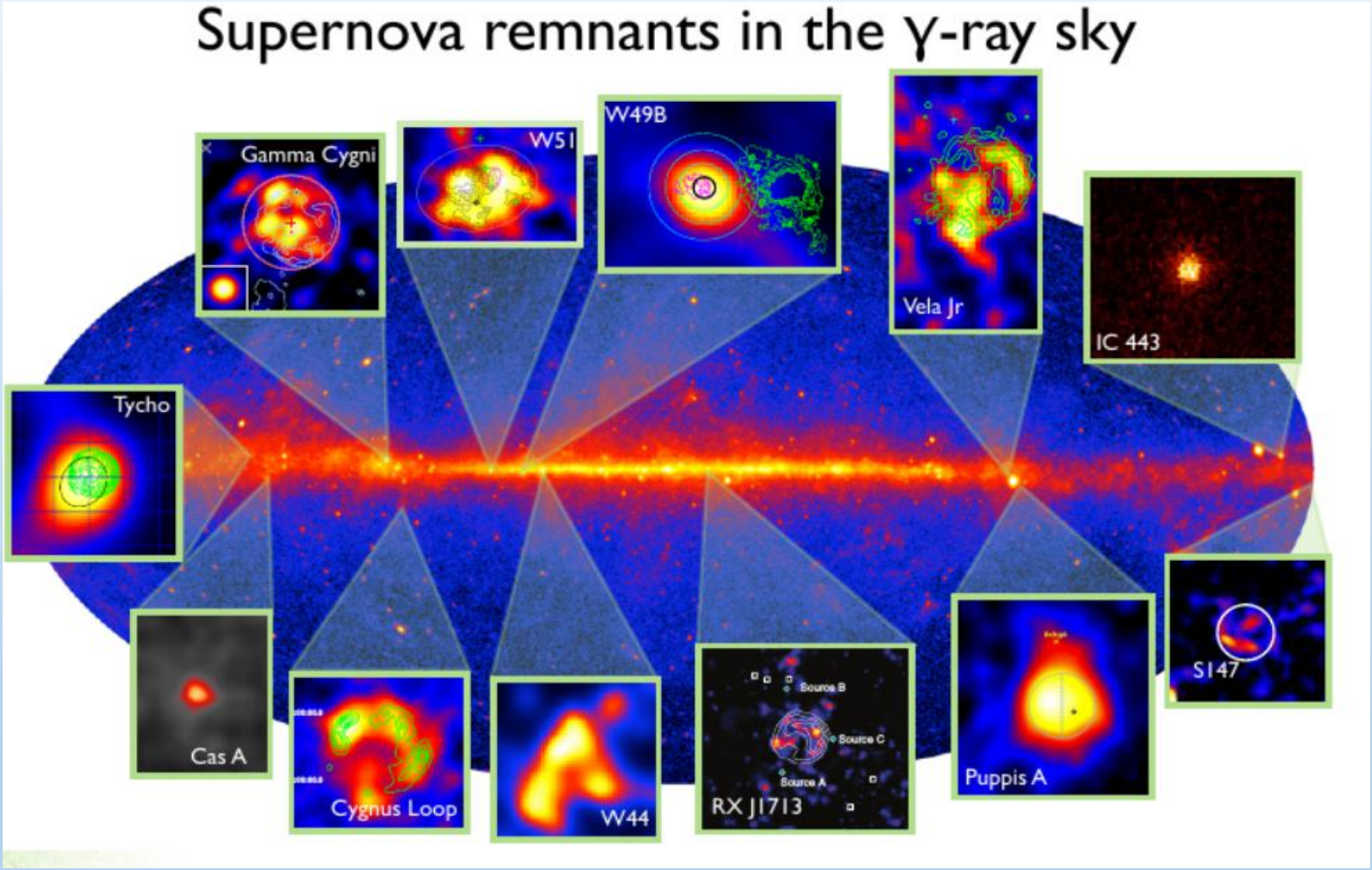






Fermi-LAT Pass 8 data:

- Increased effective area
- Better Point Spread Function (PSF)
- Introduction of PSF and EDISP subclasses



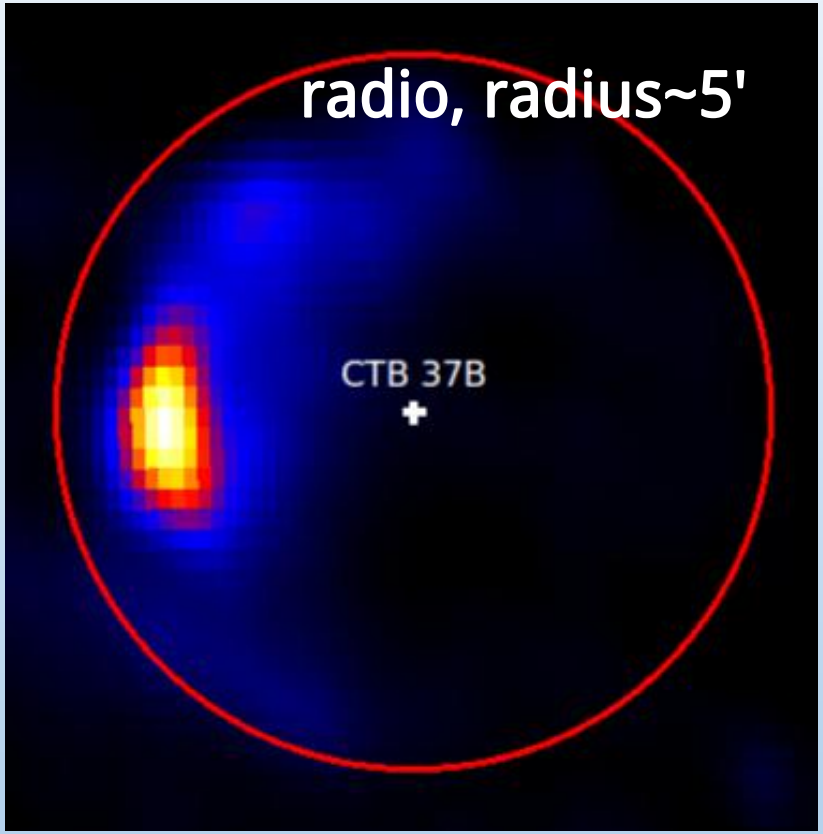
Radio SNRs: 294 (Green 2014)

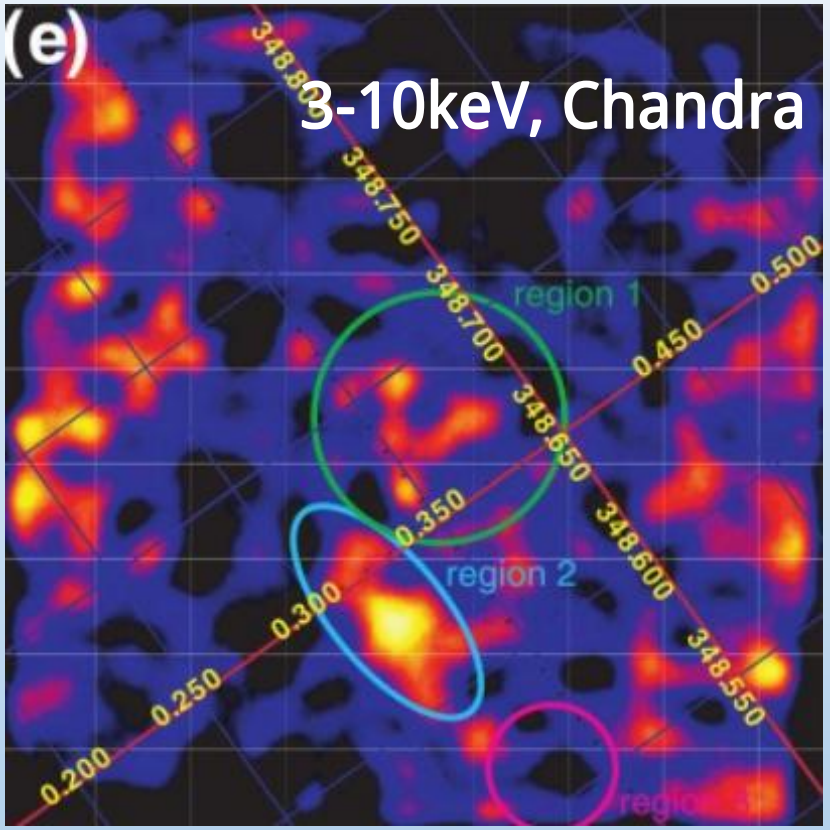
Synchrotron X-Ray: > 14

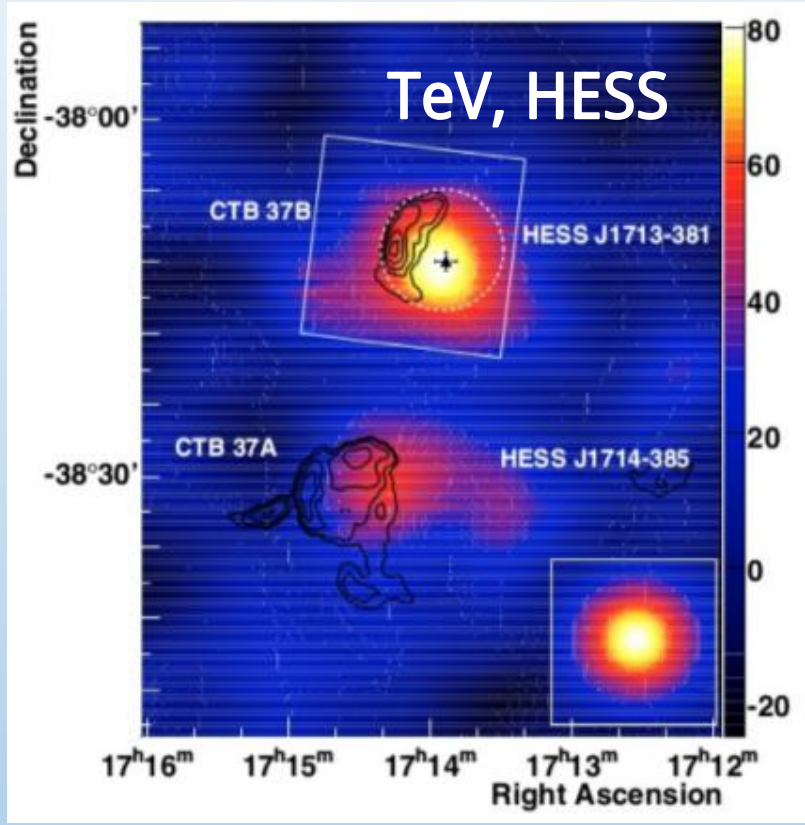
GeV SNRs: > 30 (Acero etal 2016)

TeV SNRs: ~ 25

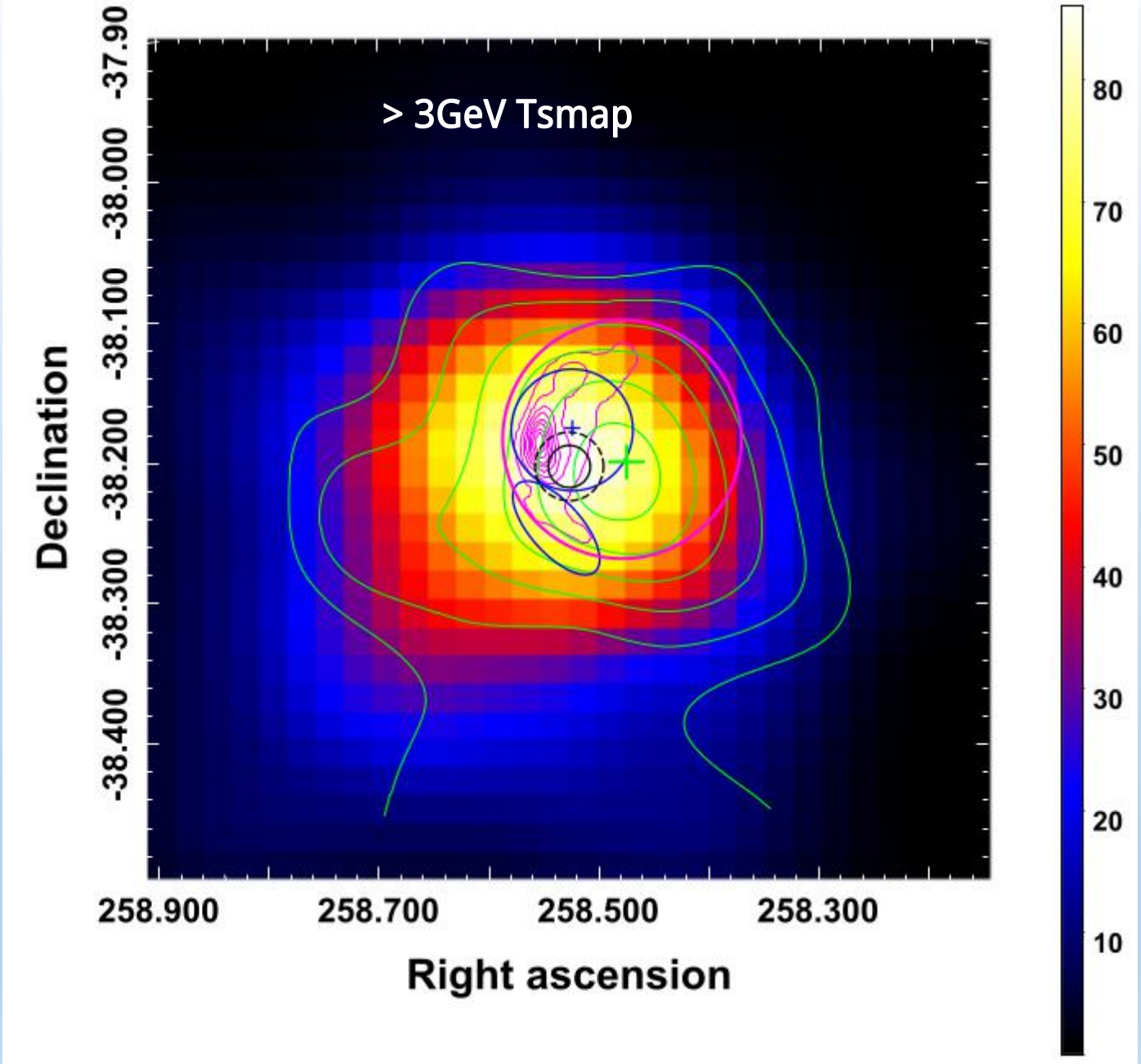
2： The GeV emission from SNR CTB 37B (Xin, Liang, Li, etal, 2016; Zeng, Xin, Liu, etal, 2017)

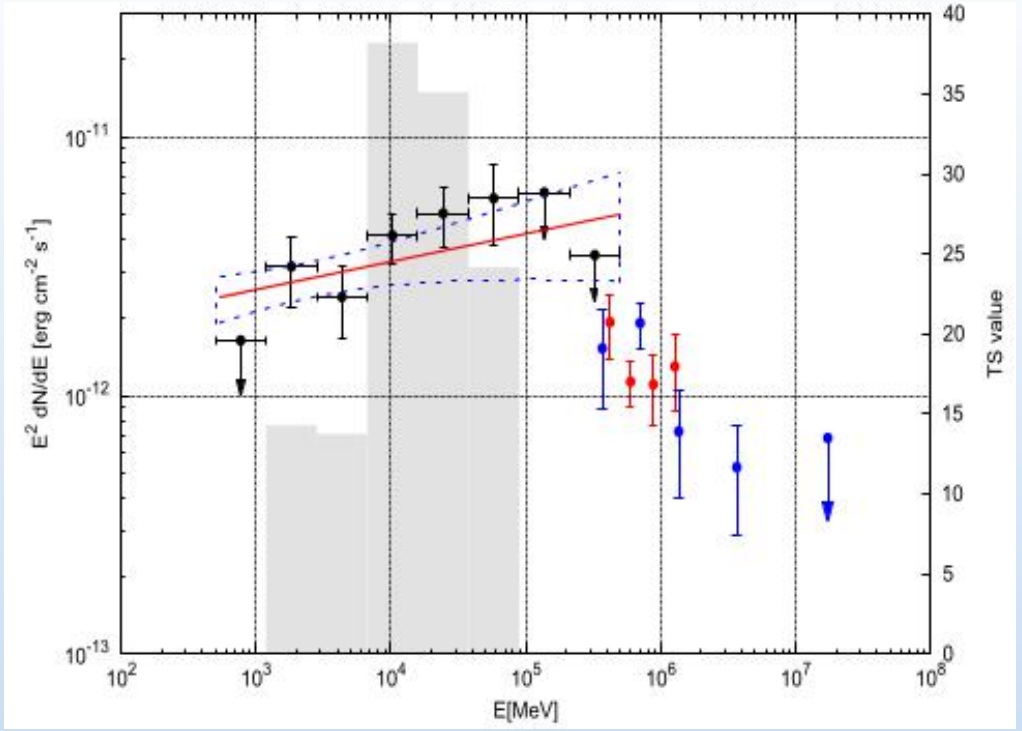


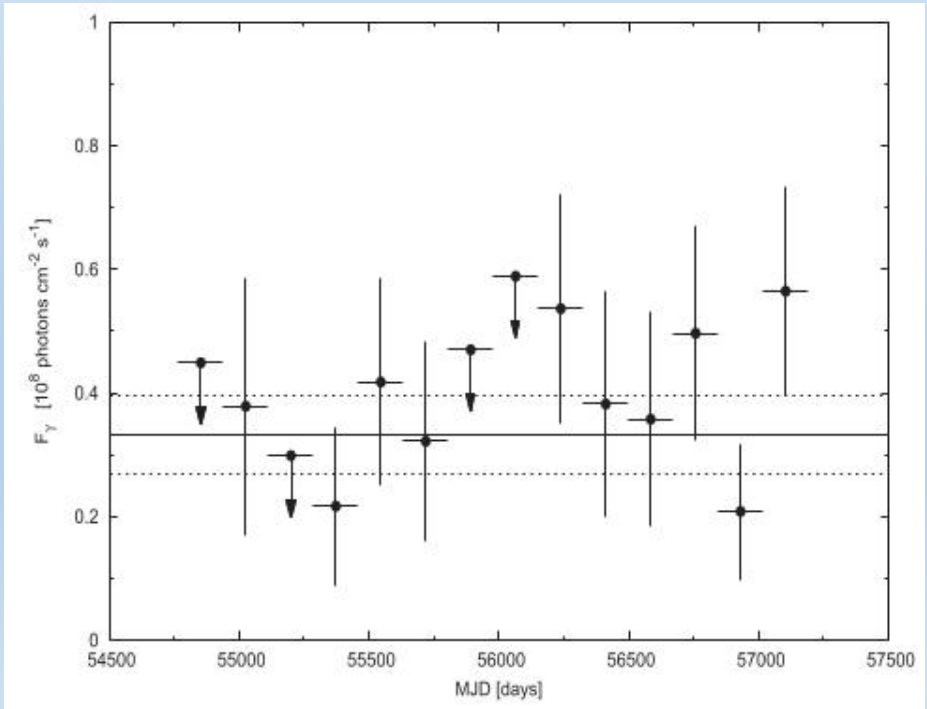




SNR CTB 37B: age~5000 years; distance~13.2kpc (Tian & Leahy 2012)

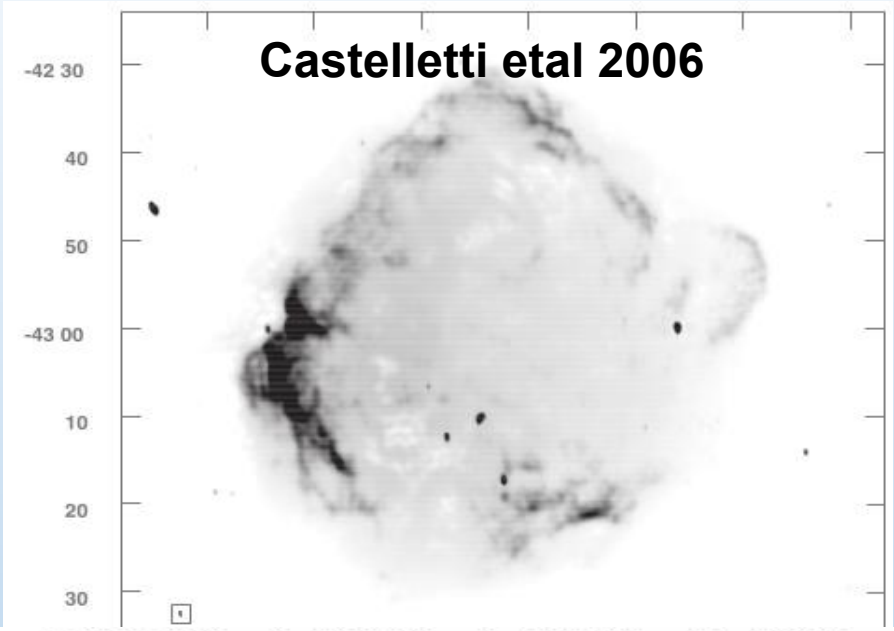


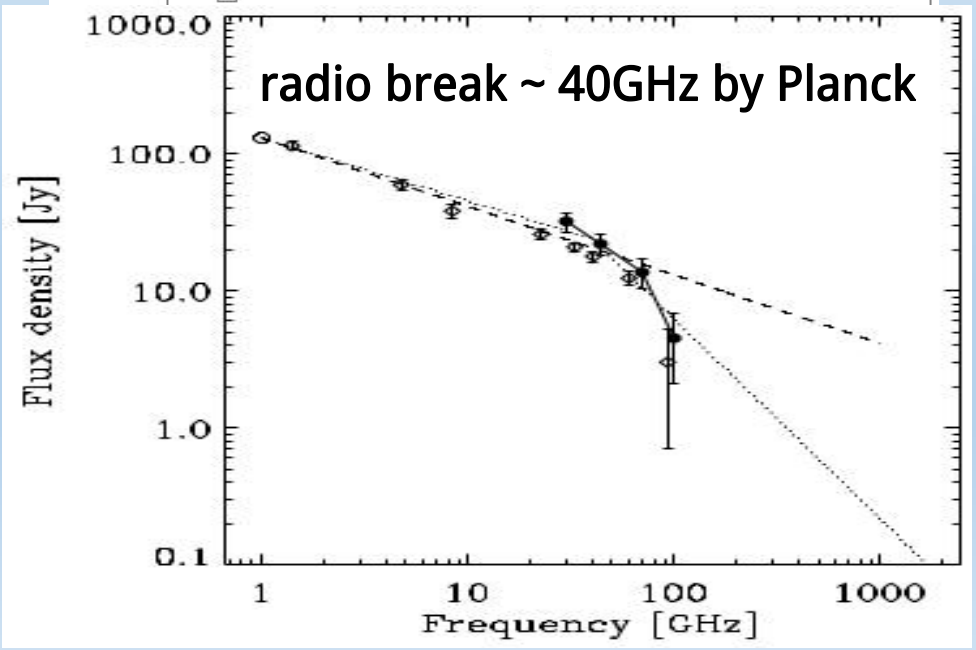


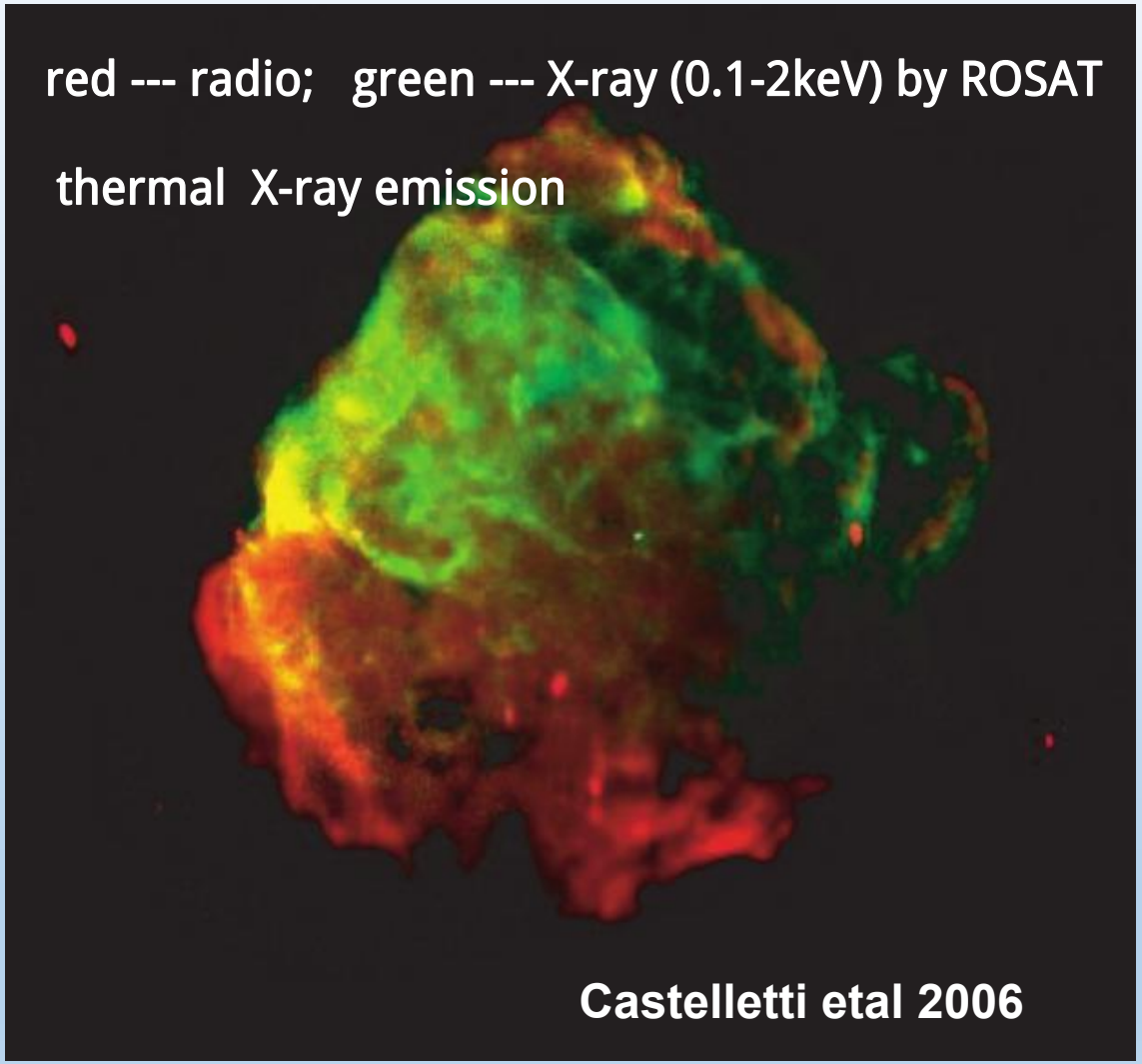


Xin, Liang, Li, etal, 2016

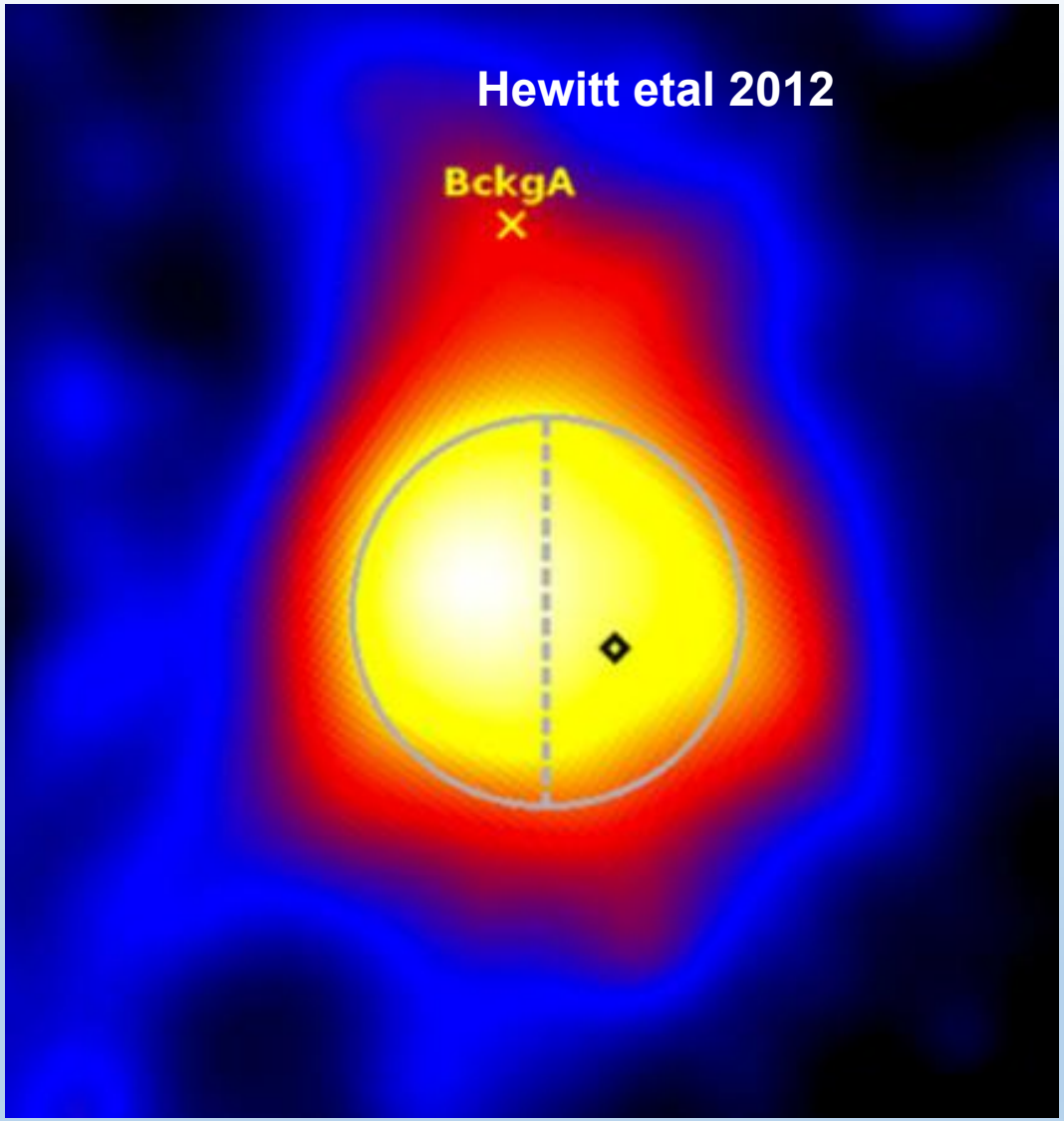
3： The GeV-break in the spectrum of SNR Puppis A



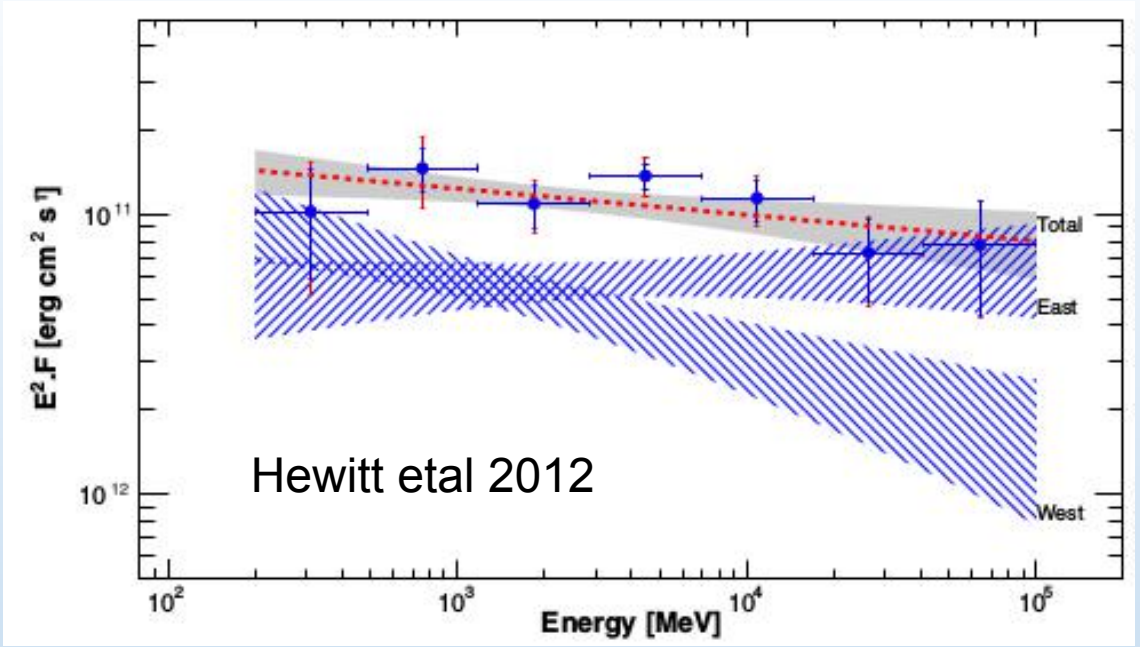


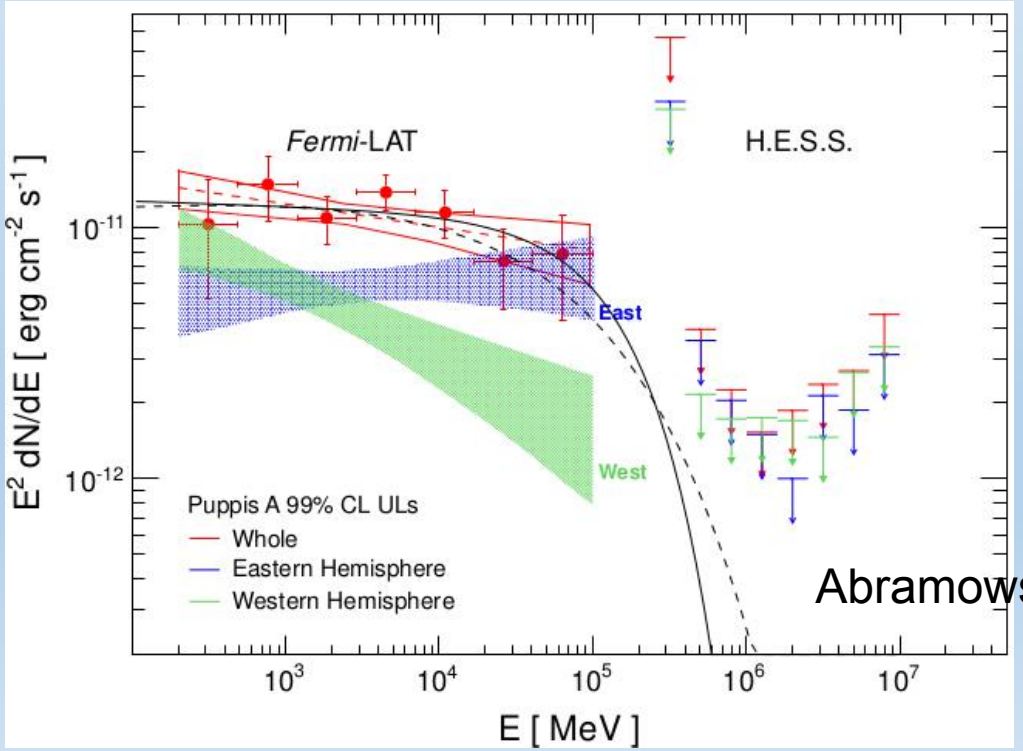


Puppis A : age ~ (4450 ± 750) year (Becker etal, 2012)

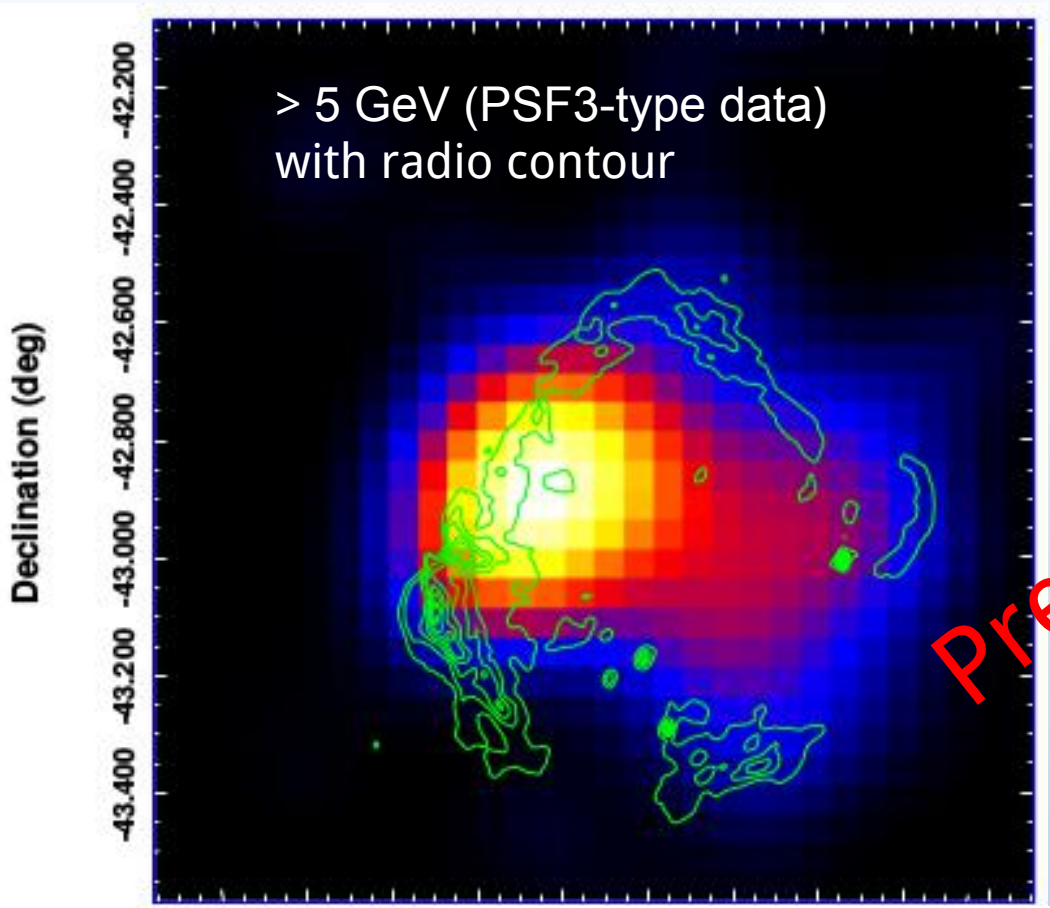


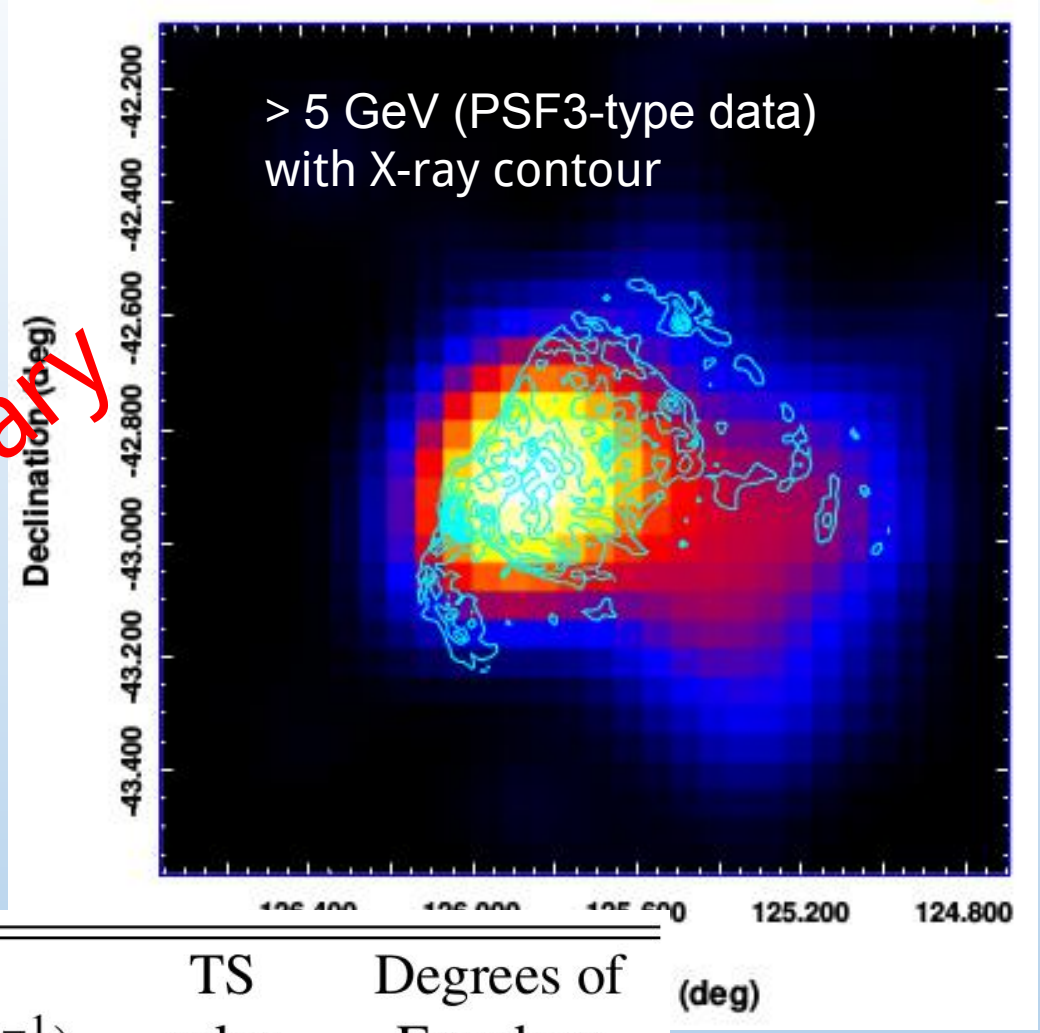
The best spatial template for γ-ray emission: a uniform disk (Hewitt etal 2012).





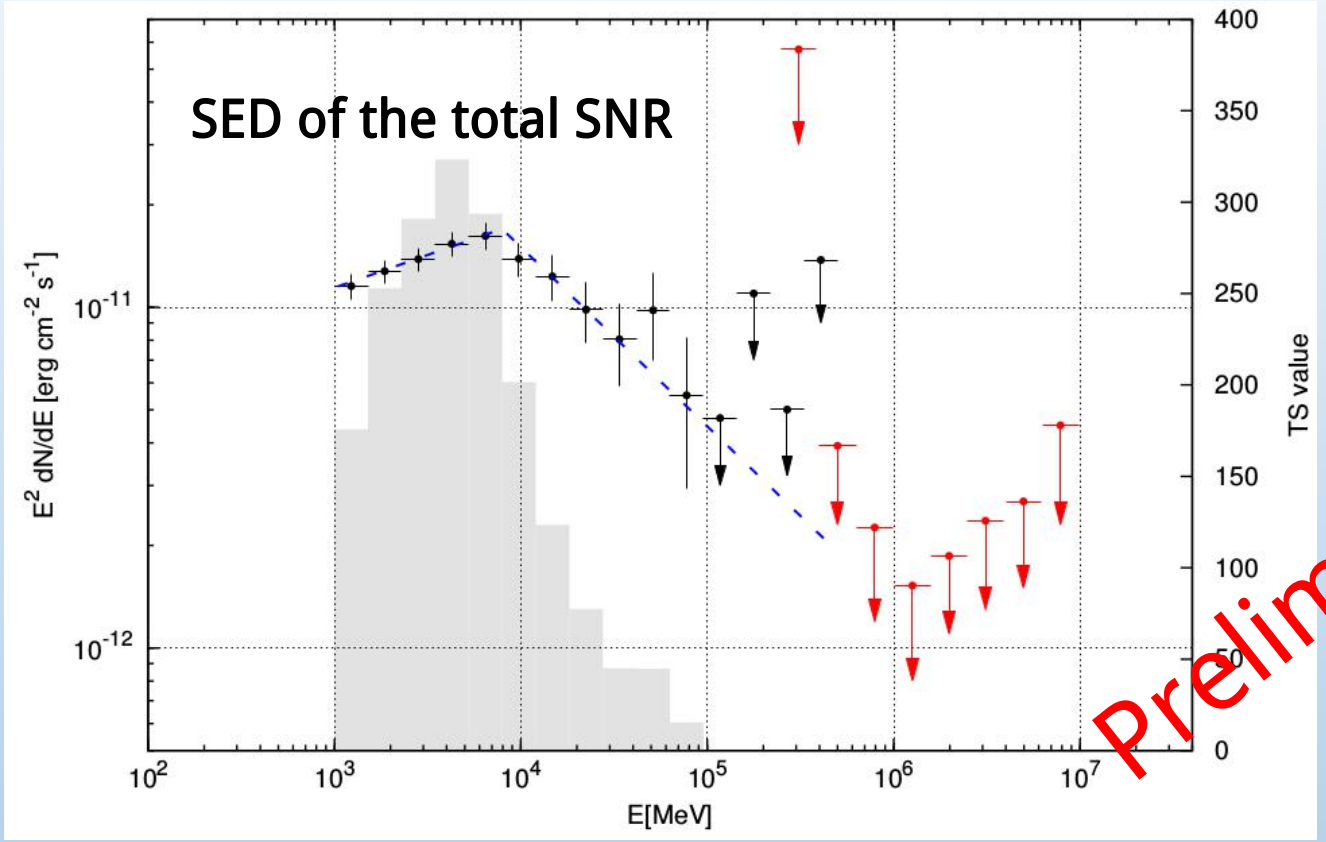
Abramowski etal 2015

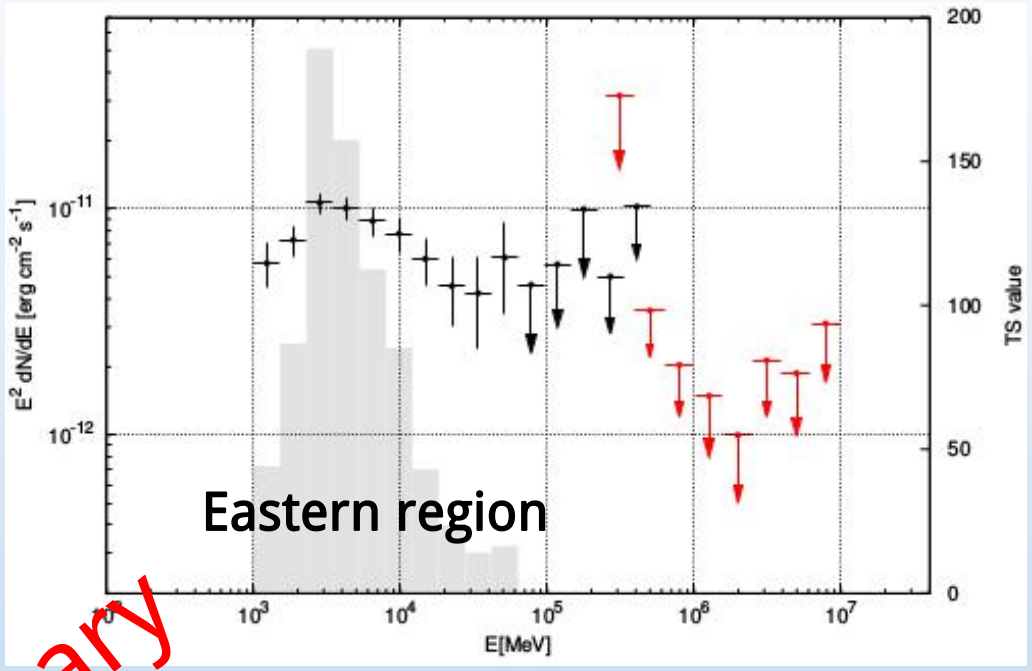


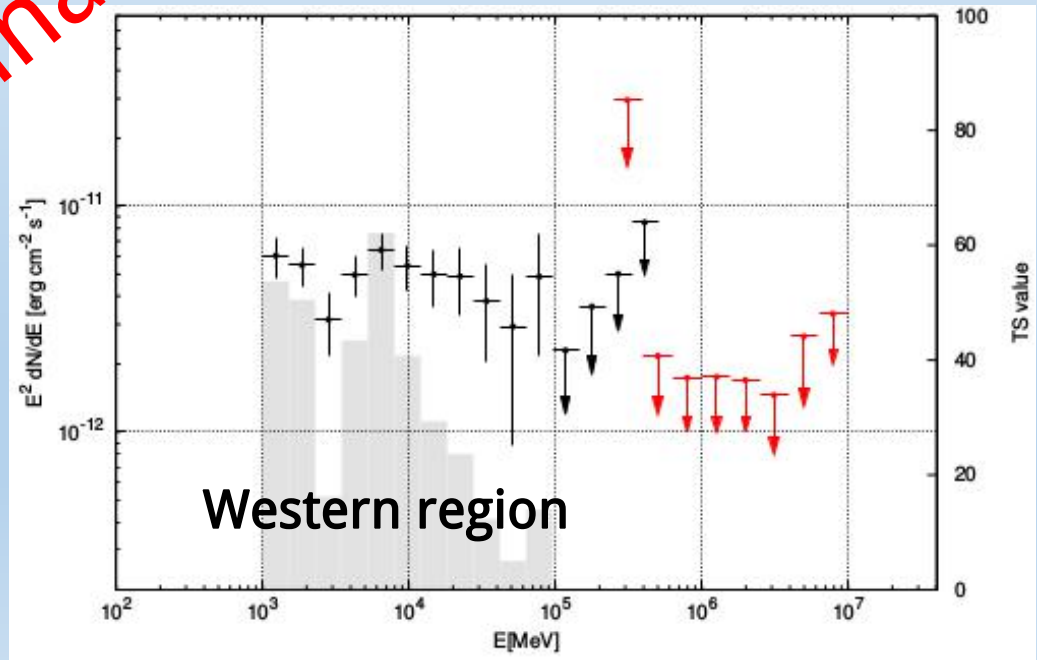


Preliminary

Spectral Template	Photon Flux (10^{-9} ph cm^{-2} s^{-1})	TS value	Degrees of Freedom
Uniform disk	8.23 ± 0.29	1825.9	5
X-ray image	8.31 ± 0.29	1890.4	2
Radio image	8.28 ± 0.30	1527.6	2
Infrared image	9.47 ± 0.33	1650.3	2







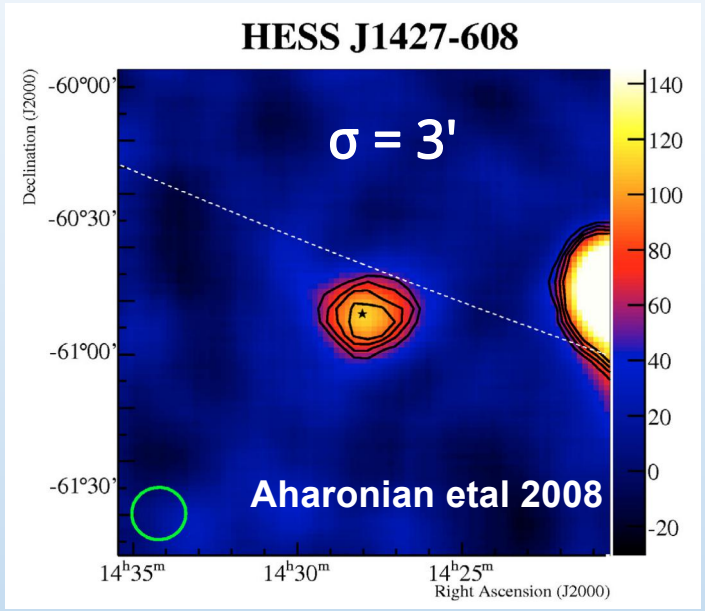
Preliminary

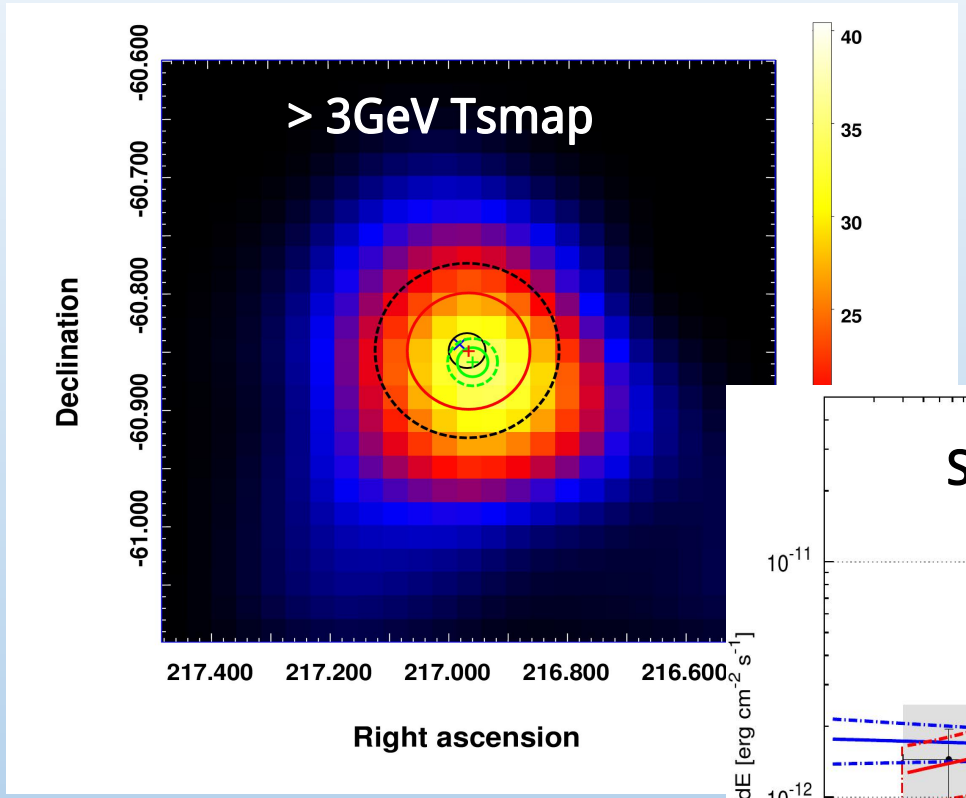
E_{breeak} (total)= 7.92 ± 1.91 GeV.

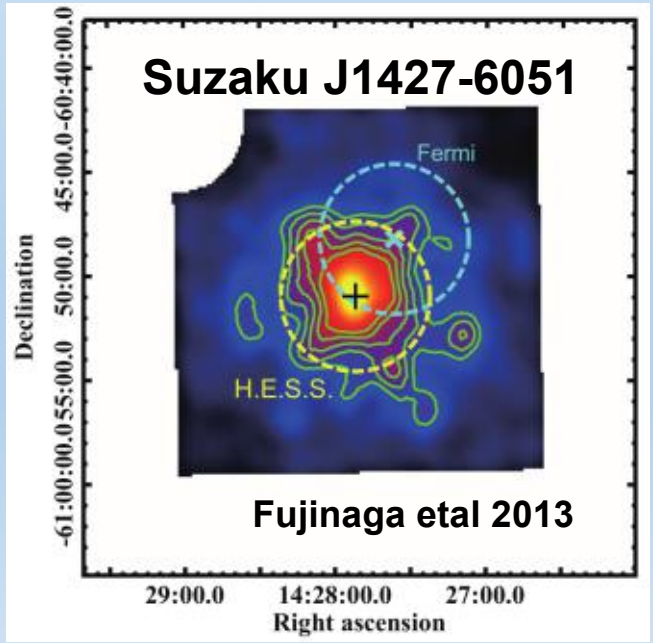
$TS_{break} = -2 \ln(L_{PL} / L_{BPL}) = 35.4 (5.6\sigma)$

4 : An unusual hard unbroken γ-ray spectrum of HESS J1427-608

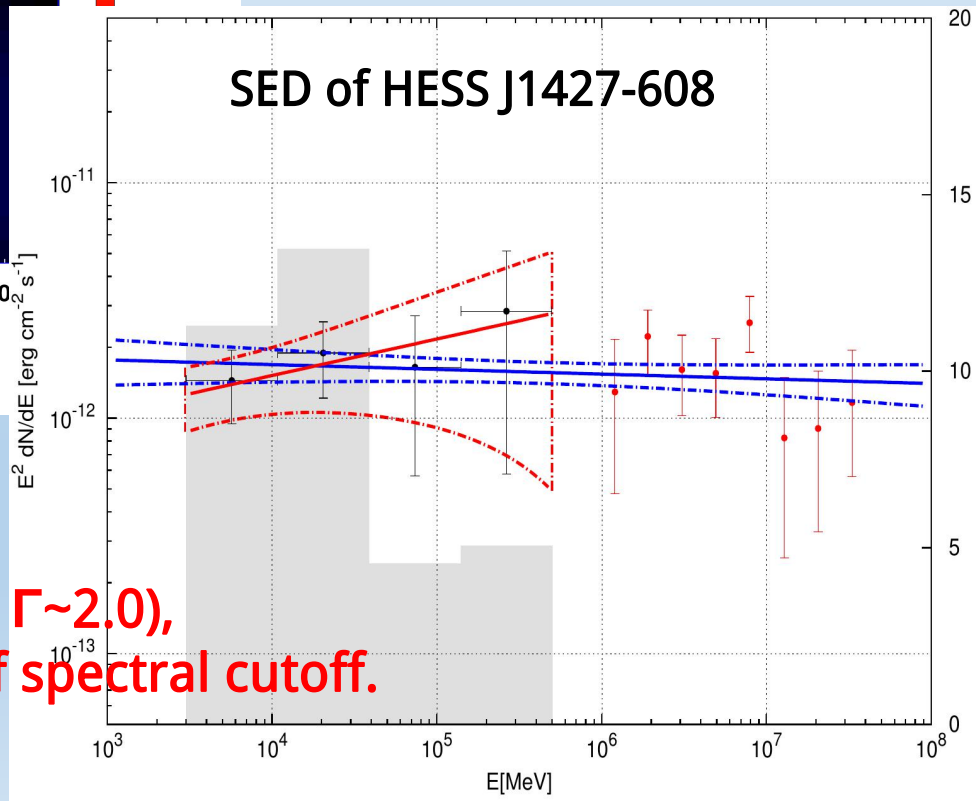
(Guo, Xin, Liao, etal, arXiv:1609.01125)

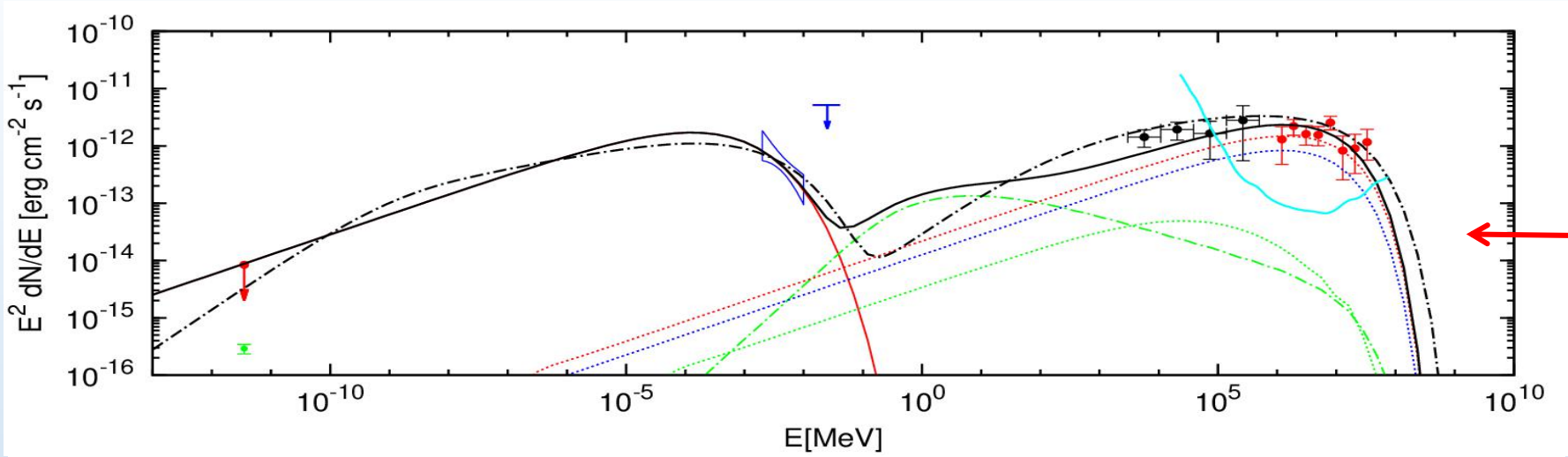




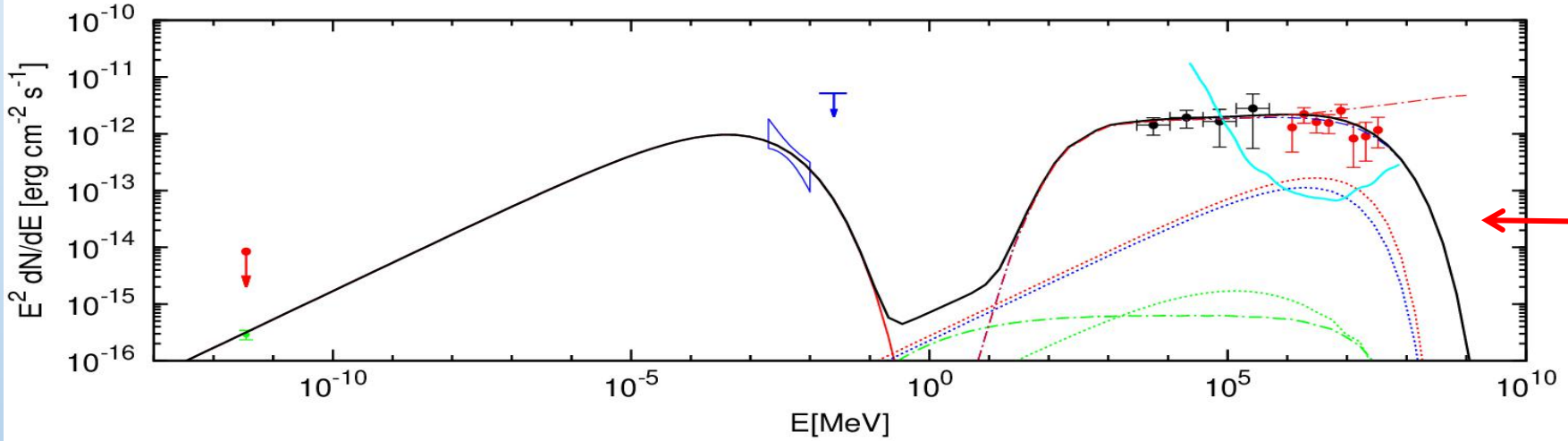


From 3 GeV to ~30 TeV :
a single power-law function (Γ~2.0),
without obvious indication of spectral cutoff.





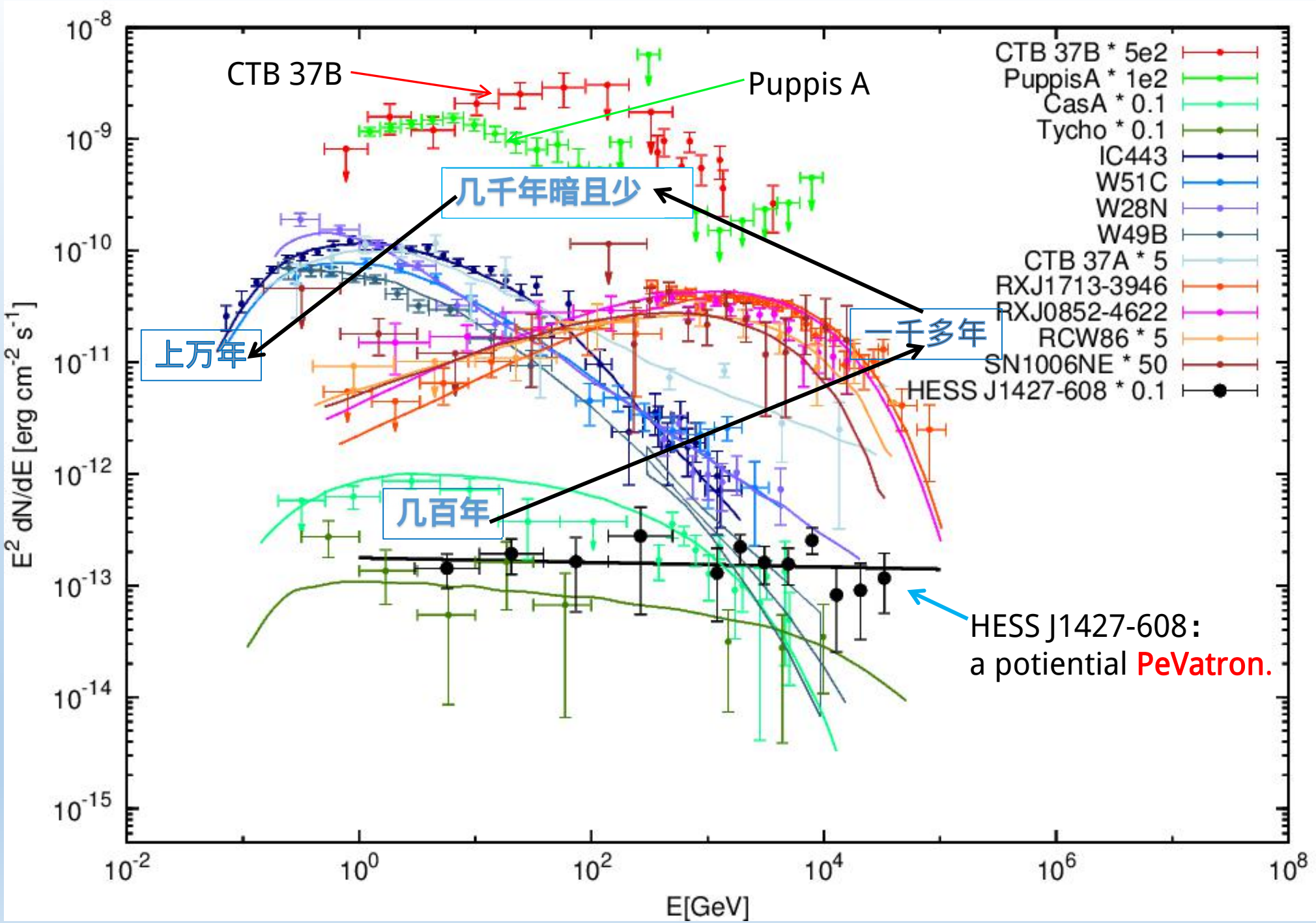
Leptonic Scenario



Hadronic Scenario

Model	α_p	α_e	$\Delta\alpha_e$	$E_{p,\mathrm{cut}}$ (TeV)	$E_{e,\mathrm{break}}$ (TeV)	$E_{e,\mathrm{cut}}$ (TeV)	W_p (10^{50} erg)	W_e (10^{48} erg)	B (μG)	n_{gas} (cm^{-3})
leptonic (PL)	–	2.3	–	–	–	35.0	–	2.5	5.0	1.0
leptonic (BPL)	–	1.6	1.0	–	0.1	80.0	–	3.0	3.5	1.0
hadronic	2.0	2.0	–	350.0	–	30.0	10.0	0.06	10.0	1.0

NOTE. — The total energy of relativistic particles, $W_{e,p}$, is calculated for $E > 1$ GeV.


CTB 37B
Puppis A
几千年暗且少
上万年
一千多年
几百年
HESS J1427-608：
a potiential PeVatron.
CTB 37B * 5e2
PuppisA * 1e2
CasA * 0.1
Tycho * 0.1
IC443
W51C
W28N
W49B
CTB 37A * 5
RXJ1713-3946
RXJ0852-4622
RCW86 * 5
SN1006NE * 50
HESS J1427-608 * 0.1
E² dN/dE [erg cm⁻² s⁻¹]
E[GeV]

5： Conclusion

(1)： SNR CTB 37B and Puppis A may provide a sub-sample with gamma-ray emission (age~several thousands years) to study the evolution of particle distribution in SNRs.

(2)： HESS J1427-608 --- a potiential PeVatron (further observations are needed).

Thanks for your attention !