The VHE sky 2006−2010

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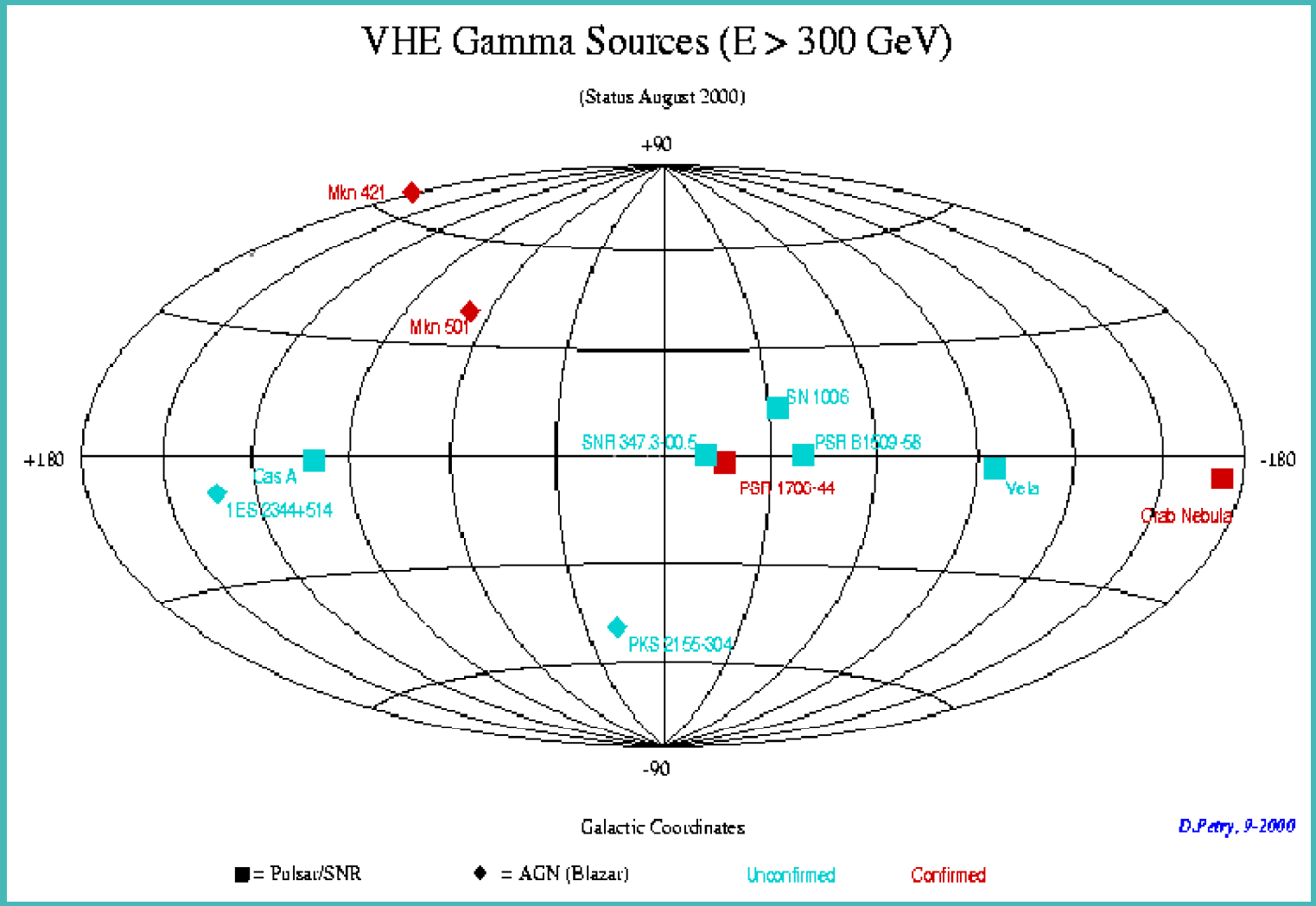
GLAST LAT Collab. Meeting − Aug 1−2, 2001

- VHE Catalog: AGN Observations above 50 GeV
- Future Experiments on the ground
- Importance for GLAST
  - Sensitivity
  - Overlap in sky, time
  - Unique capabilities on the ground

VHE Sources (2001)



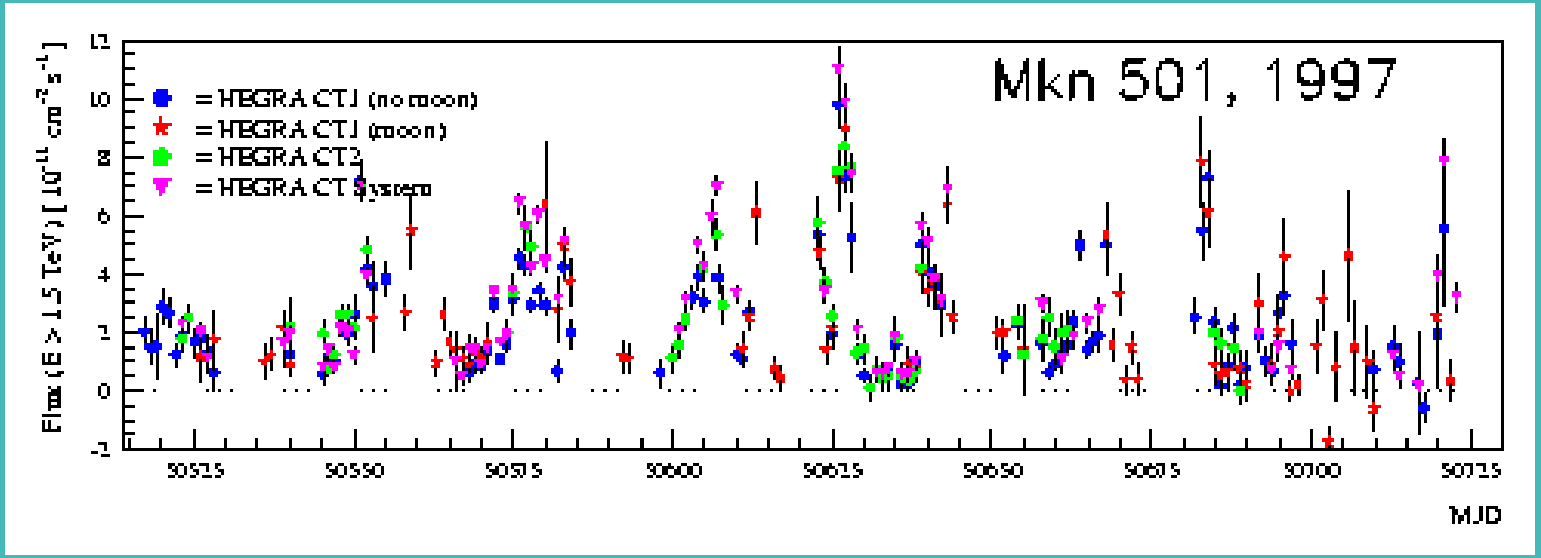
- All sources discovered with atmospheric Cherenkov technique

- **AGN Catalog (including weak detections)**

	Name	Type	Z	EGRET ?
	Mrk 421	XBL	0.031	Y
	Mrk 501	XBL	0.034	Y
	1ES2344+51	XBL	0.044	N
??	1ES1959+650	XBL	0.048	N
	PKS2155−304	XBL	0.116	Y
	1H1426+428	XBL	0.129	N

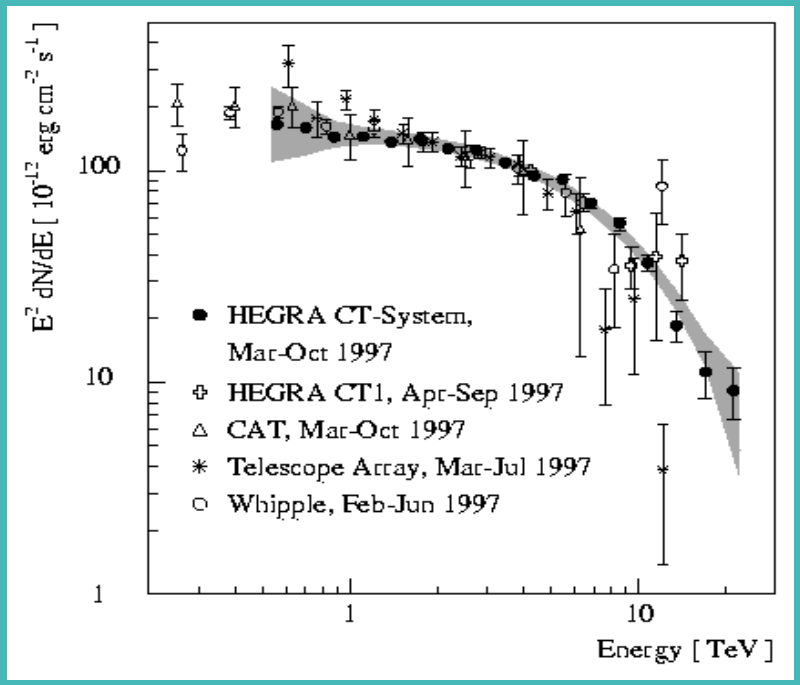
- All XBL's − different population from EGRET
- Nearby

MRK 501 – 1997

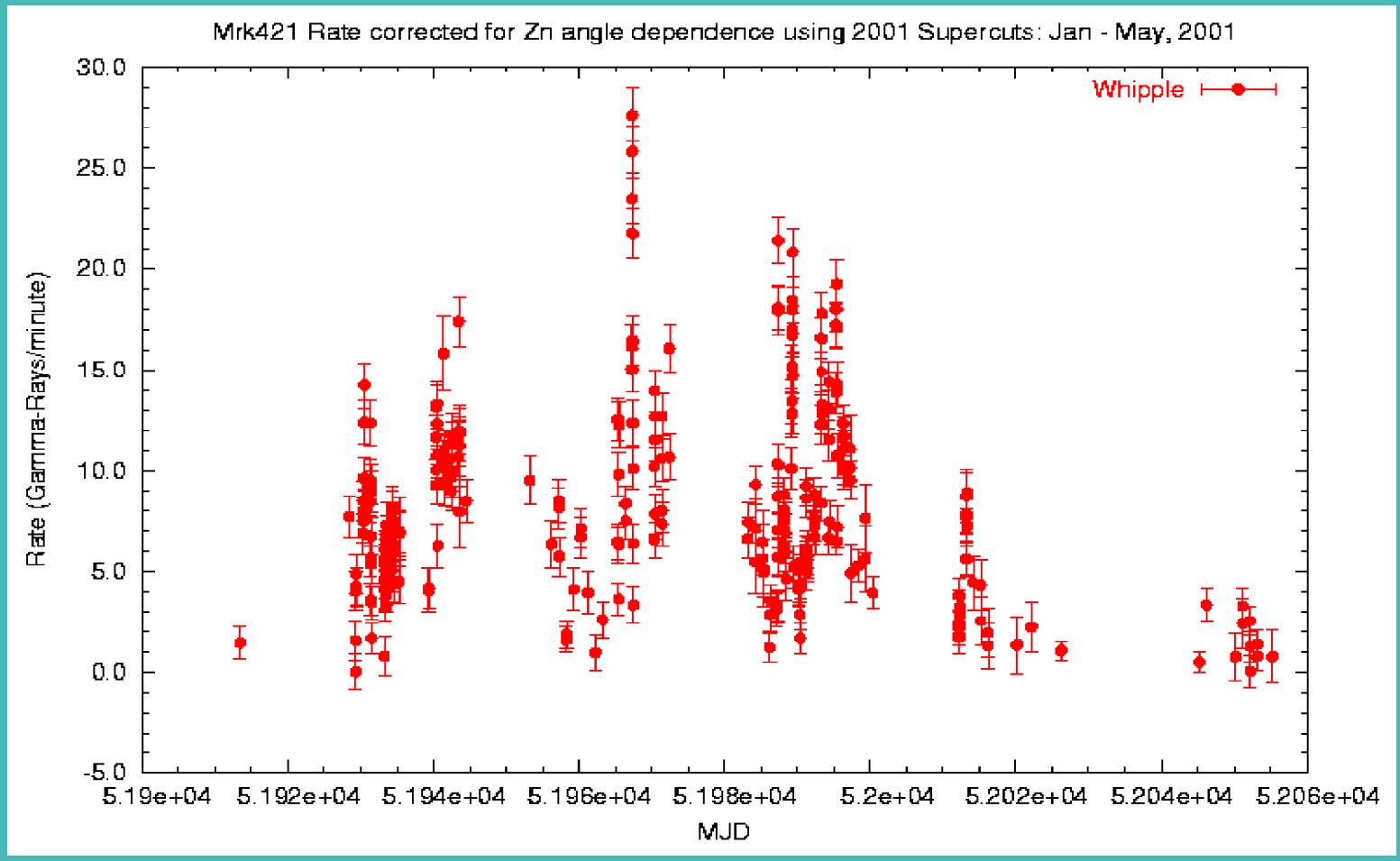


- Light curve

- Spectrum



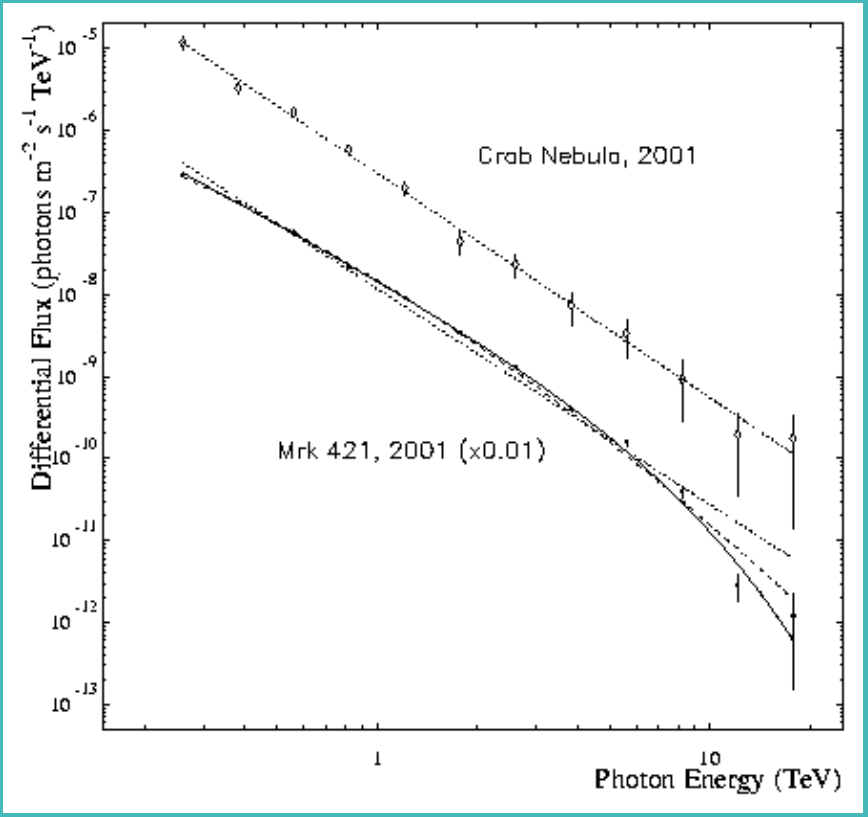
MRK 421 – 2001

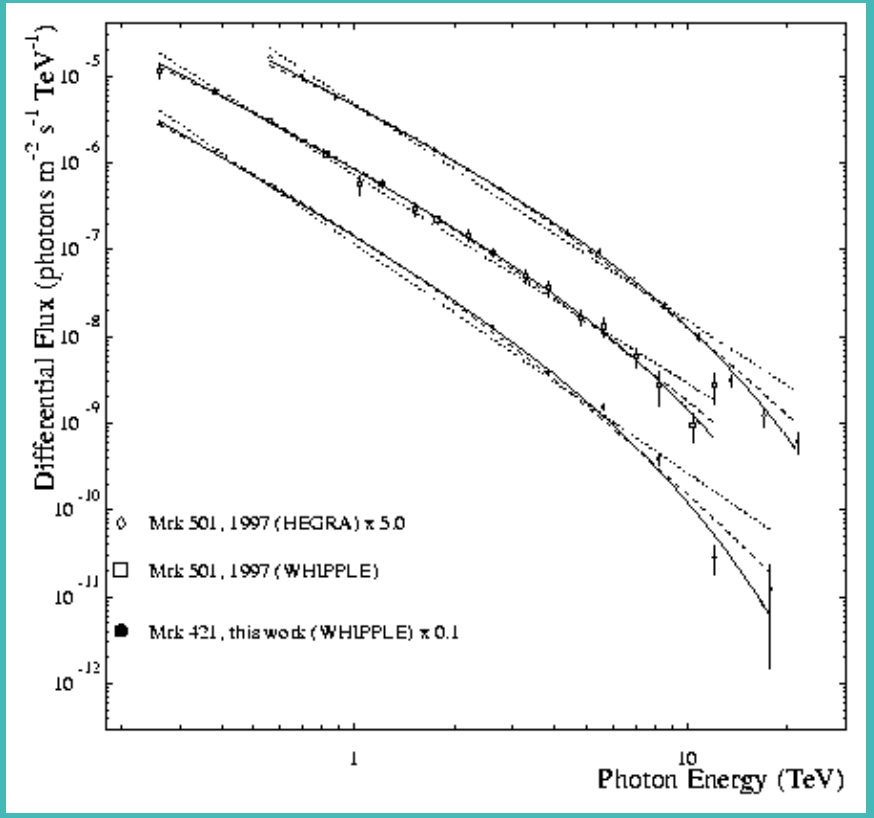


- Detection > 200 σ
- Correlation with X−rays (Holder et al, ICRC Hamburg)
- Short term variability minimum τ ~ 30 min rise ~ fall

MRK 421 − 2001 astro−ph/0107113

Whipple/VERITAS

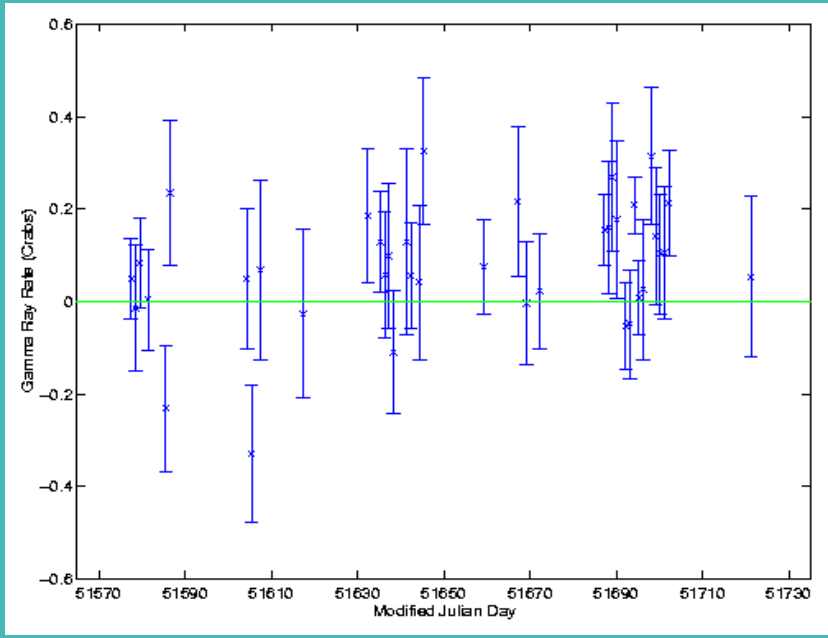


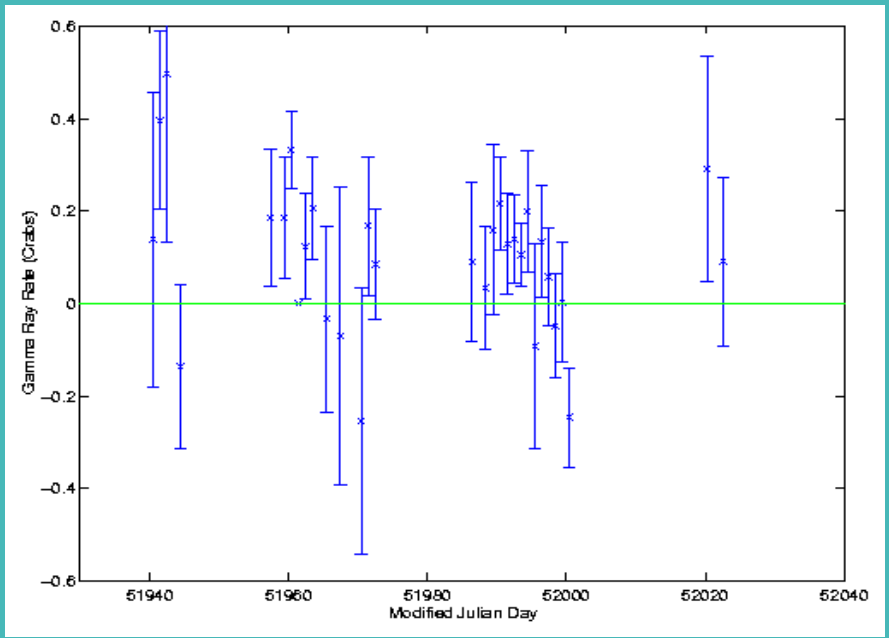


- Difficult to measure "cutoff"
- Universal feature ?
- Absorption at Source ?
- Note: HEGRA sees somewhat different spectral shapes − Mrk 421 appears different than Mrk 501 (ICRC Hamburg)

1H1426+428 (Horan et al., ICRC Hamburg)

Whipple/VERITAS (also seen by HEGRA at similar significance)





- 2000 4.19 σ
- Weak signal ~ < 100 mCrab

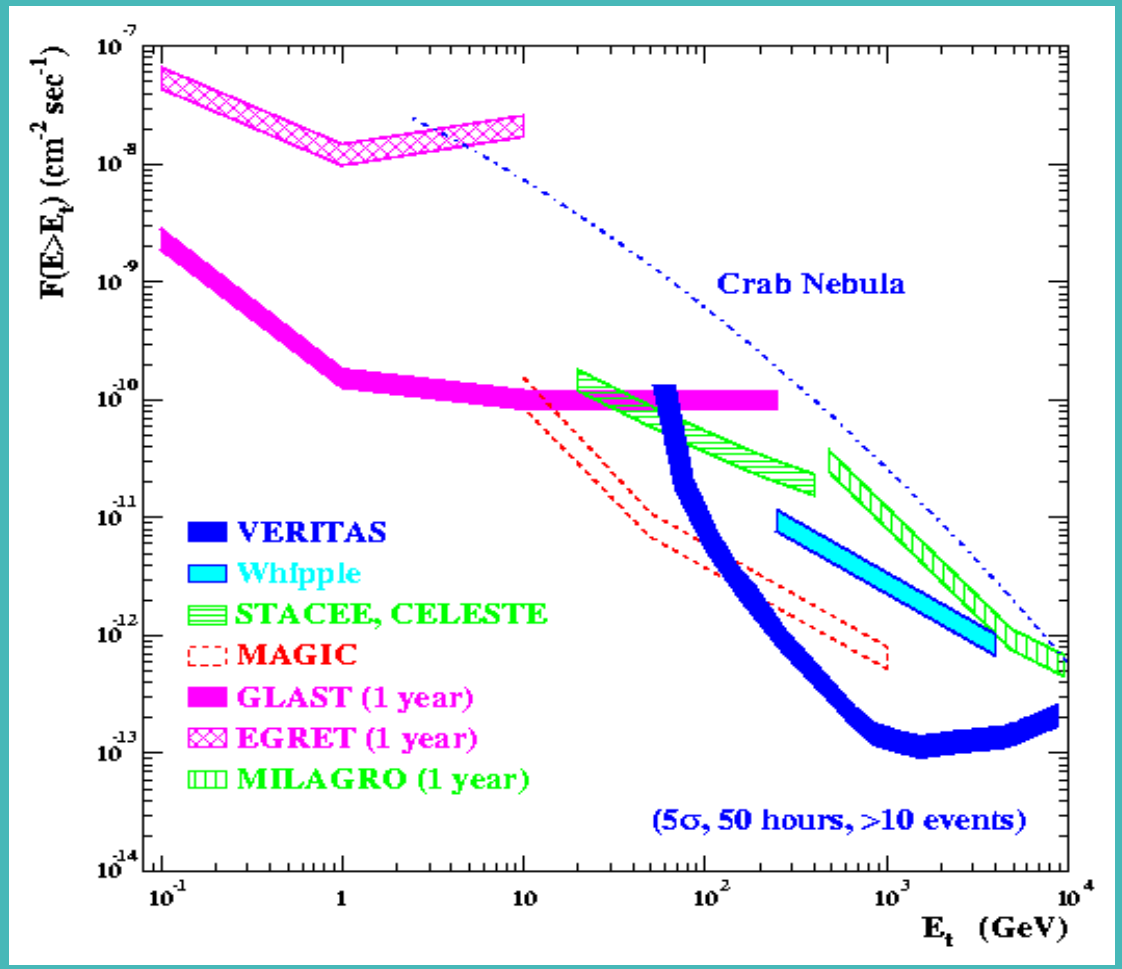
- 2001 4.94 σ

Cherenkov Telescopes around the World

2001: Operational
Under Construction

- 2005 All four new telescopes should be operational 2 N, 2 S
- Do not consider air shower arrays
- For review, see Weekes, astro−ph/0010431

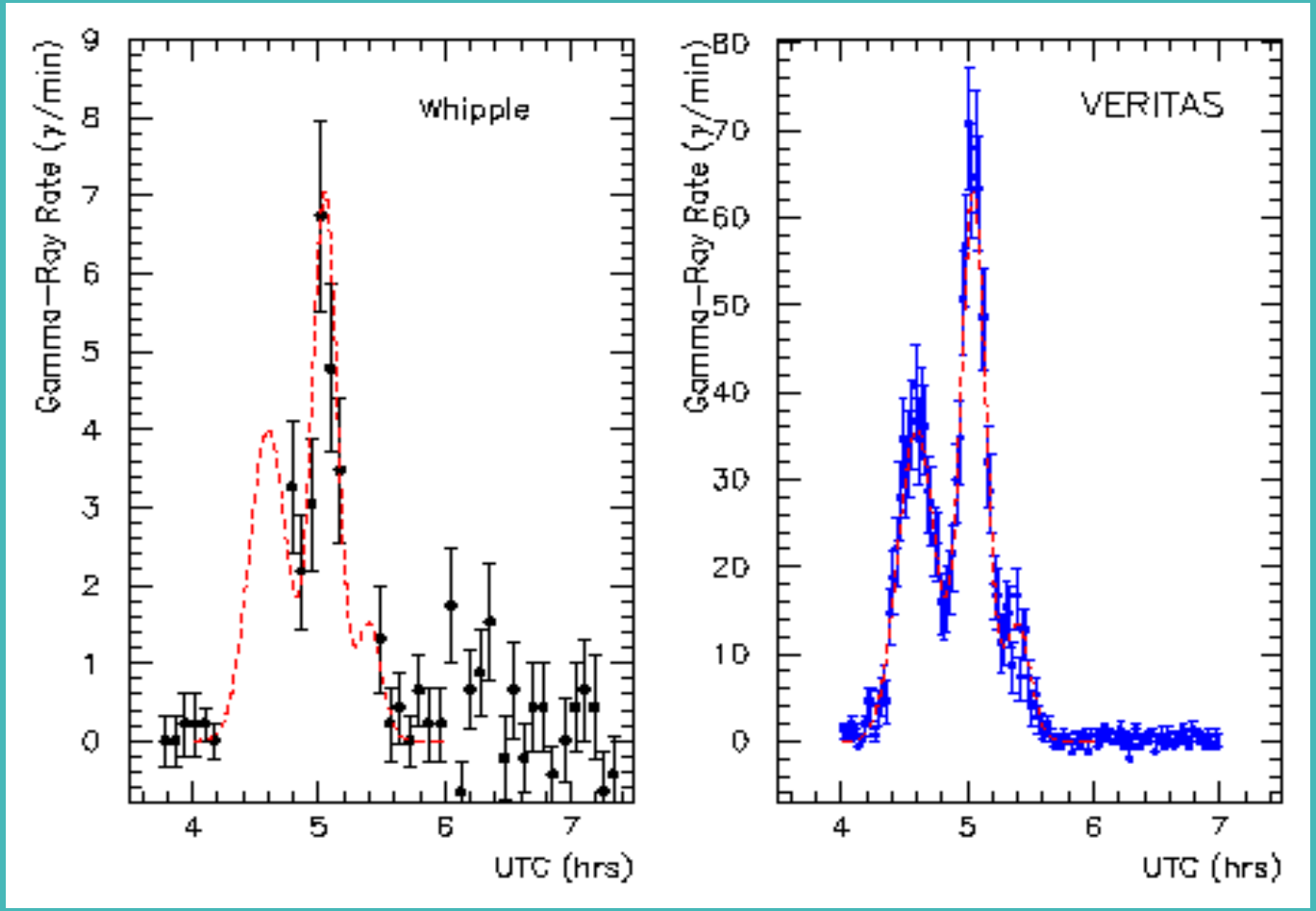
Sensitivities



- Both in space and on ground, sensitivities ~ 10 mCrab
- Limitation space− HE photon counting ground− LE threshold
- Comparing "apples" and "oranges"

Most important strength for Ground−Based

− short term sensitivity



Comparison with GLAST

Parameter	GLAST	NGACT (e.g. VERITAS)
Angular resolution	0.10^{o} (1 GeV)	0.14^{o} (50 GeV)
(single photon)	0.04^{o} (50 GeV)	0.05^{o} (300 GeV)
Energy resolution	7−10 % (1−50 GeV)	15−10 % (50−500 GeV)
FOV	2.5 sr	2×10^{-3} sr
Duty Cycle	100 %	16%
Area (m^2)	1.3	$10^4 – 10^5$
Instant. Crab Rate	< 0.5 / min	~ 50 /min

Overlap with GLAST

Assumptions (optimistic):

- Two HESS/VERITAS ACTs in each hemisphere
- Duty cycle of 10% for each telescope
- Yearly operation of 10 months/telescope
- Telescopes formulate independent observing plans
- Have not folded in GLAST observing constraints

- Fraction of Time Covered by 1 or more ACTs

  (for sources that transit near zenith)

  - Average (year) ~ 13%
  - Average (month) ~ 20% winter

    ~ 8% summer
  - Peak (day) ~ 80% winter
  - Peak (day) ~ 45% summer

Overlap with GLAST (cont.)

- Fraction of Sky covered (observations down to zenith=45^{o})
  - Northern Hemisphere ~ 82%
  - Southern Hemisphere ~ 65%
  - Good overlap for $\delta = -10^{o}$ to 10^{o}
- # Sources / ACT in a year
  - Include additional 80% source efficiency
  - **14** sources @ 25 hr/source
- Total sources (both hemispheres) seen on ground in a year
  - Minimum ~ 28 (expts in each hemis. have identical obs plans!)
  - Typical ~ 40
  - ~ 40−50% will be extragalactic

Comments

- Have not considered "survey" modes for ACTs
  - VERITAS increase numbers of sources by 4−5
  - decrease sens. by 4 @100 GeV, by 8 @ 1 Tev
- For particular sources, monitoring can continue for months
- Coordination among ground−based community will help
- GLAST will strongly affect ground−based observing plans

Summary

- NGACTs will be an important complement to GLAST
- Key strength − follow ~25 AGN with great sensitivity at VHE
- Without coordination, capabilities will greatly surpass those today
- Coordination would substantially improve the science