



MAGIC Telescopes

- Status and Results 2009/2010 -

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for the MAGIC collaboration

CHIPP Plenary Meeting 2010

The MAGIC Telescopes



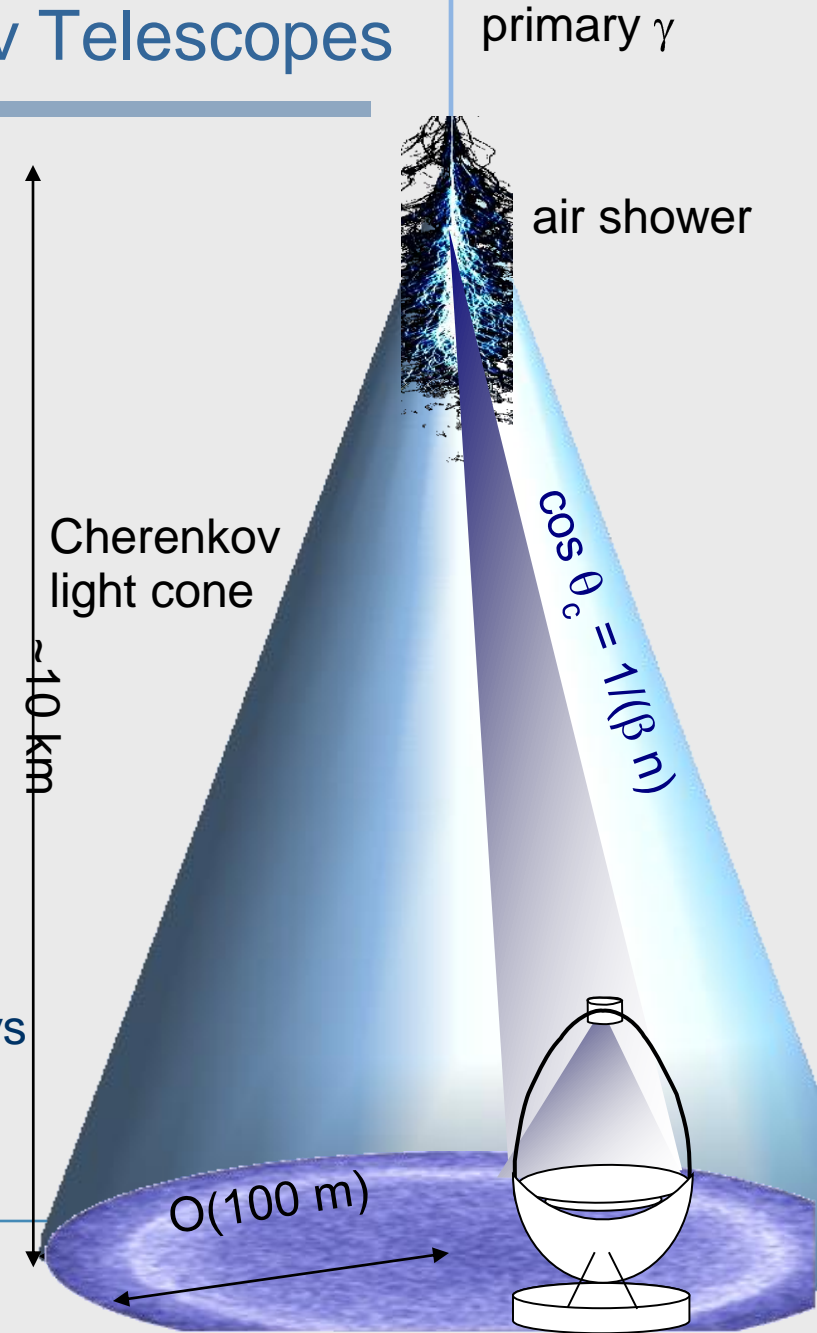
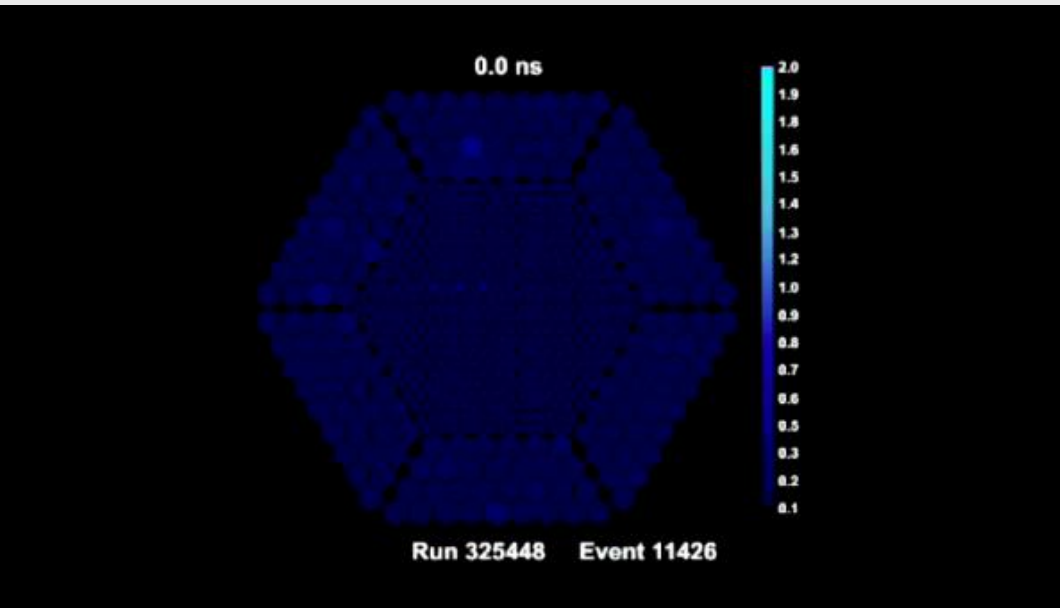
- Recording Cherenkov light from air showers induced by gamma-rays
- Phase I (monoscopic) since 2004
- Phase II (stereoscopic) since fall 2009
- World's largest Cherenkov telescopes
 - mirror diameter: 17 m
 - field of view: 3.5 deg.
 - pixels: 577 (1) / 1039 (2)

*Designed for
low energy threshold &
fast repositioning*

The MAGIC Telescopes



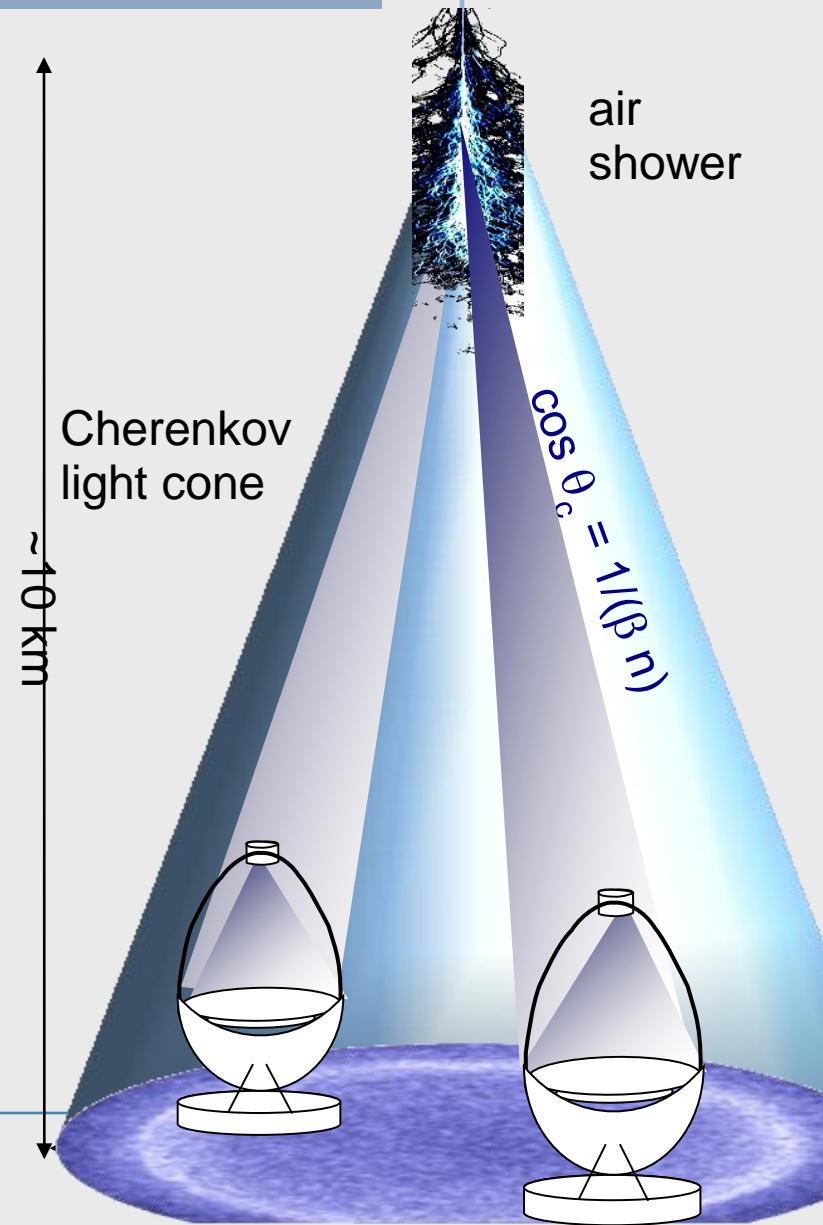
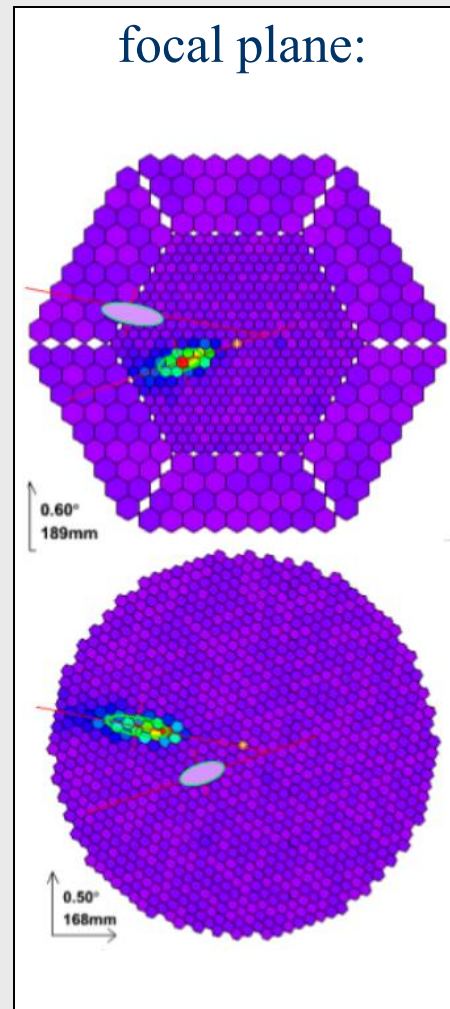
Imaging Atmospheric Cherenkov Telescopes



- Large collection area
 - $O(10^5 \text{m}^2)$
 - Cherenkov “flash”
 - $O(100 \text{ Phot./m}^2)$
 - few ns duration
- Background:
- Noise of night sky
 $> 10^8 \text{ Phot./m}^2 / \text{s}$
 - Charged Cosmic Rays
 $\sim \text{Factor } 10^4 - 10^5$

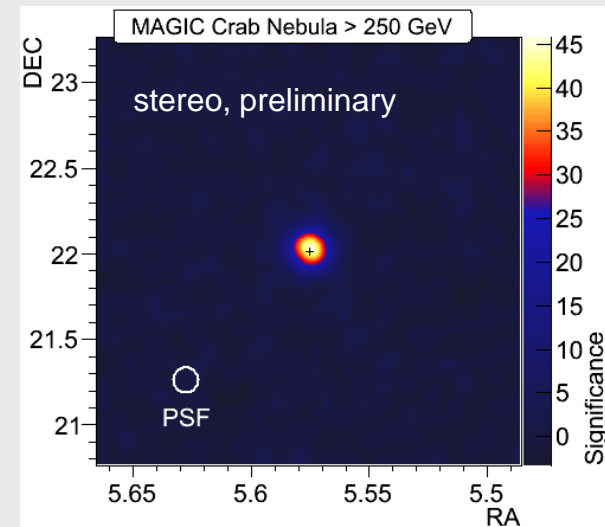
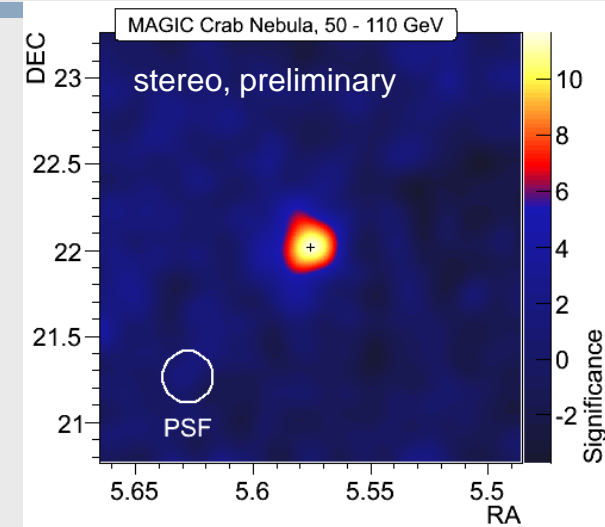
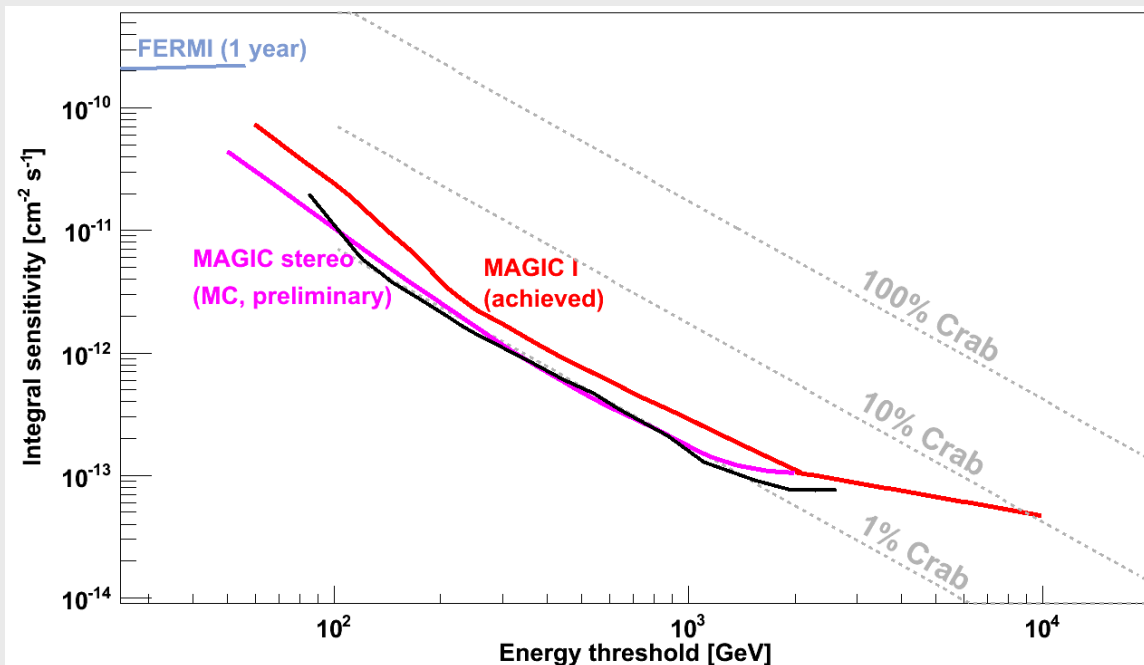
Imaging Atmospheric Cherenkov Telescopes

- trigger requires coincidence (“hardware stereo”)
- Stereo improves:
 - angular resolution
 - energy resolution
 - background suppression
 - stability of the system



Stereo Performance

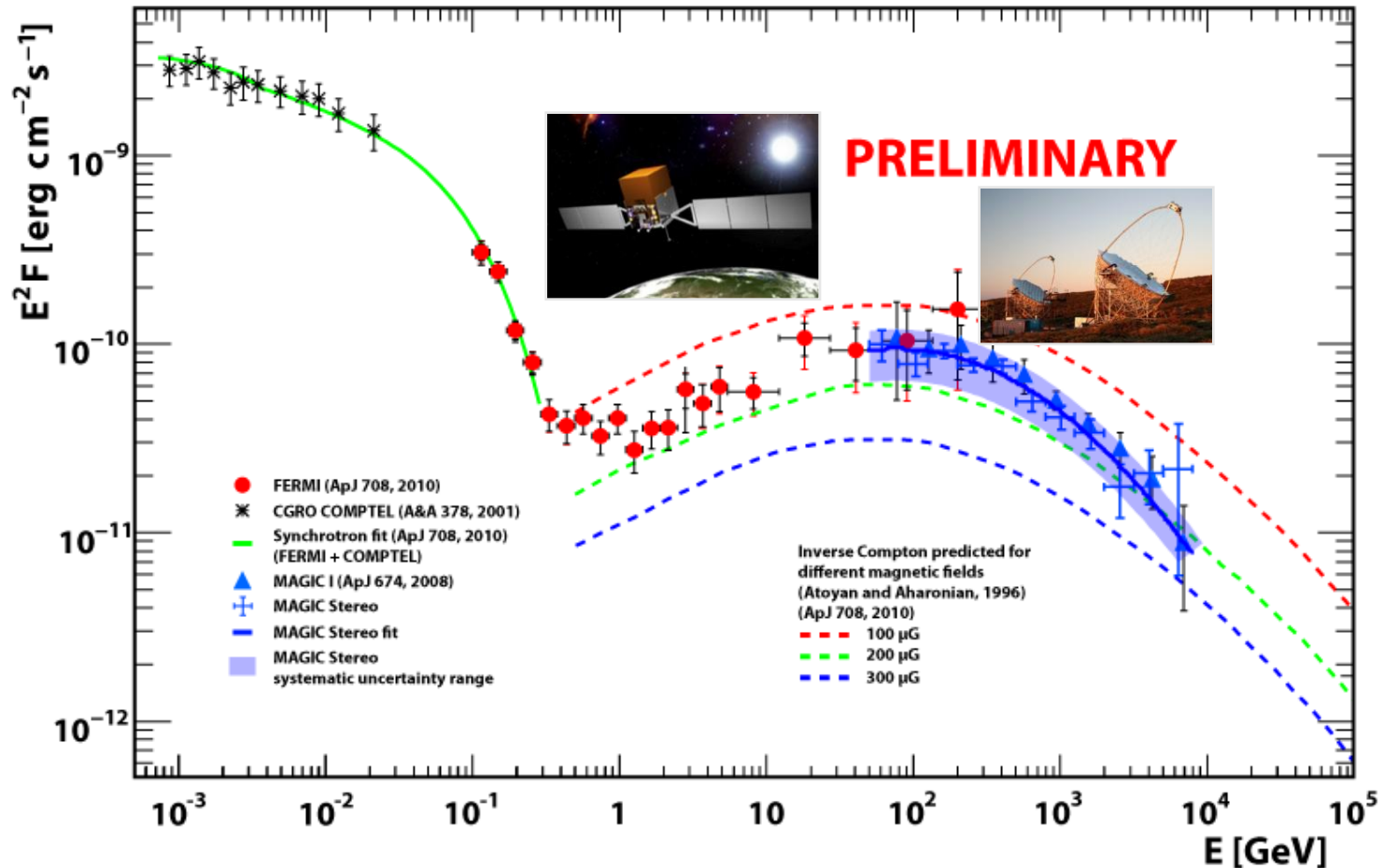
- Sensitivity: 1.6% Crab ($5\sigma/50h$) => 1% Crab
- Energy resolution: 25% (RMS) => 15%
- Direction: 0.1deg (σ 2D Gauss) => 0.07deg
(<0.025 deg. systematic)



Fermi Overlap

Crab Nebula Spectrum

MAGIC Stereo in combination with neighbouring wavelengths



MAGIC science overview 2009/2010

Astronomer's Telegrams:

10.02.2010	M87	flare, initiating joined observations (~10% crab)
25.03.2010	IC 310	detection in 20 h (~2.5% Crab)
09.04.2010	M87	historic high (~20% Crab), together with VERITAS
19.06.2010	PKS 1222+21 / 4C +21.35	FSRQ, $z=0.43$, extremely bright (>30% Crab)
22.07.2010	1FGL J2001.1+4351	BL Lac, very bright (~20% Crab)

Publications since last CHIPP Meeting:

3C 66 A/B	two variable source candidates in field of view, both interesting
Mrk 421	blazar, MWL
S5 0716+714	blazar, detection, $z=0.31$
Mrk 501	blazar, MWL, low state
PG 1553+113	blazar, MWL
Perseus Cluster	upper limit cluster & NGC 1275
OJ 287	blazar, MWL study Suzaku, no gammas despite flare -> IC
LS I +61 303	gamma-ray binary, MWL, correlated X-Ray & VHE, leptons favored
3 pulsar/PWN	search yielding upper limits
Cygnus X-3	microquasar, MWL, upper limit
AGN halo	2 Mrk blazars, emission pointlike

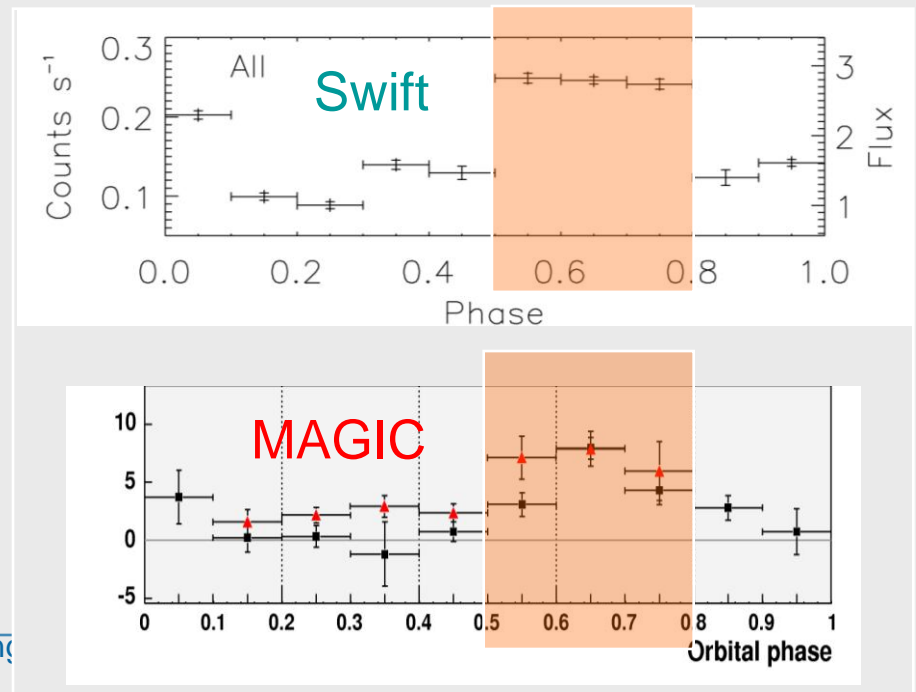
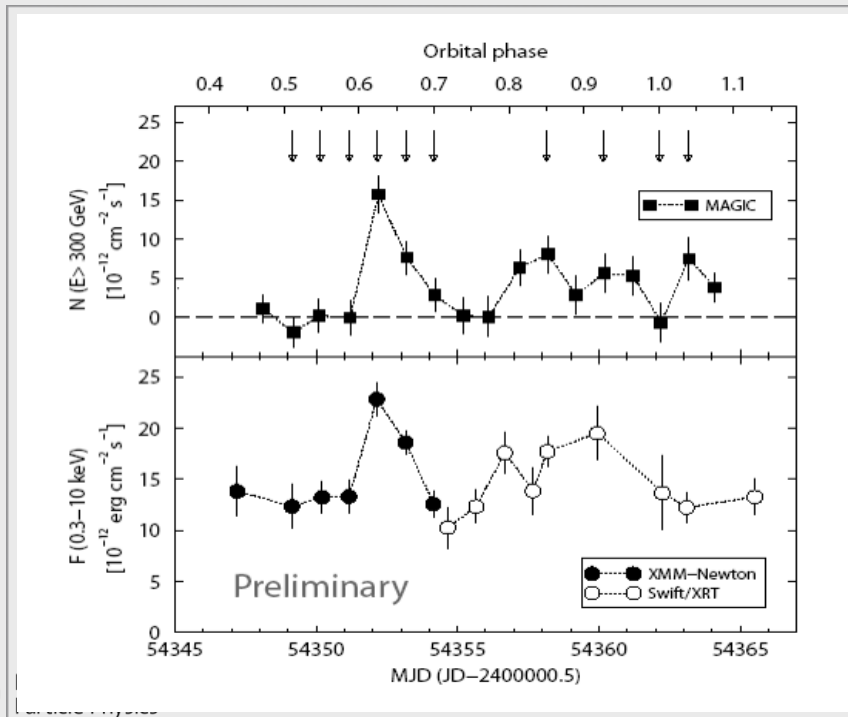
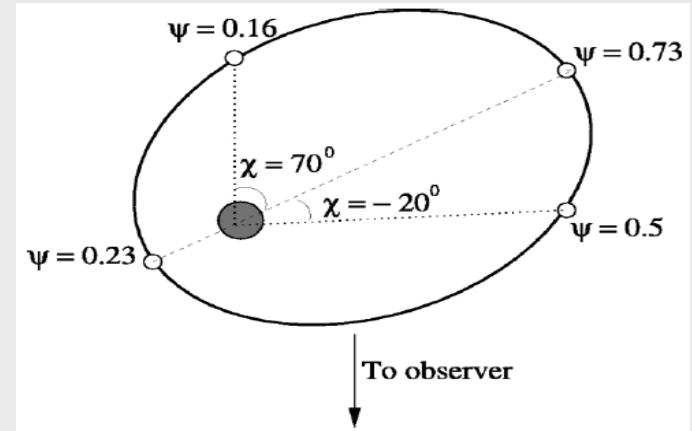
Galactic: News from LS I 61+303

High mass X/gamma-ray binary system

Discovered by MAGIC in 2006.

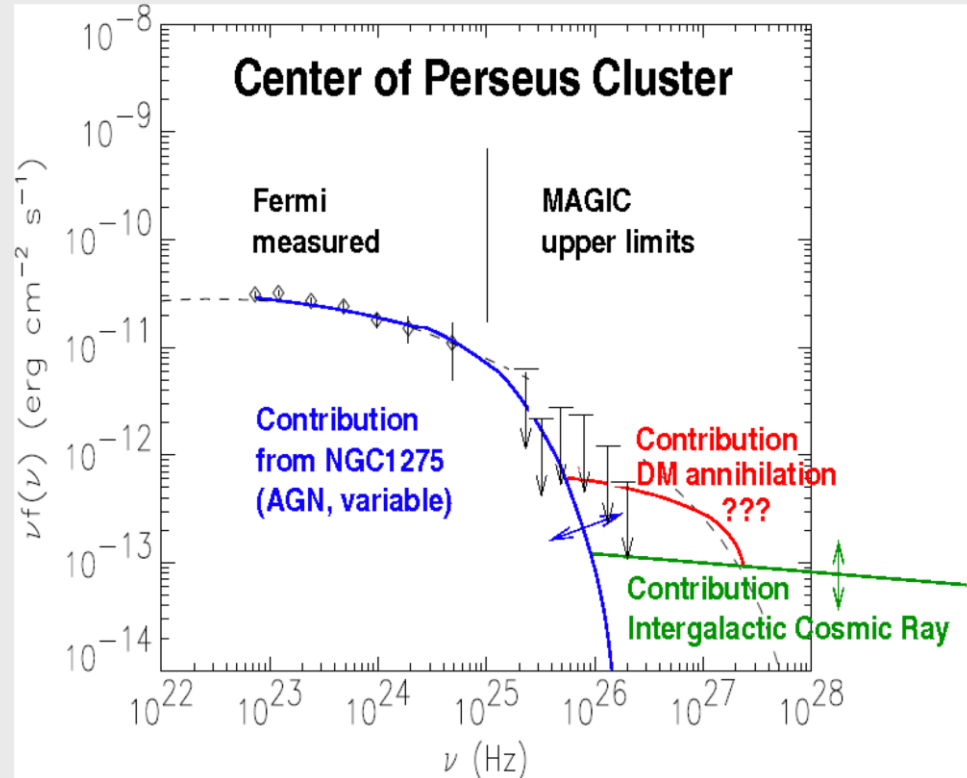
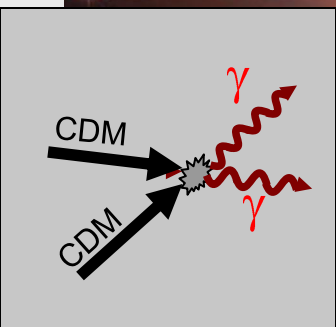
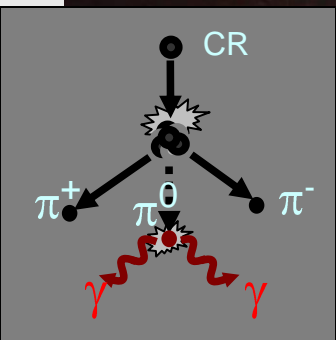
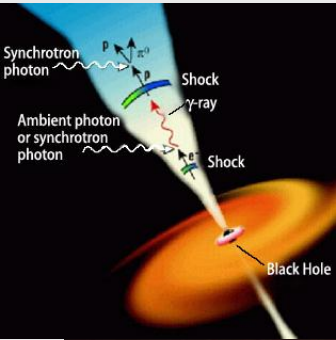
Periodic VHE emission: (26.8 ± 0.2) days

Evidence for X-ray / gamma correlation



Extragalactic: Perseus Cluster

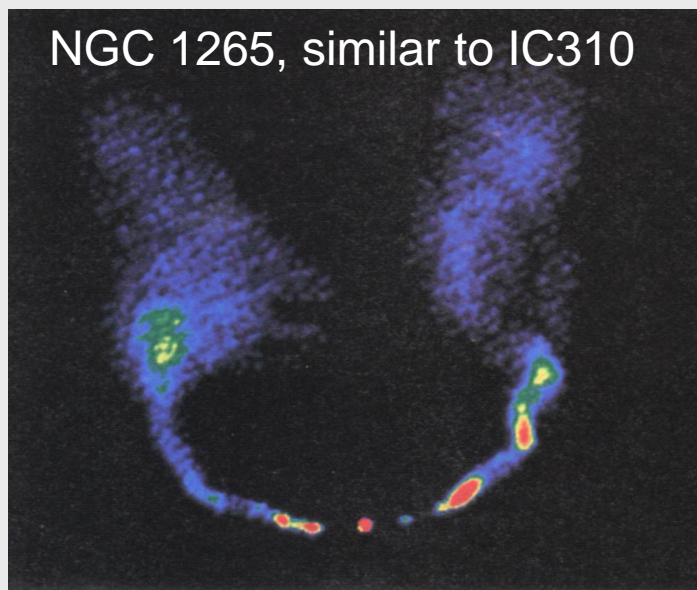
- Galaxy cluster contains various possible sources



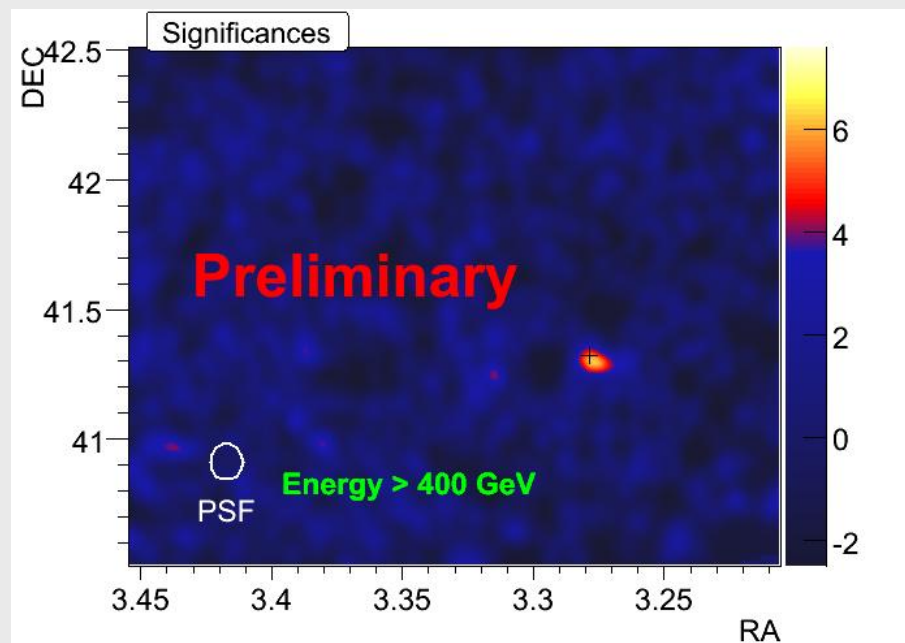
Astrophys. J. 710 (2010) 634

Head-Tail Radio Galaxy IC 310

- Fast movement through galaxy cluster
- First of its type seen in VHE
- Fermi: 2 photons in > 12 months
- MAGIC: detected in 20h-> ATel #2510 (03/2010)



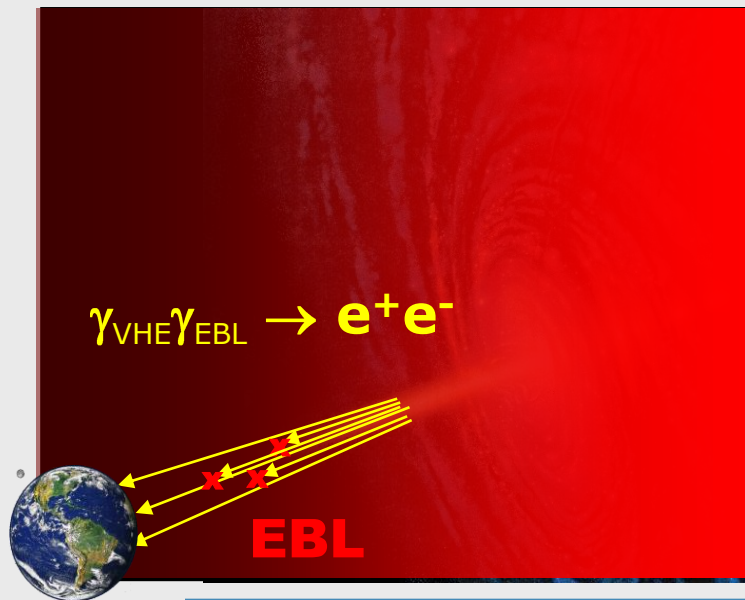
courtesy of NRAO/AUI and C.O'Dea & F.Owen



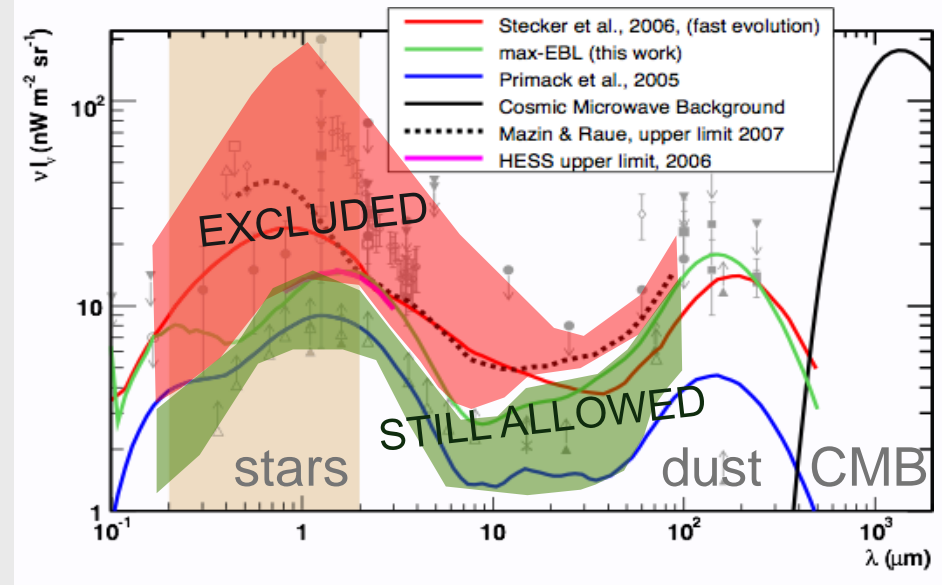
Distant AGN – EBL

- most distant AGN detected at VHE: 3C 297 (FSRQ): $z=0.5$
 - redetected in 2007
- second FSRQ (PKS 1222+21) @ $z=0.43$ detected -> ATel 06/2010
- detection of S5 0716+714 published, blazar @ $z=0.31$, 9% Crab

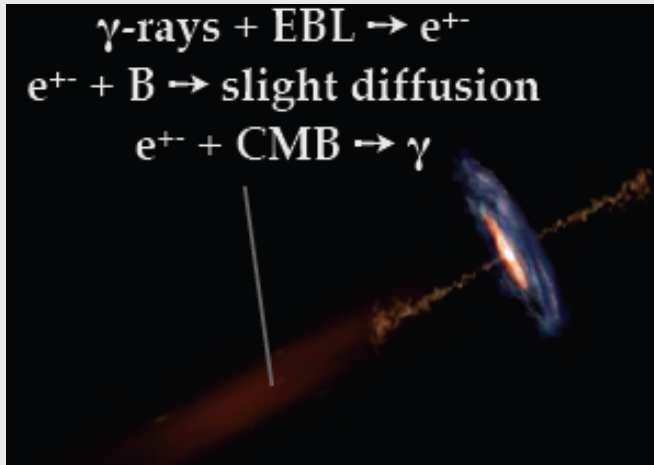
=> usable to constrain IR EBL



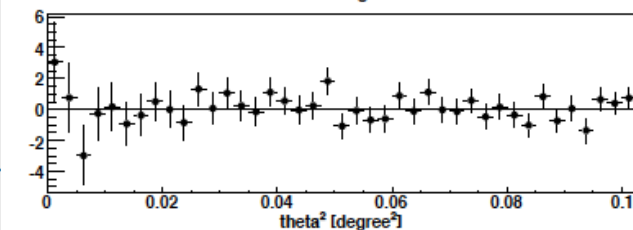
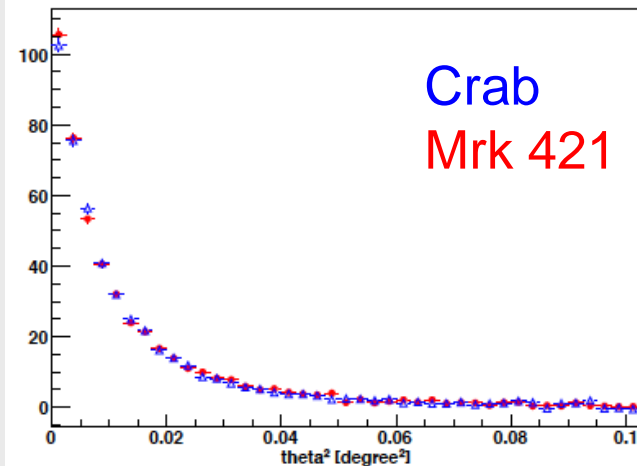
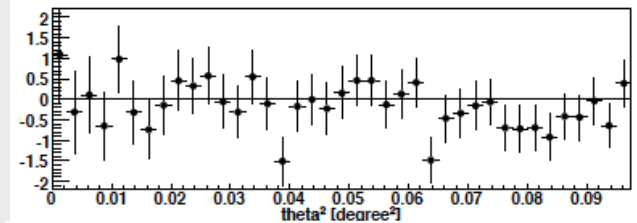
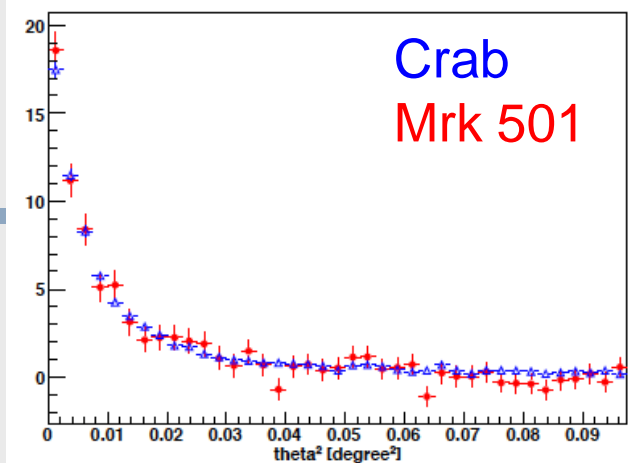
Probing EBL spectrum 0.2-2 μm



Galactic Halos



- extended extragalactic objects?
 - Comparison Crab (pointlike) with AGN
- => no extension
=> Limit on magnetic field strength



Summary

- **MAGIC II: stereo observations for ~ 1 year**

- **Stereo:**
 - improved instrument performance
 - 3 new sources detected
 - redetections & deep studies of many known sources
 - publications in preparation

- **Most sensitive instrument at 50-200 GeV**
- **Best overlap with Fermi / LAT**