

CONFÉRENCES D'ÉTÉ 2014

- MORCEAUX CHOISIS -

NEUTRINOS/ASTROPARTICULE/COSMOLOGIE

OUTLINE

- ★ Man-made neutrinos
 - T2K
 - Reactors
- ★ Cosmic neutrinos
 - Sources
 - Diffuse
- ★ GeV-TeV cosmic rays
 - New release from AMS
- ★ Ultra-high energy cosmic rays
 - Composition and shower models
 - Observations from the North
- ★ Gamma-ray astronomy highlights
 - HESS, HAWC
- ★ Indirect searches for dark matter at GC

Very High Energy
Phenomena in the Universe
(VHEPU)
Quy Nhon, Vietnam

IDM/TeVPA
Amsterdam

ICHEP
Valencia

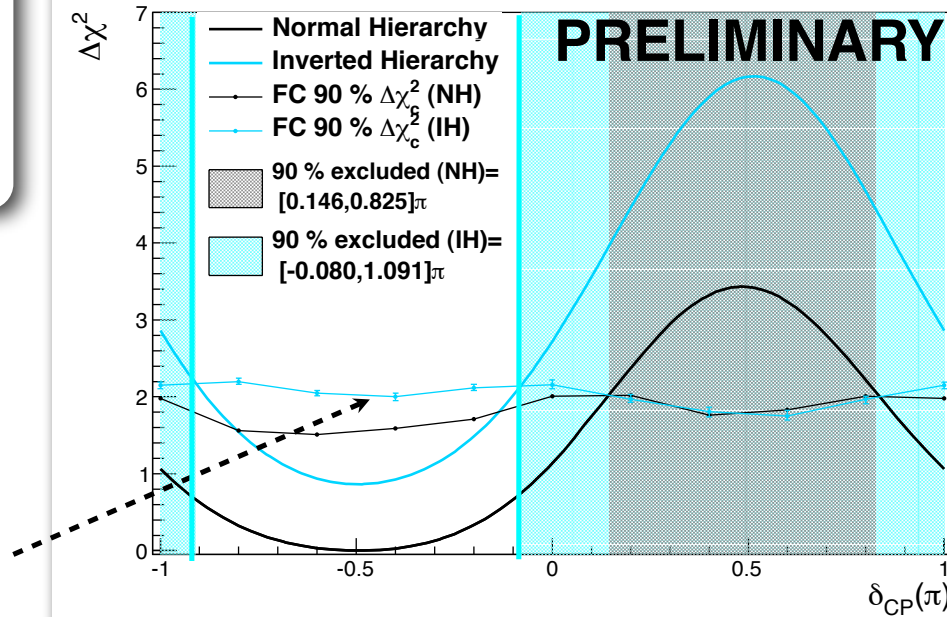
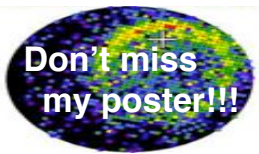
NEUTRINOS : COMBINED FIT

FREQUENTIST:

likelihood ratio fit of
 $\nu_\mu + \nu_e E_{\text{rec}}$ spectra

Combining T2K joint analysis with reactor constraint (PDG 2013):
 $\sin^2 2\theta_{13} = 0.095 \pm 0.01$

$\sin^2 \theta_{23}$, Δm^2_{32} and $\sin^2 2\theta_{13}$ are marginalized following the 3D $\Delta\chi^2$ surface from Run1+2+3+4



δ_{CP} EXCLUDED REGIONS

PRELIMINARY

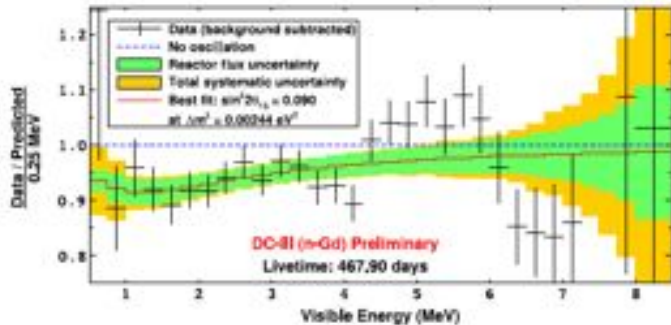
	BEST FIT	90% CL (π)
NH	-0.495	[0.146, 0.825]
IH	-0.495	[-0.080, 1.091]

NEUTRINOS: REACTORS

- ★ Daya Bay confirms antineutrino anomaly
- ★ Bump observed by 3 experiments
 - No influence on $\sin^2 \theta_{13}$
 - Detection effect? Reactor physics?

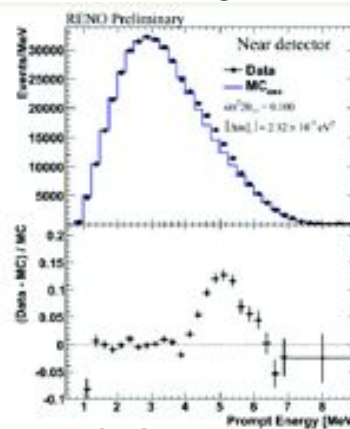
- According to preliminary studies the θ_{13} measurement is not affected thanks to the near detectors

Double Chooz



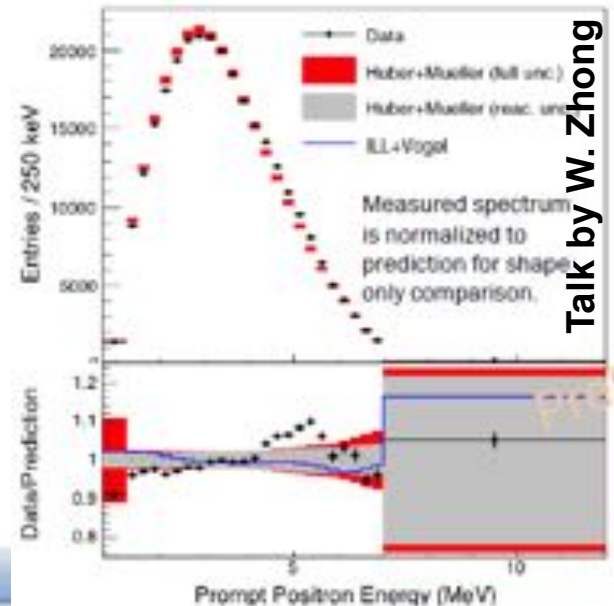
arXiv:1406.7763

RENO



S. Seo at
NEUTRINO2014

Daya Bay



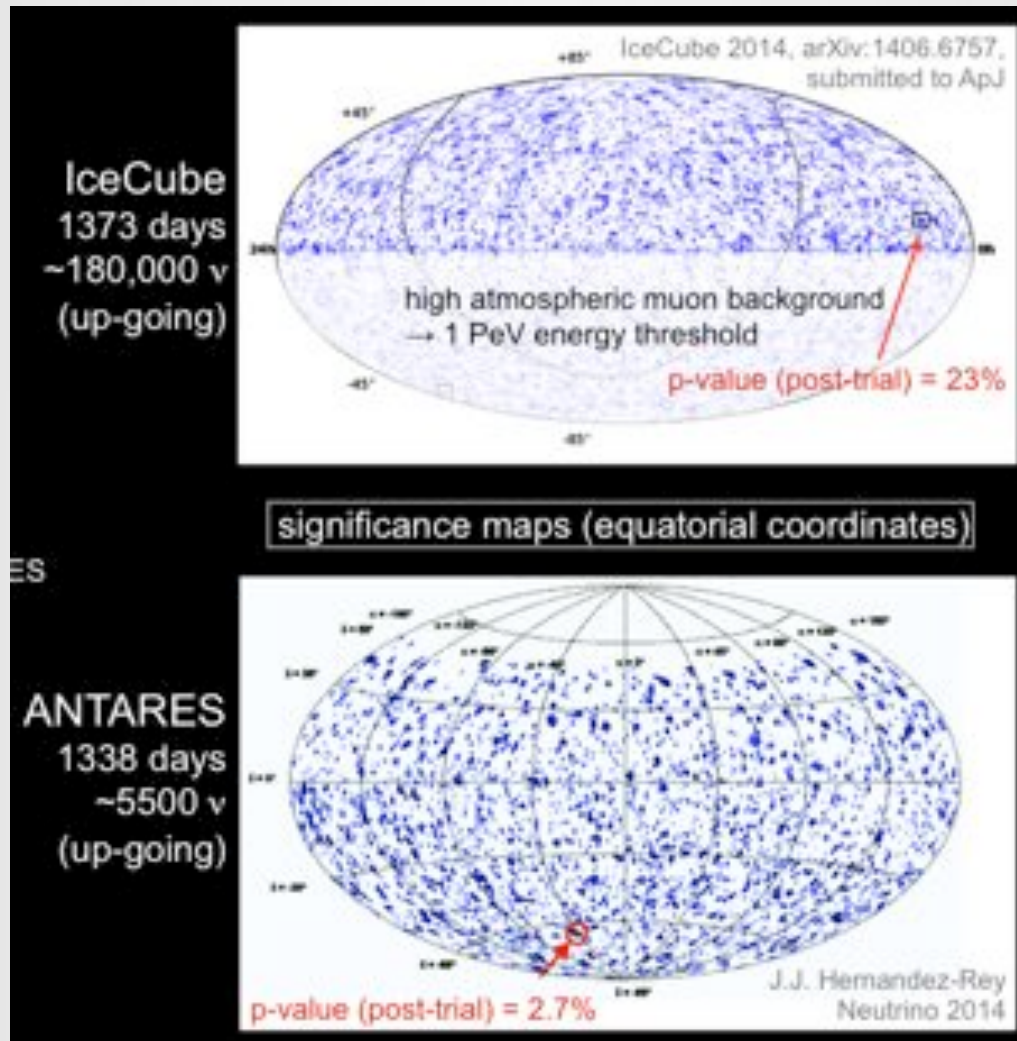
Talk by W. Zhong

See also D. Dwyer, T. Langford arXiv:1407.1281

Marco Zito-ICHEP 2014

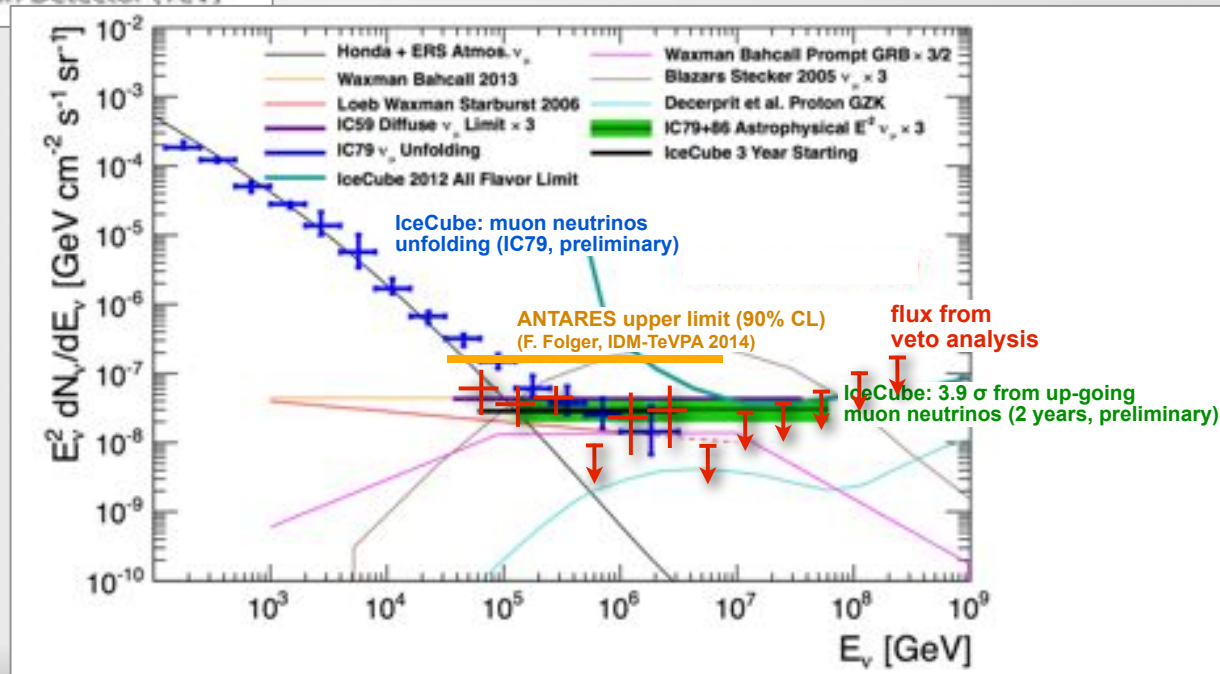
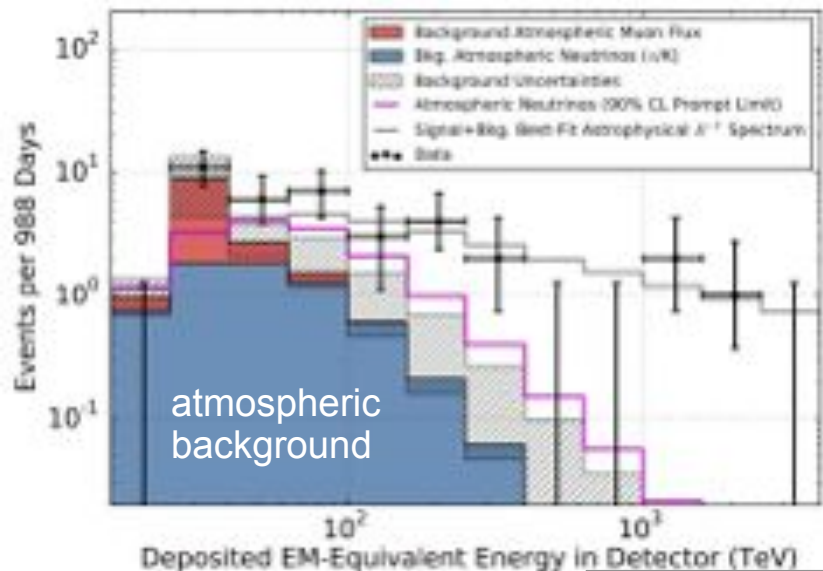
NEUTRINOS: COSMIC

No sources found so far



A. Kappes, ICHEP

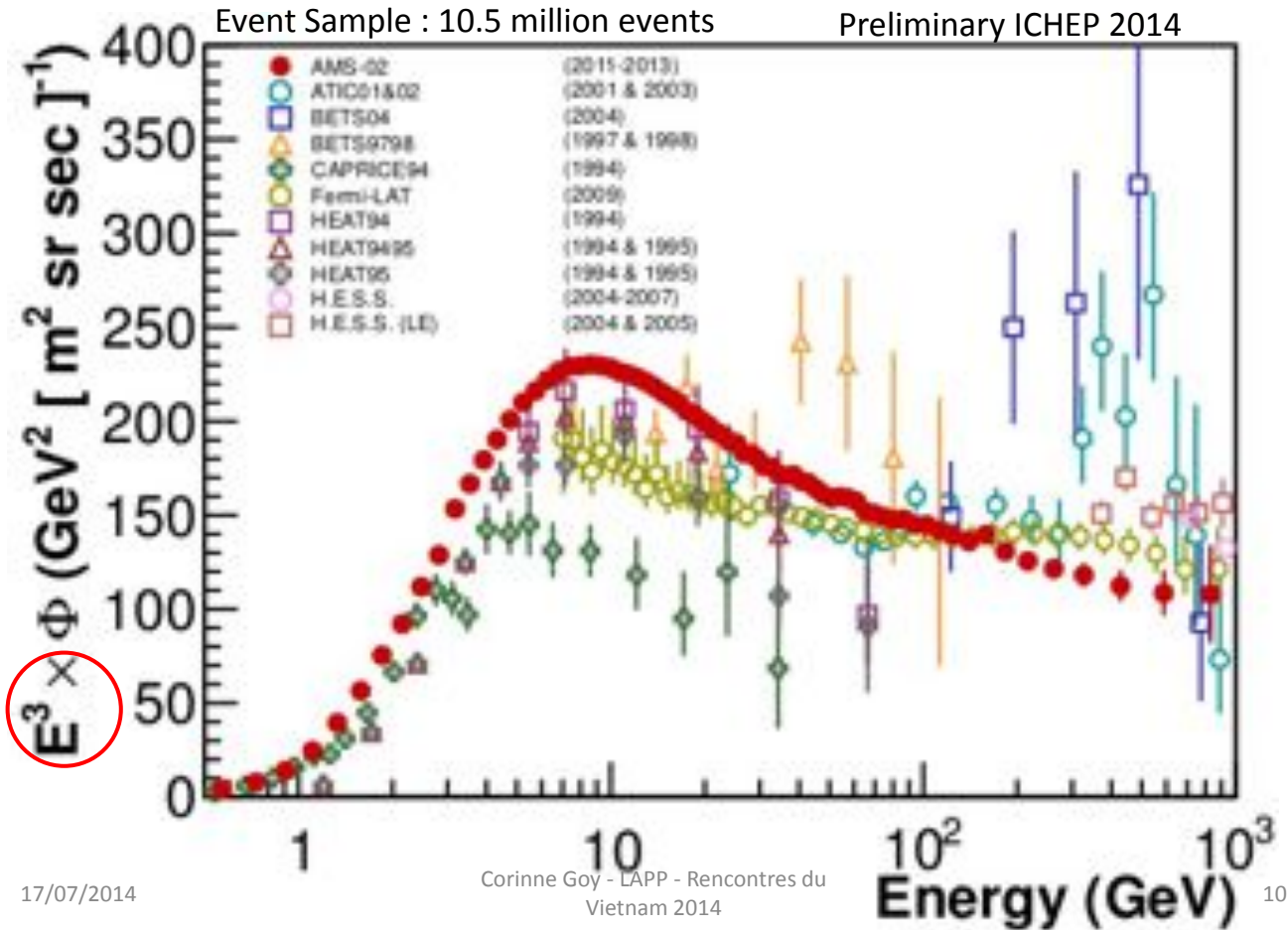
NEUTRINOS: COSMIC



A. Kappes, ICHEP

HE COSMIC RAYS

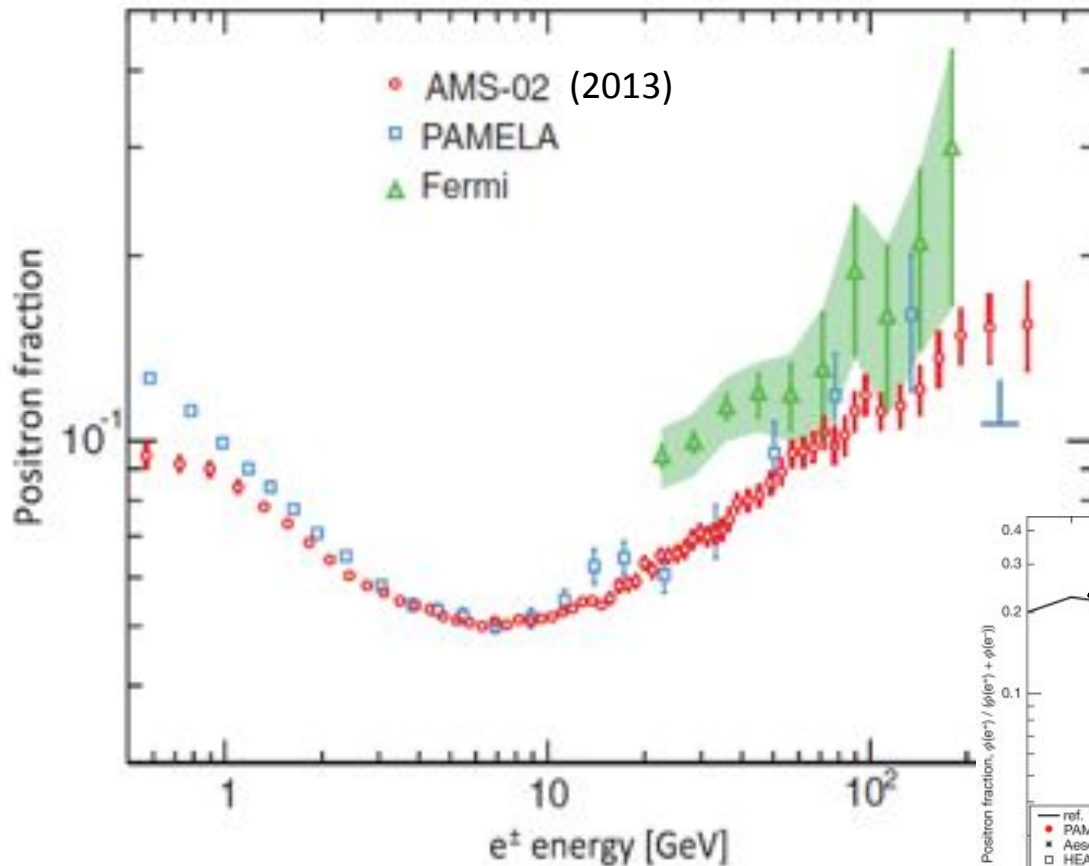
All electrons flux (1) : AMS 2014 - 1 TeV



Problem w/ Fermi

AMS released also
 e^- and e^+
independently

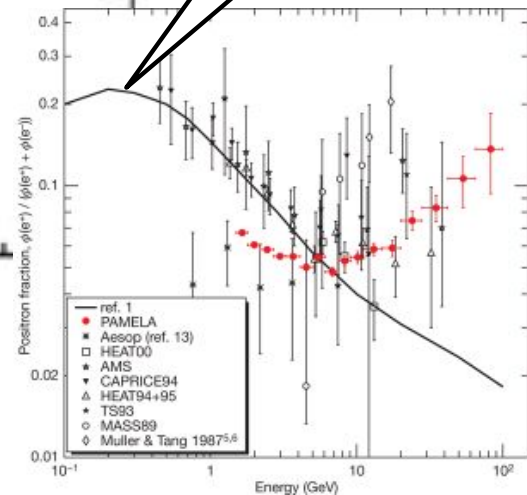
HE COSMIC RAYS



Secondary origin
 only :

$$\frac{\varphi_{e^+}}{\varphi_{e^-} + \varphi_{e^+}} \sim E^{-\delta}$$

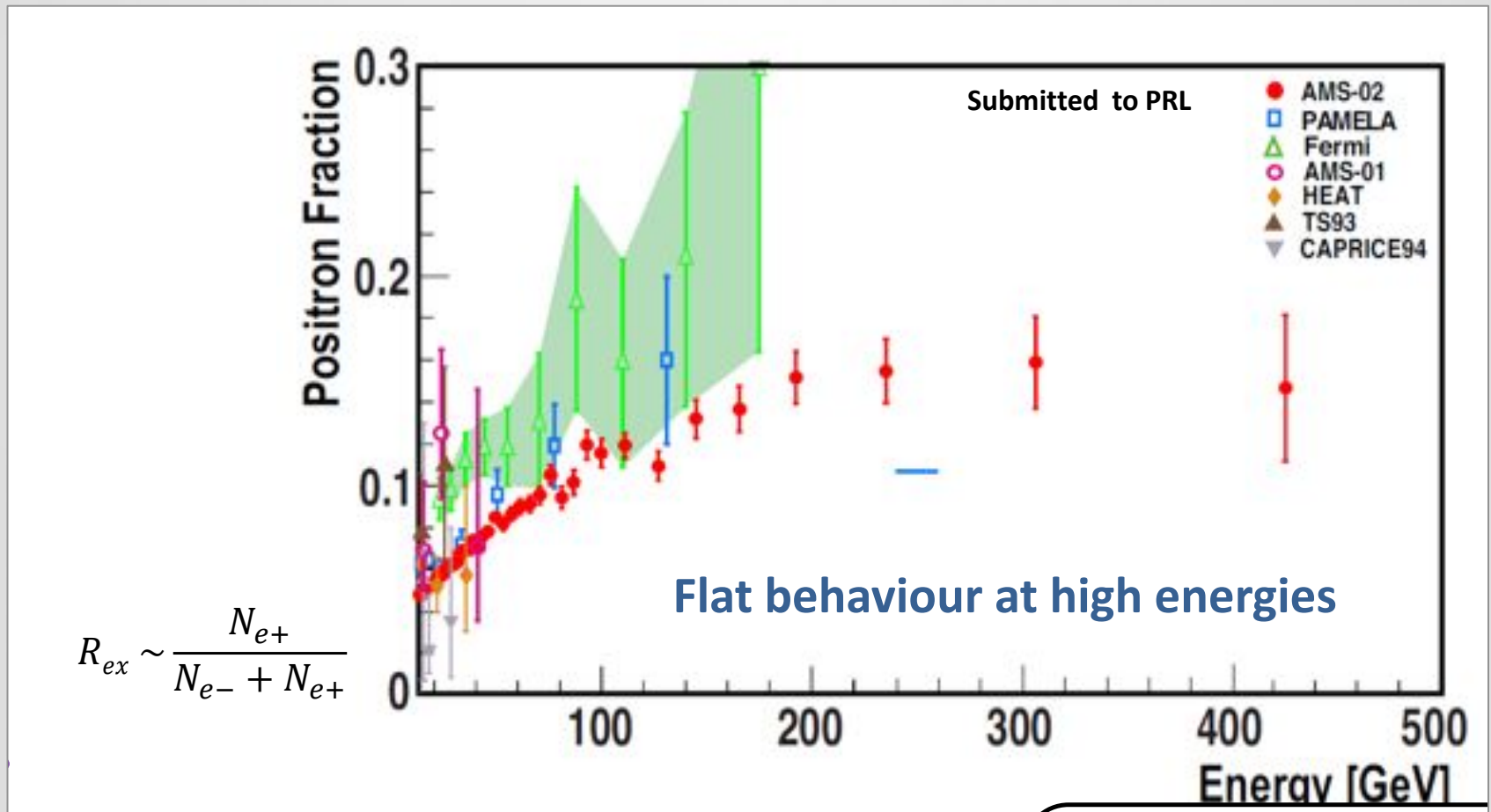
 $(\gamma_p/\gamma_e \sim 1,$
 $\delta = 0.3 - 0.8)$



17/07/2014

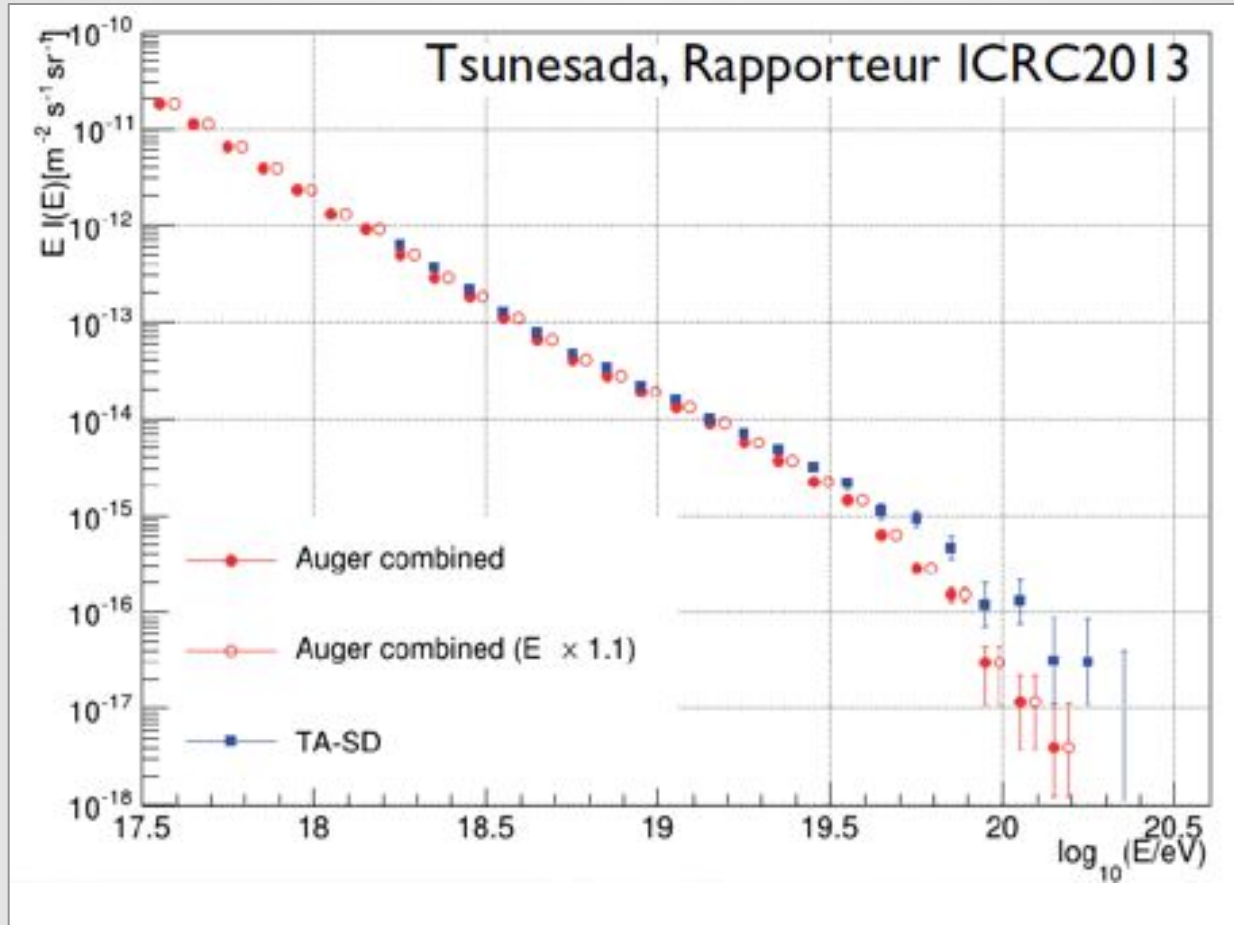
Corinne Goy - LAPP - Rencontres du Vietnam 2014

HE COSMIC RAYS

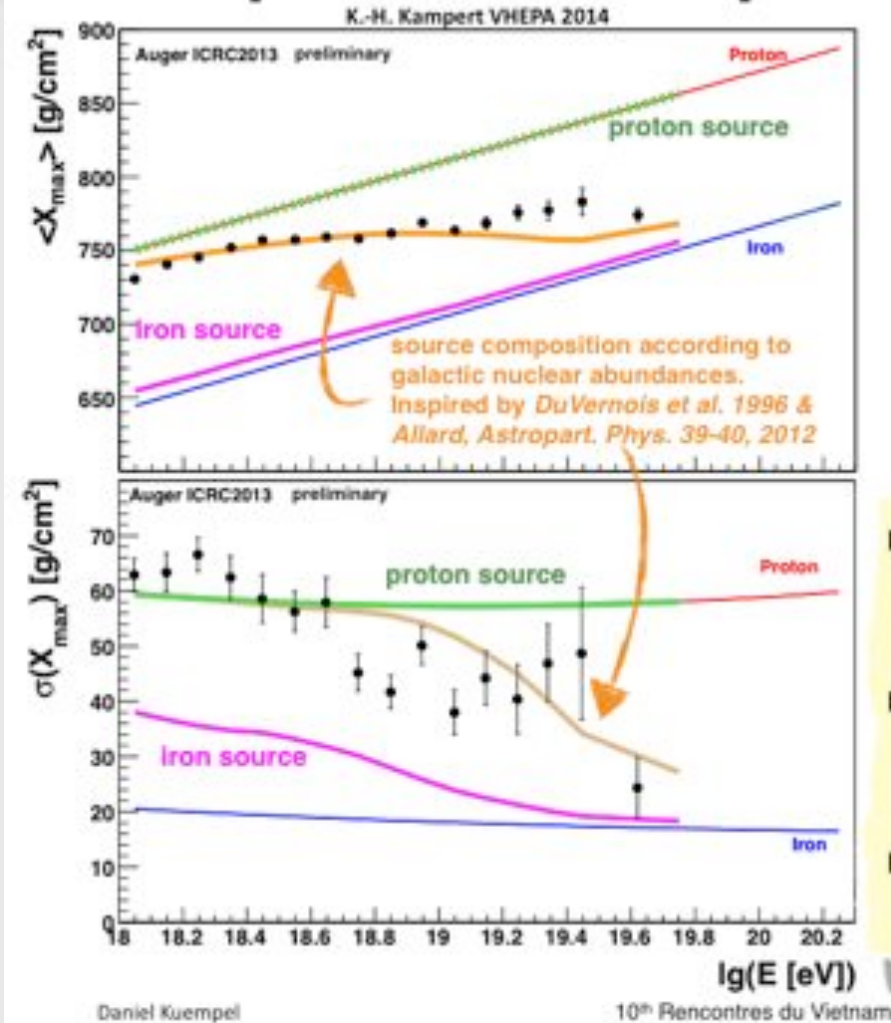


CALET to be launched in 6 months

UHE COSMIC RAYS



Example with composition



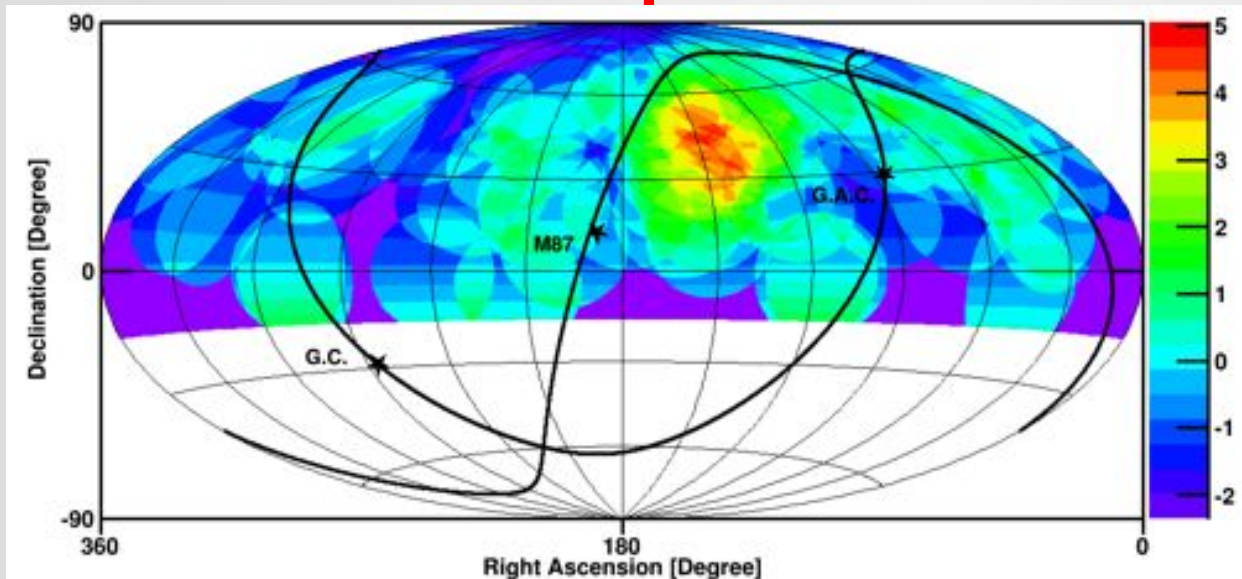
+ differences between hadronic interaction models significantly reduced with the help of LHC data

T. Pierog, VHEPU

UHE COSMIC RAYS

- ★ Telescope Array (northern observatory) sees hot spot
 - Auger-like detector in Utah
 - Confirms GZK, compatible composition

Hotspot



$E > 5.7 \times 10^{19}$ eV (72 events)

Aitoff projection in Equatorial Coordinates

Events over-sampled using 20 circles

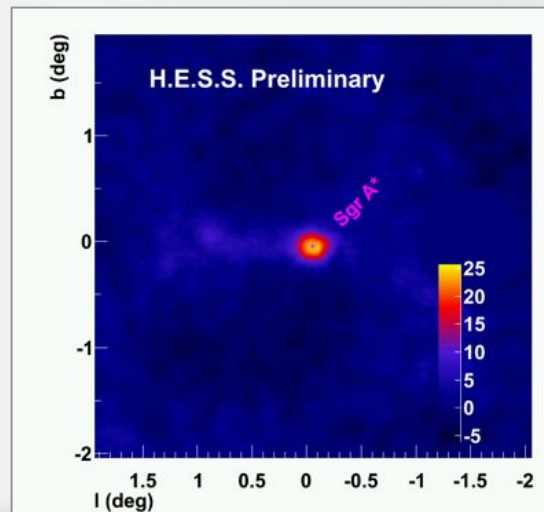
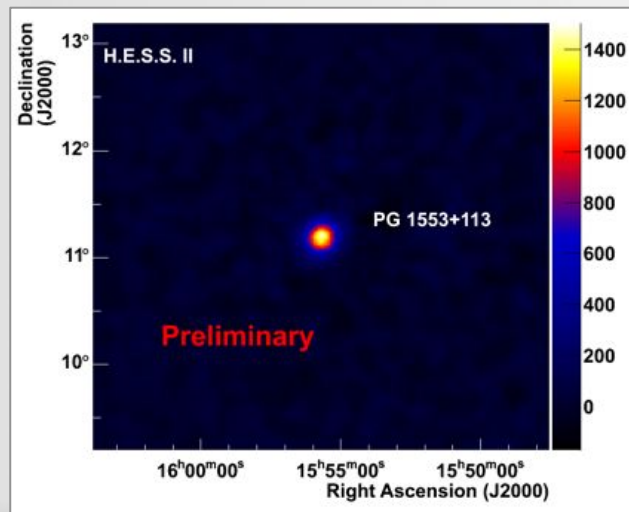
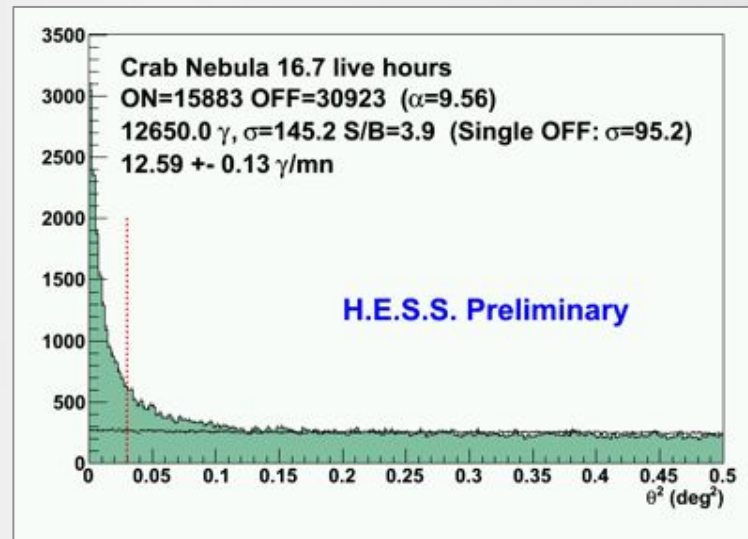
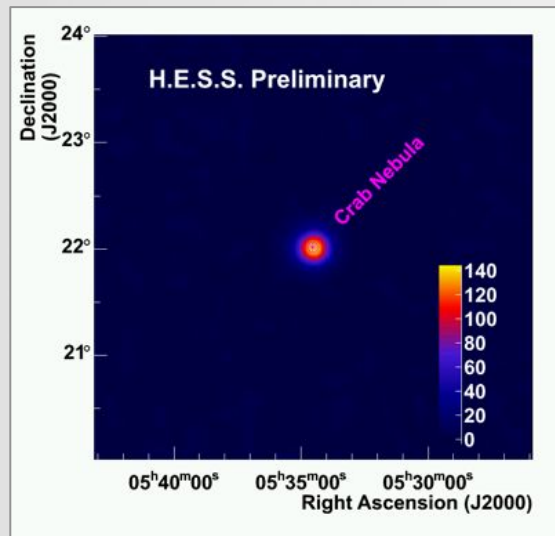
19/72 events fall in hotspot (RA,dec) ~ (146.7, 43.2)

4.5 events expected (26% of events in 6% of the area)

LiMa significance: 5.2σ Estimate 3.4σ chance probability

GAMMA-RAY ASTRONOMY

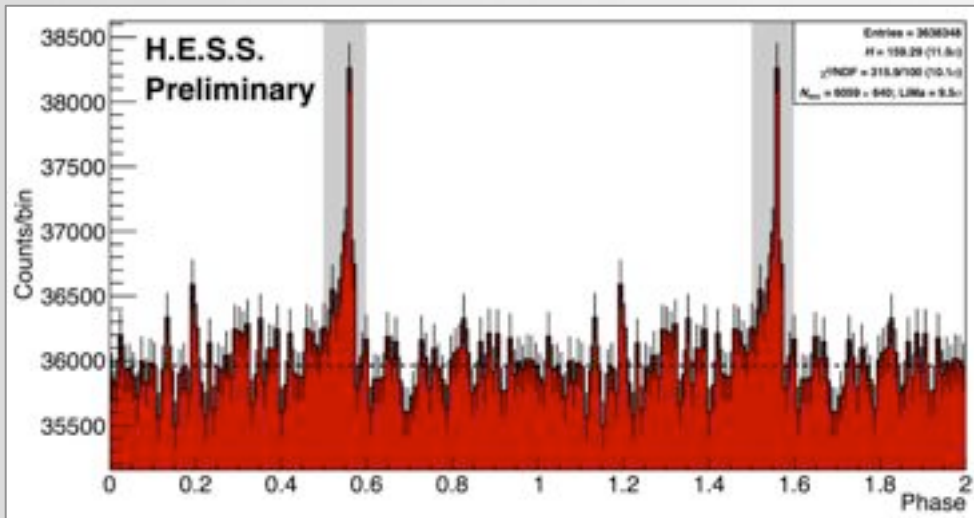
★ First results from 5-tel. HESS array



P.B., VHEPU

GAMMA-RAY ASTRONOMY

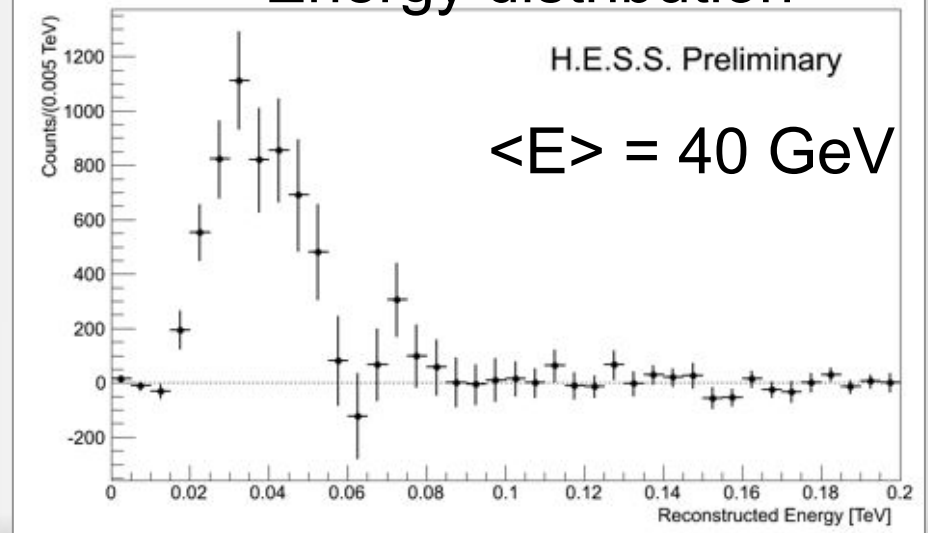
★ Observation of pulsed emission $>$ tens of GeV



P.B., VHEPU

Only observed once before
by MAGIC & Veritas
on the Crab pulsar

Energy distribution



GAMMA-RAY ASTRONOMY

★ MAGIC observation of a lensed blazar

Farthest AGN ever detected

**Discovery of Very High Energy Gamma-Ray Emission
From Gravitationally Lensed Blazar S3 0218+357 With
the MAGIC Telescopes**

ATel #6349; *Razmik Mirzoyan (Max-Planck-Institute for Physics) On Behalf of the MAGIC
Collaboration*

on 28 Jul 2014; 14:20 UT

Credential Certification: Razmik Mirzoyan (Razmik.Mirzoyan@mpp.mpg.de)

S3 0218+357 is a blazar that underwent a series of flares separated 11.5 days, interpreted as due to the gravitationally lensed effect

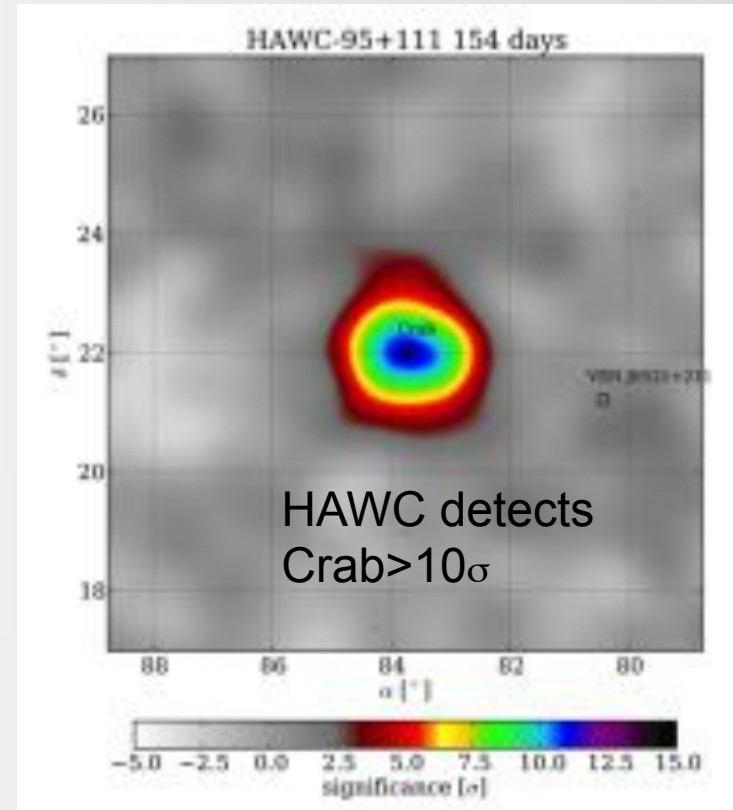
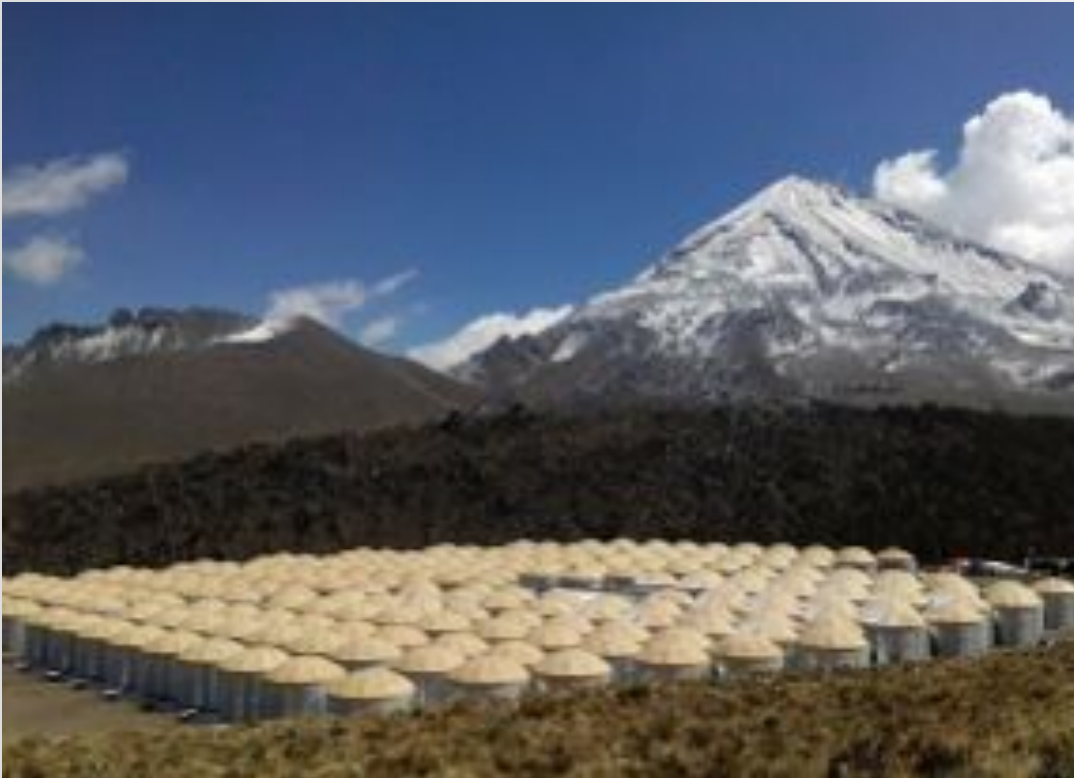
Detection of a flare by MAGIC at the expected time of arrival of the Fermi gravitationally lensed component

$z=0.944$ → breaking distance records: the most distance source ever detected at VHE

GAMMA-RAY ASTRONOMY

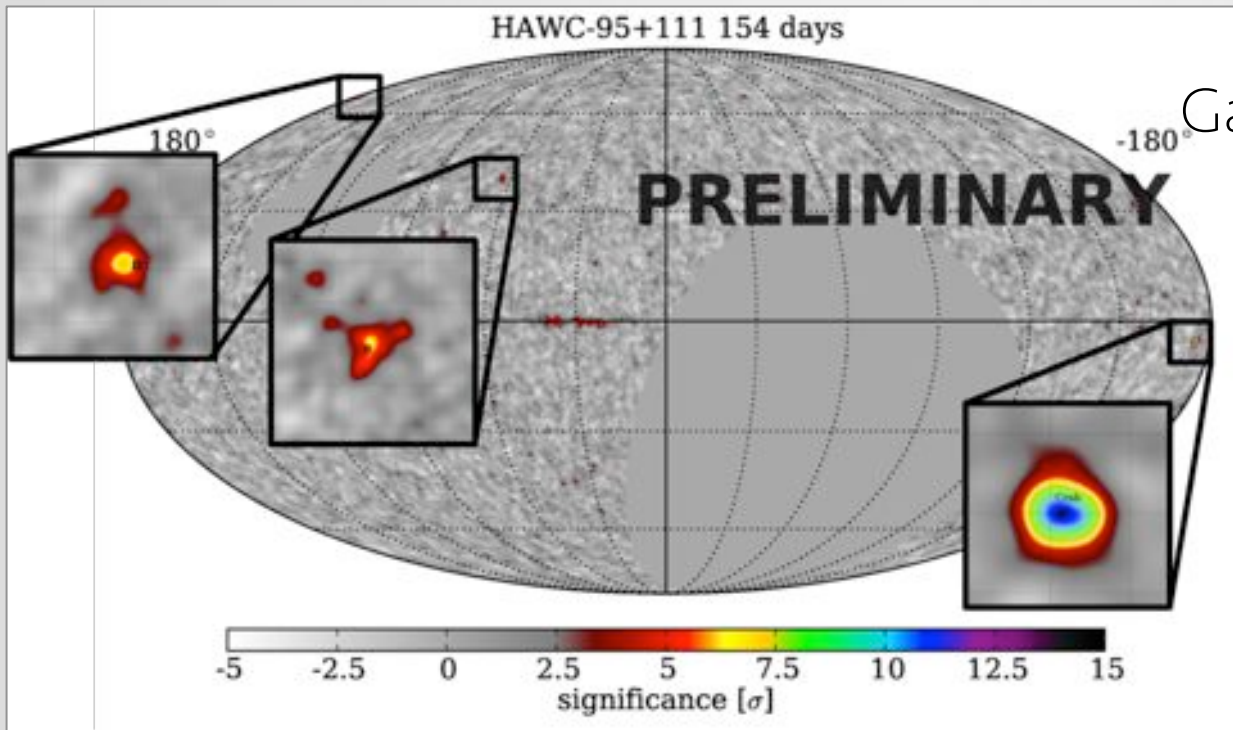
★ HAWC is getting results!

- Construction complete in 2014
- Science operations with 111 tanks began 1 Aug 2013
- First results are coming now

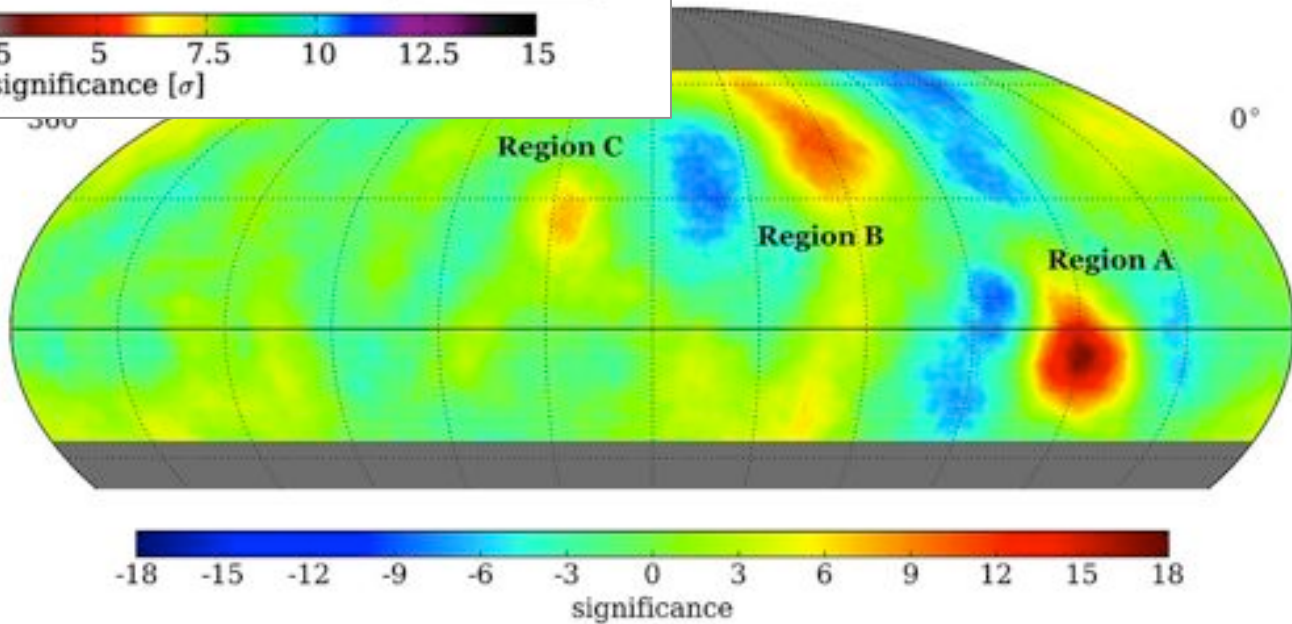


B. Dingus, VHEPU

GAMMA-RAY ASTRONOMY



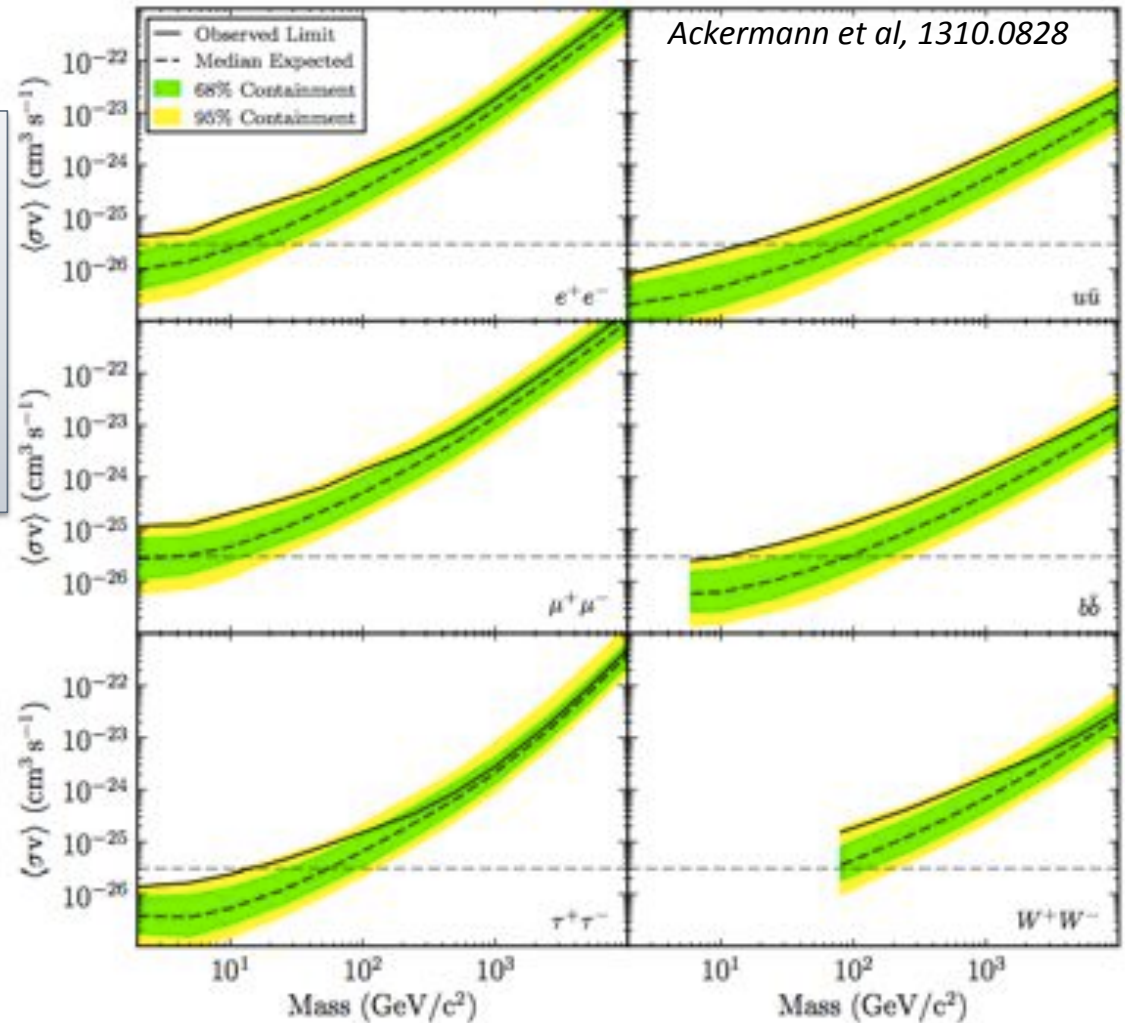
Gamma rays



10 TeV Cosmic rays
(also Milagro, Argo, IceCube)

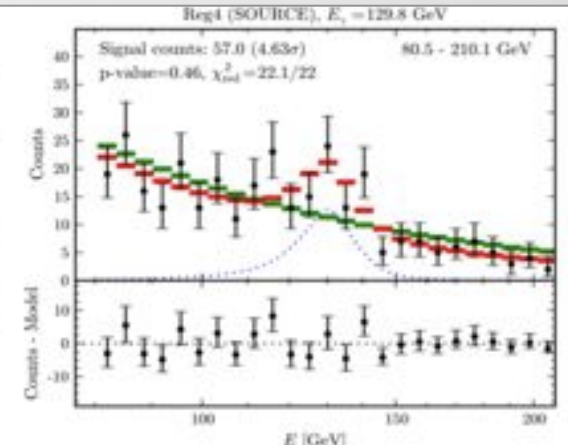
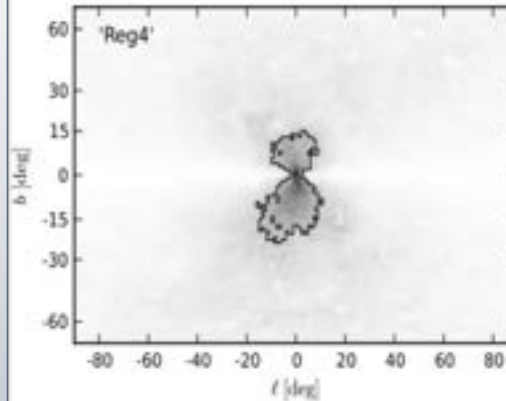
DARK MATTER

- 4 years of observation
- One order of magnitude uncertainty due to halo models and statistical fluctuations
- Limits below thermal cross-section for DM particle mass between 2-15 GeV



DARK MATTER

- Weniger, C. JCAP 1208 (2012) 007 , claims line at 129.8 GeV (133 GeV after Fermi-LAT data recalibration)
- Optimize region based on background and DM halo morphology
- Significance depends on the DM halo assumption ($3-5\sigma$)



Official Fermi collaboration paper:
Ackermann et al. (Fermi collaboration) PRD 2013

1) Reprocessed data

P7REP CLEAN

4.3 σ (P7V6 CLEAN) \rightarrow 2.8 σ (P7REP CLEAN)

P7REP SOURCE

4.6 σ (P7V6SOURCE) \rightarrow 3.2 σ (P7REPSOURCE)

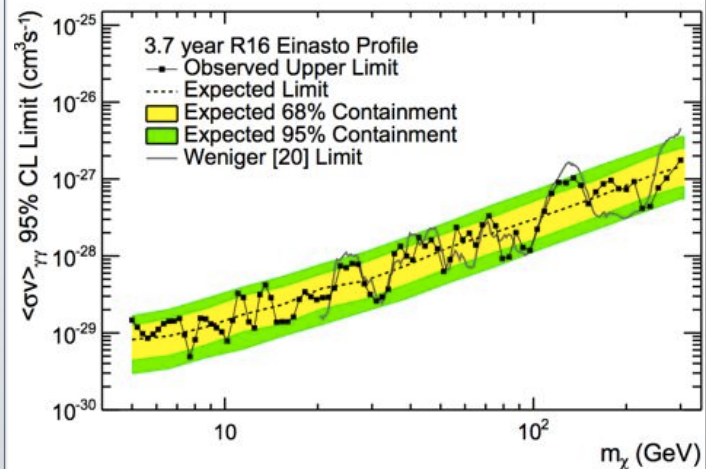
2) 2D Fit - includes incidence-angle dependence of the energy resolution

P7REP CLEAN

2.8 σ (1-D) \rightarrow 2.8 σ (P7REP CLEAN)

P7REP SOURCE

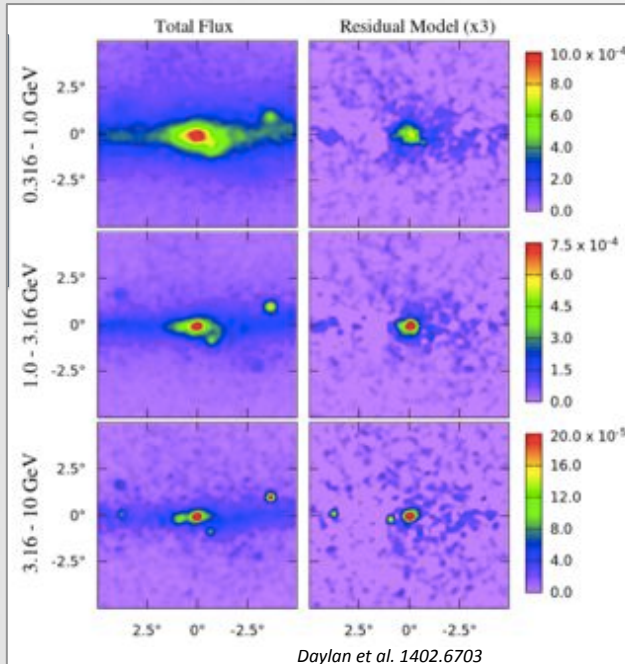
4.6 σ (P7V6SOURCE) \rightarrow 3.2 σ (P7REPSOURCE)



- Lower significance: 133 GeV feature with 3.3 (1.5) sigma significance before (after) trials, at best.

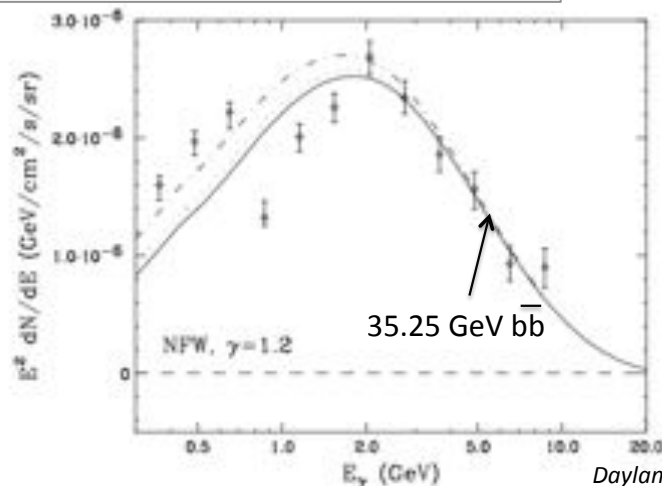
DARK MATTER

GeV excess at the Galactic center (special TeVPA/IDM session)

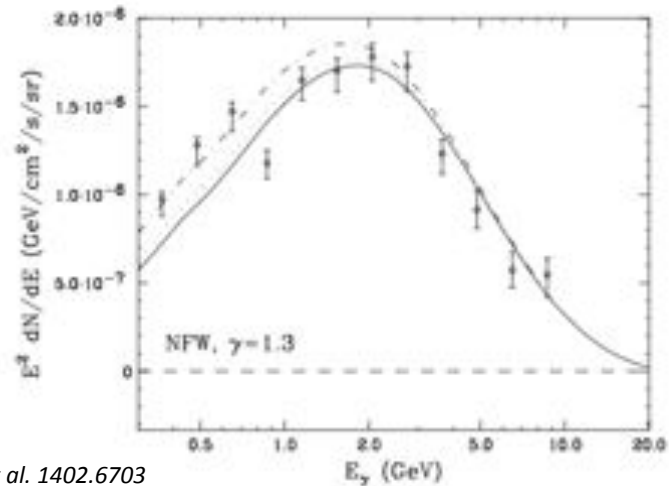


Daylan et al. 1402.6703

- Best fit for a halo profile with slope $\gamma = 1.17$ and by dark matter particles with a mass of $\sim 20\text{-}40$ GeV and that annihilate to quarks with a cross section of $\sigma v \sim (1 - 2) \times 10^{-26} \text{ cm}^3/\text{s}$.



Daylan et al. 1402.6703



DARK MATTER

- ★ Discussions at IDM/TeVPA included:
 - Contribution from the Fermi bubbles
 - Pulsar interpretation
 - Fermi diffuse model & subtraction
 - Electrons and radio emission
 - Antiproton constraints
 - Comparison with dwarf limits
- ★ Fermi collaboration seems skeptical
 - Diffuse model neglects CR abundance enhancement
 - IC template depends on inputs
(Source distribution, diffusive halo, source spectra, ...)

OTHER FUNNY THINGS

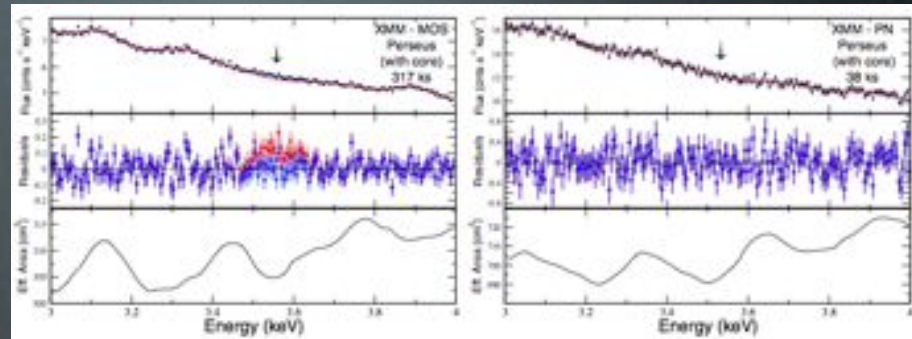
- ★ 3.5 keV line observed in stacking of galaxy clusters
 - Related to sterile neutrino decays
 - Very messy spectrum

Bulbul et al., 1402.2301

$3.55 - 3.57 \pm 0.03$ KeV

73 clusters

$z = 0.01 - 0.35$

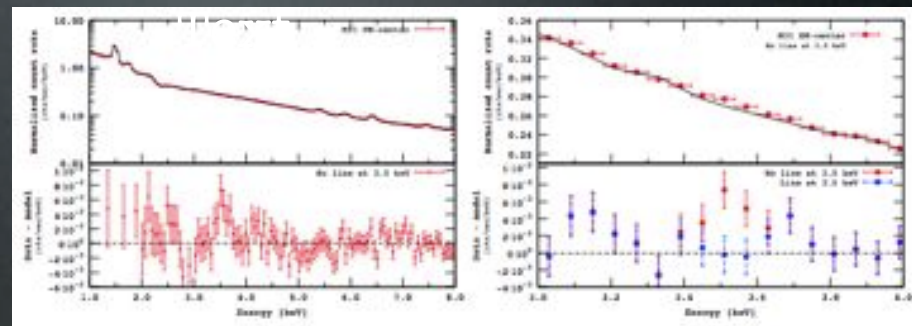


Boyarsky, Ruchayskiy,
1402.4119

3.5 KeV

Andromeda galaxy
+ Perseus cluster

$z = 0$ and 0.0179



OTHER FUNNY THINGS

- ★ Arecibo confirms observation of radio bursts
 - Fast, ~ 10 ms
 - Extragalactic
 - Unknown origin

