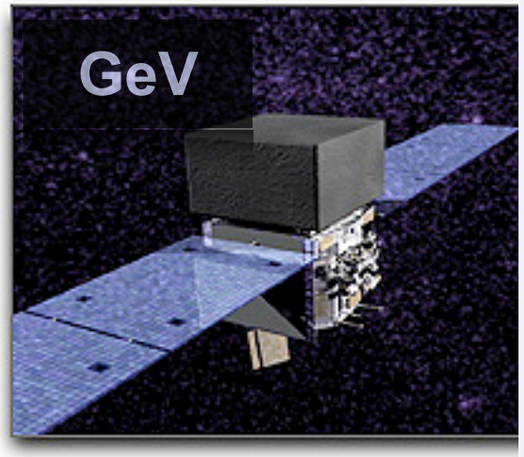
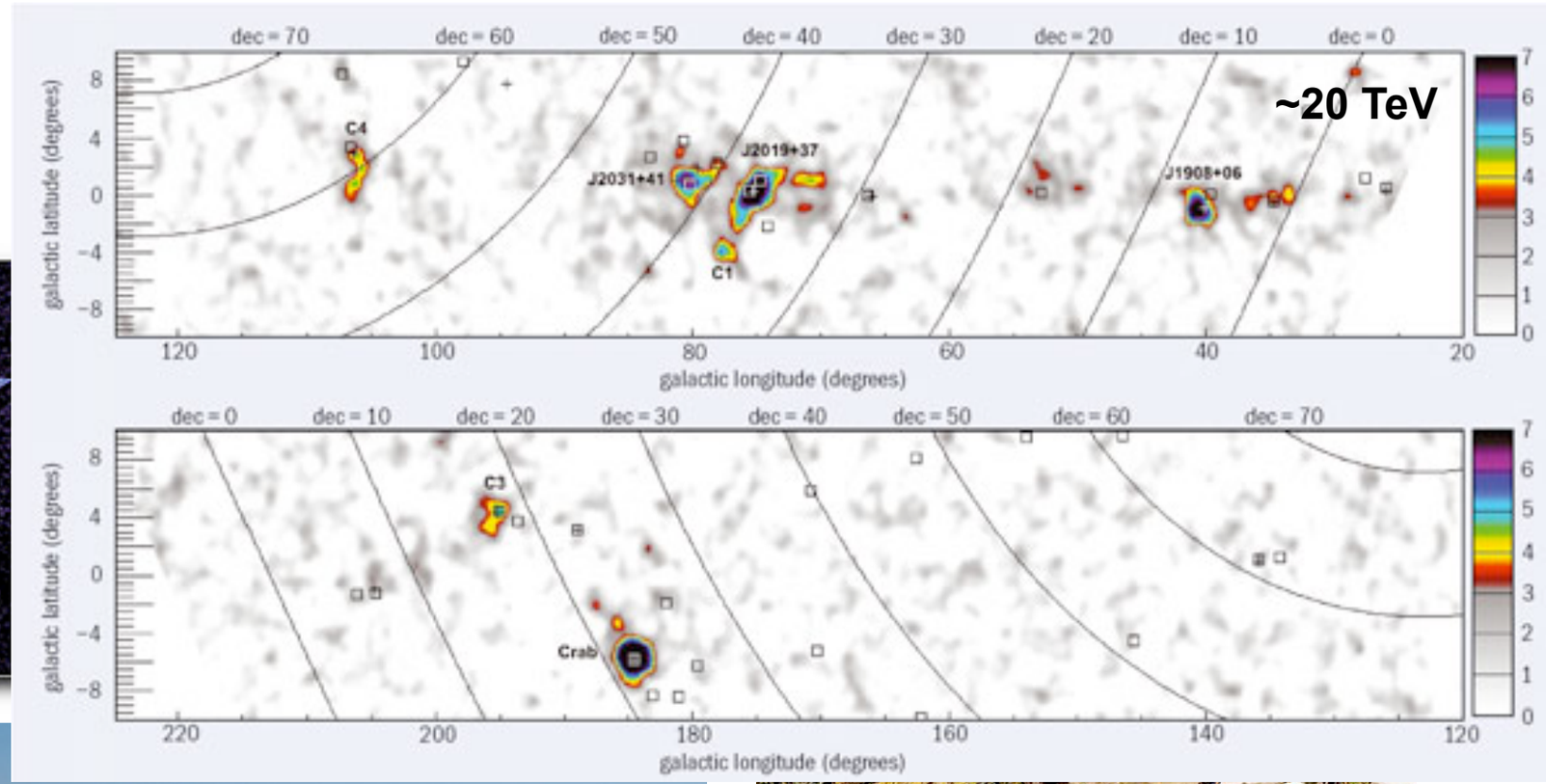
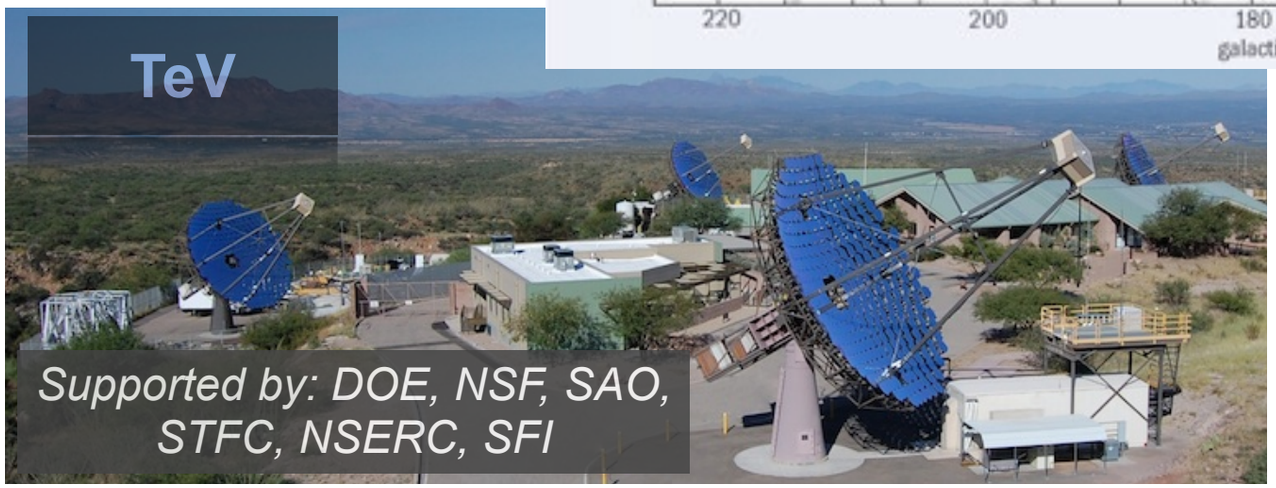
Resolving Milagro Diffuse TeV sources with VERITAS

Ester Aliu[1]
for the VERITAS Collaboration[2]

[1)] Barnard College, New York City, USA
[2)] http://veritas.sao.arizona.edu







Resolving Milagro Diffuse TeV sources with VERITAS

E. ALIU
Barnard College

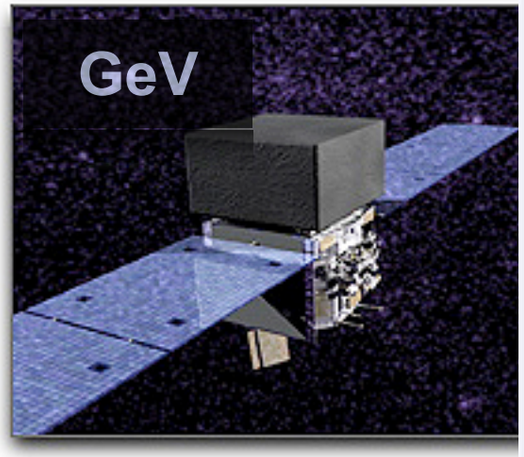
OUTLINE

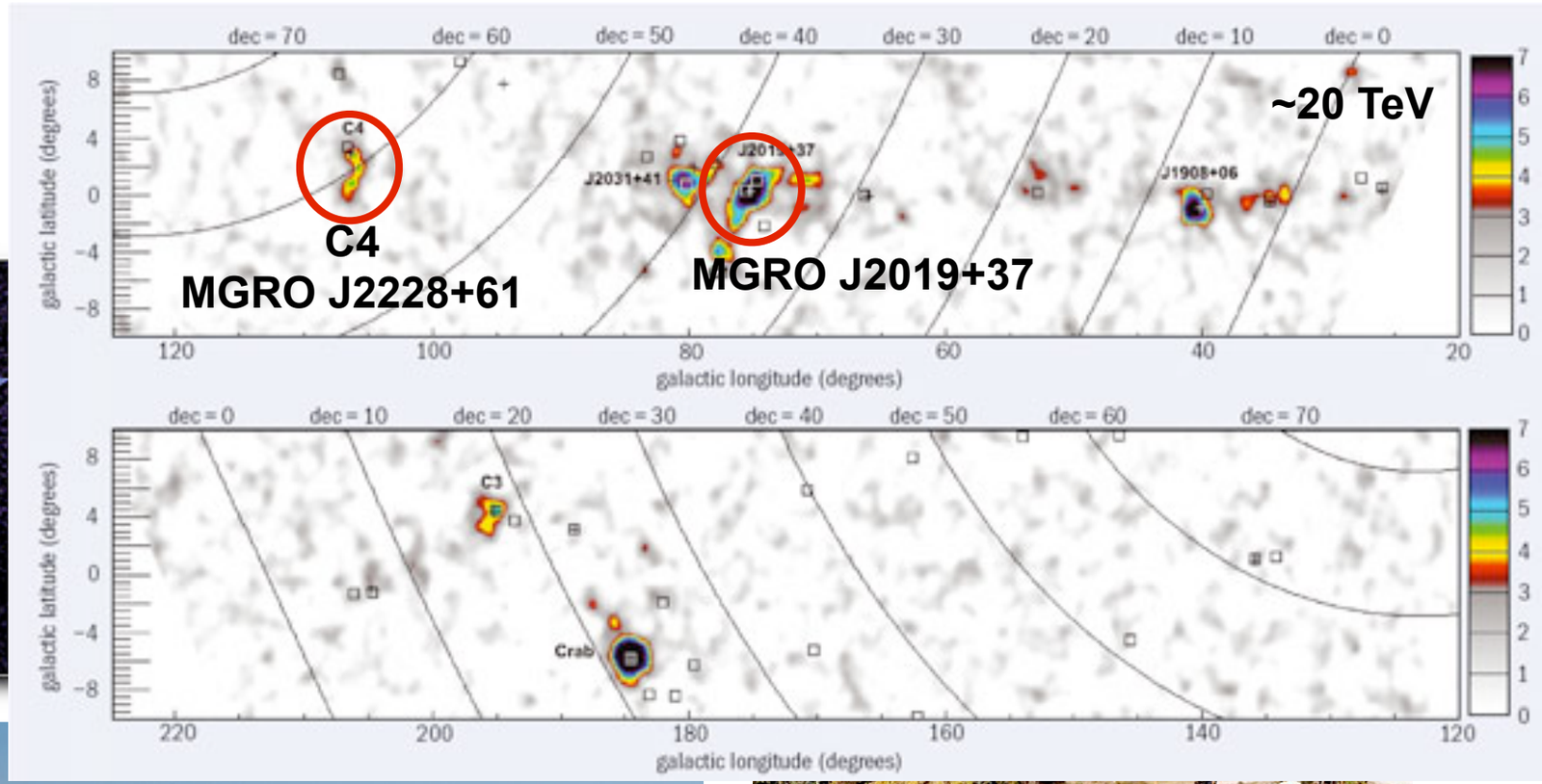
2012
Heidelberg International Symposium on High Energy Gamma-ay Astronomy

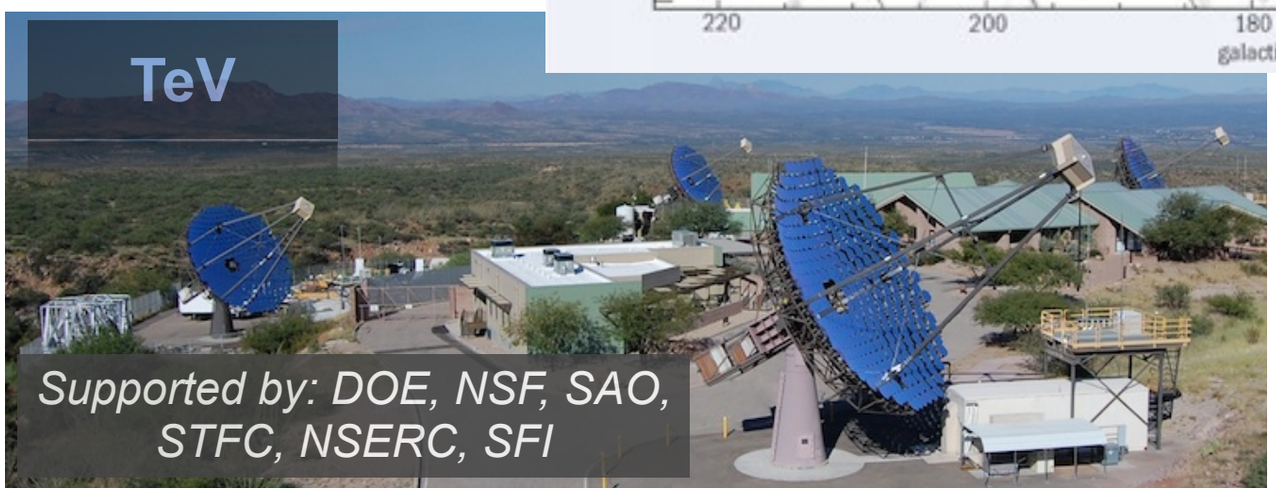
Resolving Milagro Diffuse TeV sources with VERITAS

Ester Aliu[1]
for the VERITAS Collaboration[2]

[1)] Barnard College, New York City, USA
[2)] http://veritas.sao.arizona.edu







Resolving Milagro Diffuse TeV sources with VERITAS

E. ALIU
Barnard College

OUTLINE

2012
Heidelberg International Symposium on High Energy Gamma-ay Astronomy

Resolving Milagro Diffuse TeV sources with VERITAS

E. ALIU
Barnard College

OUTLINE

Milagro

E ~ 20 TeV

Brightest reported TeV diffuse source in the Galaxy, 80% C.U.
Located towards Cyg OB1

Milagro Coll. ApJ 91L:664 (2007)
- association with pulsar

PSR J2021+3651

$\dot{E} = 2.1 \times 10^{36}$ erg/s

38.000
37.000
36.000
35.000
308.000
306.000
304.000
302.000
-1
0.68
2.4
4.2
5.9
7.6
9.4
11
13

MGRO J2019+37

Known SNR, PWNe
2FGL sources
HII regions
Hard X-ray transient
Young clusters Cyg OB1
WR binaries

Resolving Milagro Diffuse TeV sources with VERITAS

E. ALIU
Barnard College

OUTLINE

Milagro

E ~ 20 TeV

Brightest reported TeV diffuse source in the Galaxy, 80% C.U.
Located towards Cyg OB1

Milagro Coll. ApJ 91L:664 (2007)
- association with pulsar

Paredes et al. A&A 507:241 (2009)
Zabalza & Paredes AICP (2010)
- association with HII region

PSR J2021+3651

$\dot{E} = 2.1 \times 10^{36}$ erg/s

38.000
37.000
36.000
35.000
308.000
306.000
304.000
302.000
-1
0.68
2.4
4.2
5.9
7.6
9.4
11
13

MGRO J2019+37

Known SNR, PWNe
HII regions
Young clusters Cyg OB1
2FGL sources
Hard X-ray transient
WR binaries

Resolving Milagro Diffuse TeV sources with VERITAS

E. ALIU
Barnard College

OUTLINE

Milagro

E ~ 20 TeV

Brightest reported TeV diffuse source in the Galaxy, 80% C.U.
Located towards Cyg OB1

PSR J2021+3651

$\dot{E} = 2.1 \times 10^{36}$ erg/s

Milagro Coll. ApJ 91L:664 (2007)
- association with pulsar

Paredes et al. A&A 507:241 (2009)
Zabalza & Paredes AICP (2010)
- association with HII region

Bednarek, MNRAS 382:367 (2007)
- association with Ber87, young cluster in Cyg OB1

38.000
37.000
36.000
35.000
308.000
306.000
304.000
302.000
-1
0.68
2.4
4.2
5.9
7.6
9.4
11
13

MGRO J2019+37

Known SNR, PWNe
2FGL sources
HII regions
Hard X-ray transient
Young clusters Cyg OB1
WR binaries

Resolving Milagro Diffuse TeV sources with VERITAS

E. ALIU
Barnard College

OUTLINE

Milagro

E ~ 20 TeV

Brightest reported TeV diffuse source in the Galaxy, 80% C.U.
Located towards Cyg OB1

PSR J2021+3651

$\dot{E} = 2.1 \times 10^{36}$ erg/s

Milagro Coll. ApJ 91L:664 (2007)
- association with pulsar

Paredes et al. A&A 507:241 (2009)
Zabalza & Paredes AICP (2010)
- association with HII region

Bednarek, MNRAS 382:367 (2007)
- association with Ber87, young cluster in Cyg OB1

38.000
37.000
36.000
35.000
308.000
306.000
304.000
302.000
-1
0.68
2.4
4.2
5.9
7.6
9.4
11
13

MGRO J2019+37

Known SNR, PWNe
2FGL sources
HII regions
Hard X-ray transient
Young clusters Cyg OB1
WR binaries

Resolving Milagro Diffuse TeV sources with VERITAS

E. ALIU
Barnard College

OUTLINE

Milagro

E ~ 20 TeV

Brightest reported TeV diffuse source in the Galaxy, 80% C.U.
Located towards Cyg OB1

PSR J2021+3651

$\dot{E} = 2.1 \times 10^{36}$ erg/s

Milagro Coll. ApJ 91L:664 (2007)
- association with pulsar

Paredes et al. A&A 507:241 (2009)
Zabalza & Paredes AICP (2010)
- association with HII region

Bednarek, MNRAS 382:367 (2007)
- association with Ber87, young cluster in Cyg OB1

38.000
37.000
36.000
35.000
308.000
306.000
304.000
302.000
-1
0.68
2.4
4.2
5.9
7.6
9.4
11
13

MGRO J2019+37

Known SNR, PWNe
2FGL sources
HII regions
Hard X-ray transient
Young clusters Cyg OB1
WR binaries

Resolving Milagro Diffuse TeV sources with VERITAS

E. ALIU
Barnard College

OUTLINE

Milagro

E ~ 20 TeV

Brightest reported TeV diffuse source in the Galaxy, 80% C.U.
Located towards Cyg OB1

PSR J2021+3651

$\dot{E} = 2.1 \times 10^{36}$ erg/s

Milagro Coll. ApJ 91L:664 (2007)
- association with pulsar

Paredes et al. A&A 507:241 (2009)
Zabalza & Paredes AICP (2010)
- association with HII region

Bednarek, MNRAS 382:367 (2007)
- association with Ber87, young cluster in Cyg OB1

38.000
37.000
36.000
35.000
308.000
306.000
304.000
302.000
-1
0.68
2.4
4.2
5.9
7.6
9.4
11
13

MGRO J2019+37

Known SNR, PWNe
2FGL sources
HII regions
Hard X-ray transient
Young clusters Cyg OB1
WR binaries

Resolving Milagro Diffuse TeV sources with VERITAS

E. ALIU
Barnard College

OUTLINE

Milagro

E ~ 20 TeV

Brightest reported TeV diffuse source in the Galaxy, 80% C.U.
Located towards Cyg OB1

PSR J2021+3651

$\dot{E} = 2.1 \times 10^{36}$ erg/s

Milagro Coll. ApJ 91L:664 (2007)
- association with pulsar

Paredes et al. A&A 507:241 (2009)
Zabalza & Paredes AICP (2010)
- association with HII region

Bednarek, MNRAS 382:367 (2007)
- association with Ber87, young cluster in Cyg OB1

38.000
37.000
36.000
35.000
308.000
306.000
304.000
302.000
-1
0.68
2.4
4.2
5.9
7.6
9.4
11
13

MGRO J2019+37

Known SNR, PWNe
2FGL sources
HII regions
Hard X-ray transient
Young clusters Cyg OB1
WR binaries

Resolving Milagro Diffuse TeV sources with VERITAS

E. ALIU
Barnard College

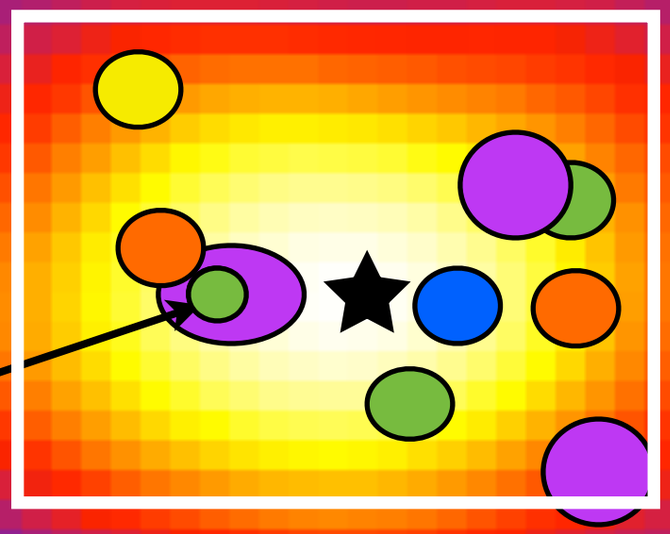
OUTLINE

Milagro

E ~ 20 TeV

Brightest reported TeV diffuse source in the Galaxy, 80% C.U.
Located towards Cyg OB1

1.8° x 2.5°



PSR J2021+3651

$\dot{E} = 2.1 \times 10^{36}$ erg/s

Milagro Coll. ApJ 91L:664 (2007)
- association with pulsar

Paredes et al. A&A 507:241 (2009)
Zabalza & Paredes AICP (2010)
- association with HII region

Bednarek, MNRAS 382:367 (2007)
- association with Ber87, young cluster in Cyg OB1

MGRO J2019+37

Known SNR, PWNe
2FGL sources
HII regions
Hard X-ray transient
Young clusters Cyg OB1
WR binaries

Resolving Milagro Diffuse TeV sources with VERITAS

E. ALIU
Barnard College

OUTLINE

Milagro

E ~ 20 TeV

Brightest reported TeV diffuse source in the Galaxy, 80% C.U.
Located towards Cyg OB1

1.8° x 2.5°

PSR J2021+3651

$\dot{E} = 2.1 \times 10^{36}$ erg/s

Milagro Coll. ApJ 91L:664 (2007)
- association with pulsar

Paredes et al. A&A 507:241 (2009)
Zabalza & Paredes AICP (2010)
- association with HII region

Bednarek, MNRAS 382:367 (2007)
- association with Ber87, young cluster in Cyg OB1

38.000
37.000
36.000
35.000
308.000
306.000
304.000
302.000
-1
0.68
2.4
4.2
5.9
7.6
9.4
11
13

MGRO J2019+37

Known SNR, PWNe
2FGL sources
HII regions
Hard X-ray transient
Young clusters Cyg OB1
WR binaries

Resolving Milagro Diffuse TeV sources with VERITAS

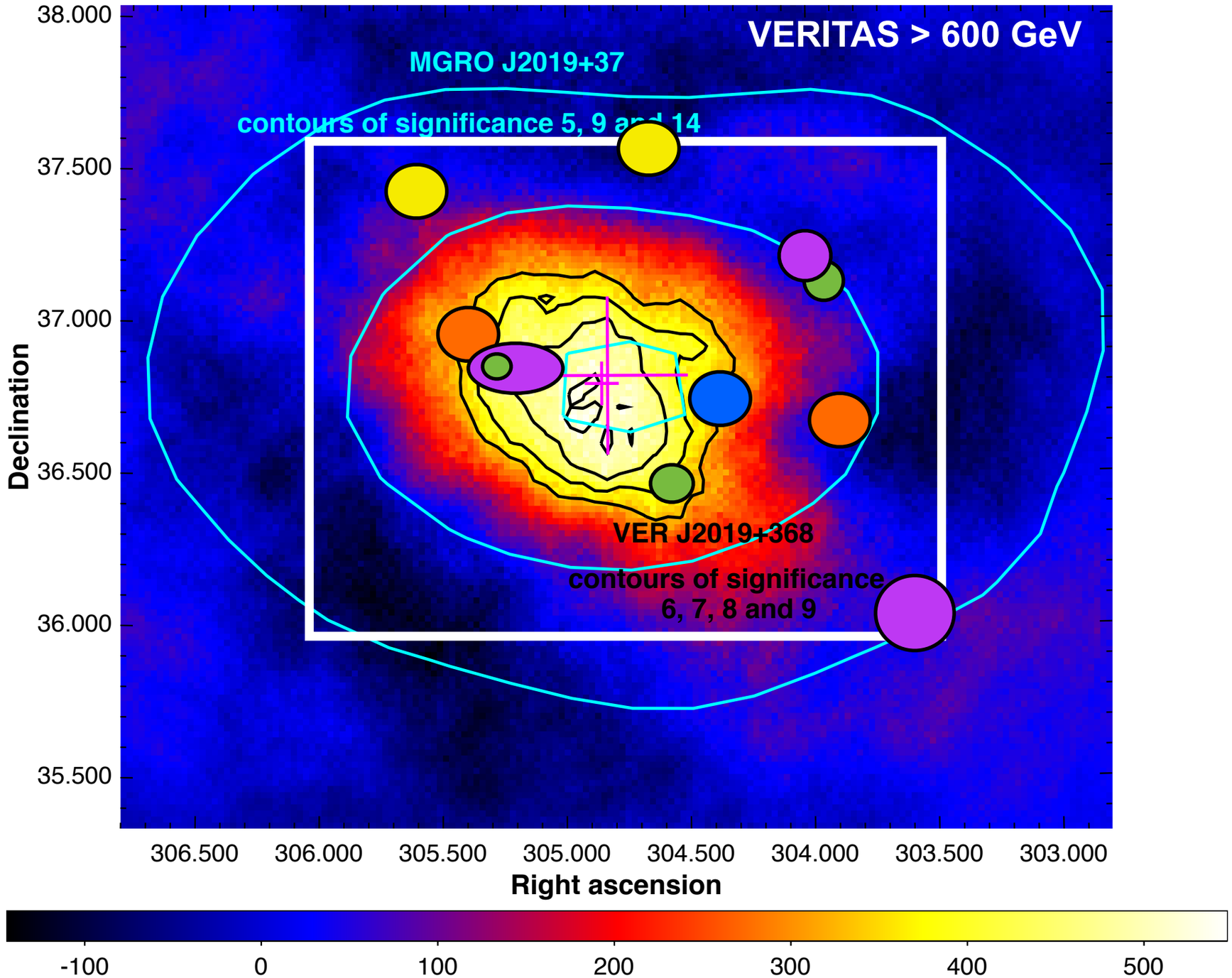
E. ALIU
Barnard College

OUTLINE

Search Radius ~ Milagro PSF (0.5 deg)

VERITAS Coll. in preparation

- Relatively deep exposure: 75 hrs, > 500 events ~ 9.5σ
- Significantly smaller source
- Compatible centroids between VERITAS and Milagro

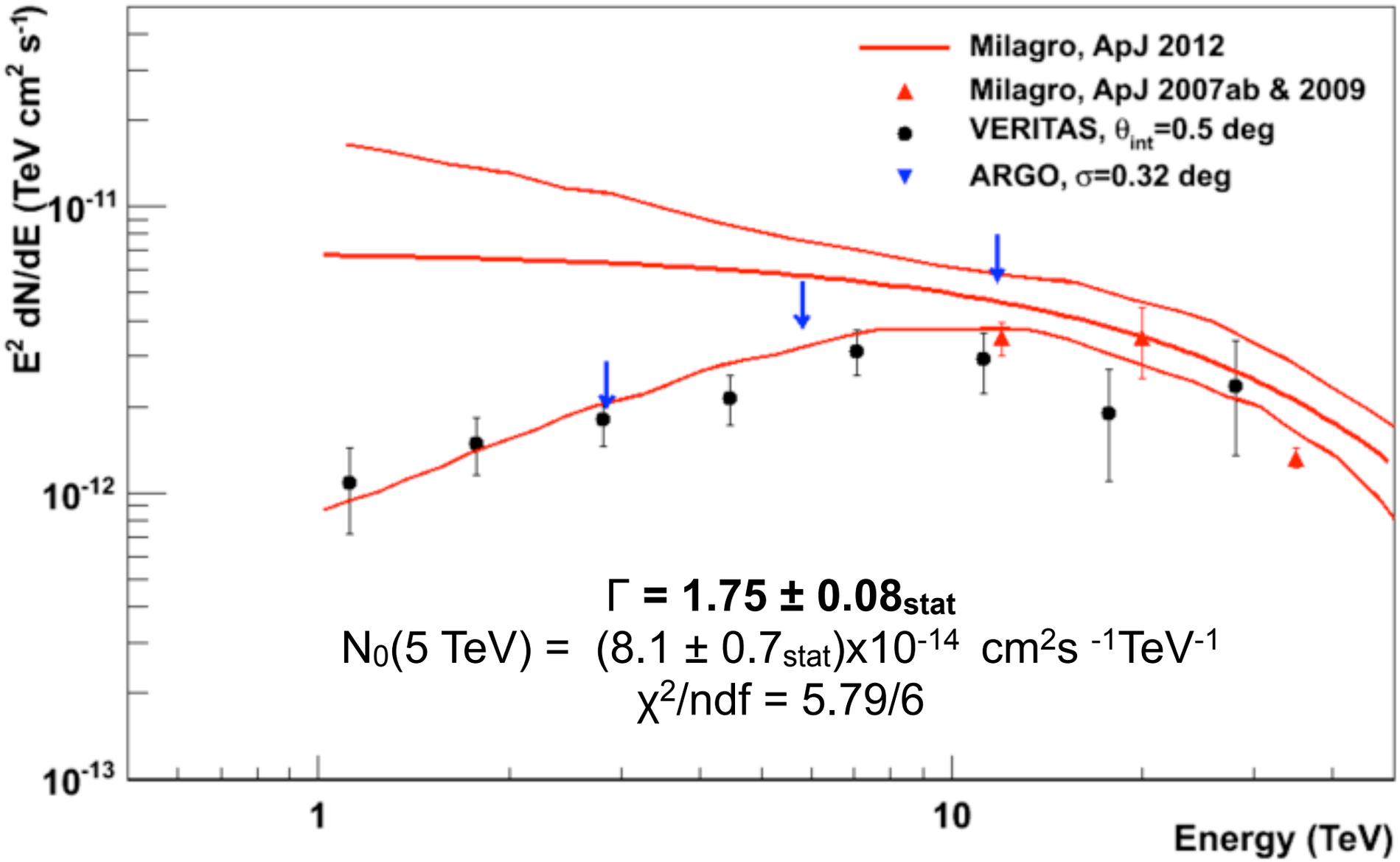


E. ALIU
Barnard College

Is MGRO J2019+37 == VER J2019+368 ?

VERITAS Coll. in preparation

- The spectrum VER J2019+368 is compatible with the Milagro flux points at 12, 20 and 35 TeV and the ARGO upper limit flux



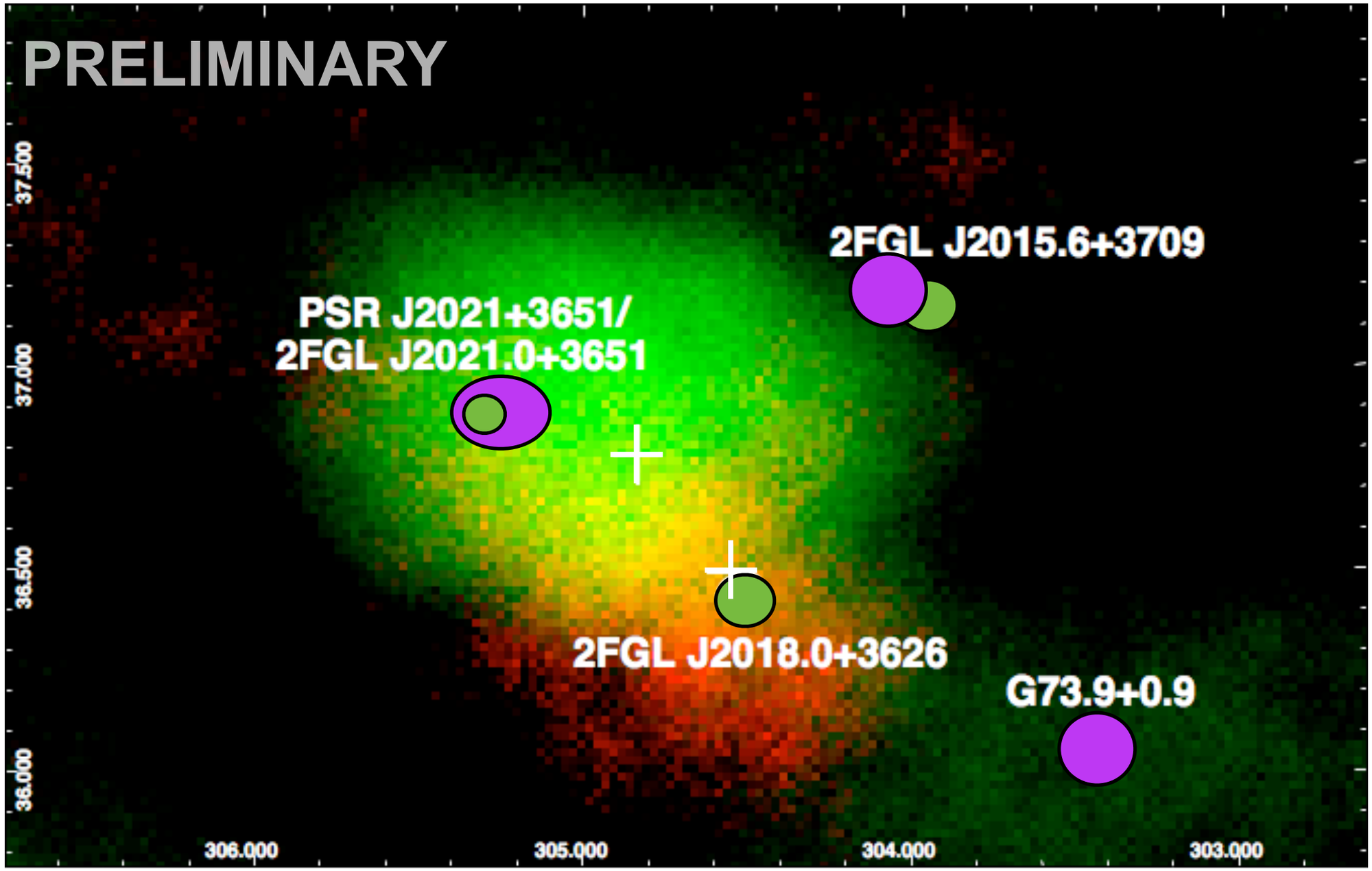
Energy Dependent Morphology

VERITAS Coll. in preparation

Resolving Milagro Diffuse TeV sources with VERITAS

E. ALIU
Barnard College

OUTLINE



Green : VERITAS > 1 TeV (θ_{int} = 0.5 deg)
Red : VERITAS < 1 TeV (θ_{int} = 0.5 deg)

Resolving Milagro Diffuse TeV sources with VERITAS

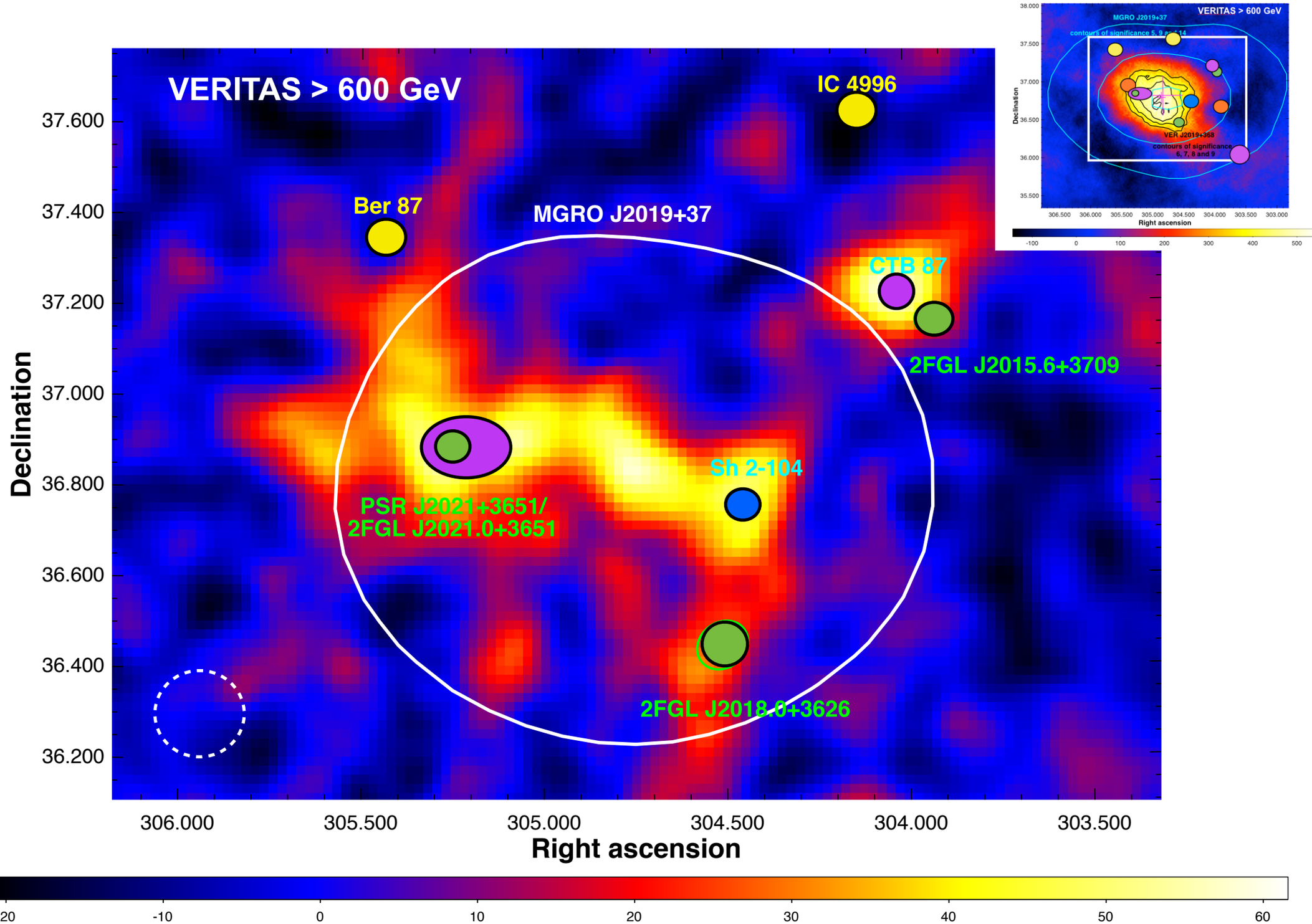
E. ALIU
Barnard College

OUTLINE

Search Radius ~ 0.09 deg (≳ VERITAS PSF)

VERITAS Coll. in preparation

- Clearly separated source coincident with SNR (6.2σ post-trials)
- Elongated complex emission in the center (> 5σ post-trials)



Resolving Milagro Diffuse TeV sources with VERITAS

E. ALIU
Barnard College

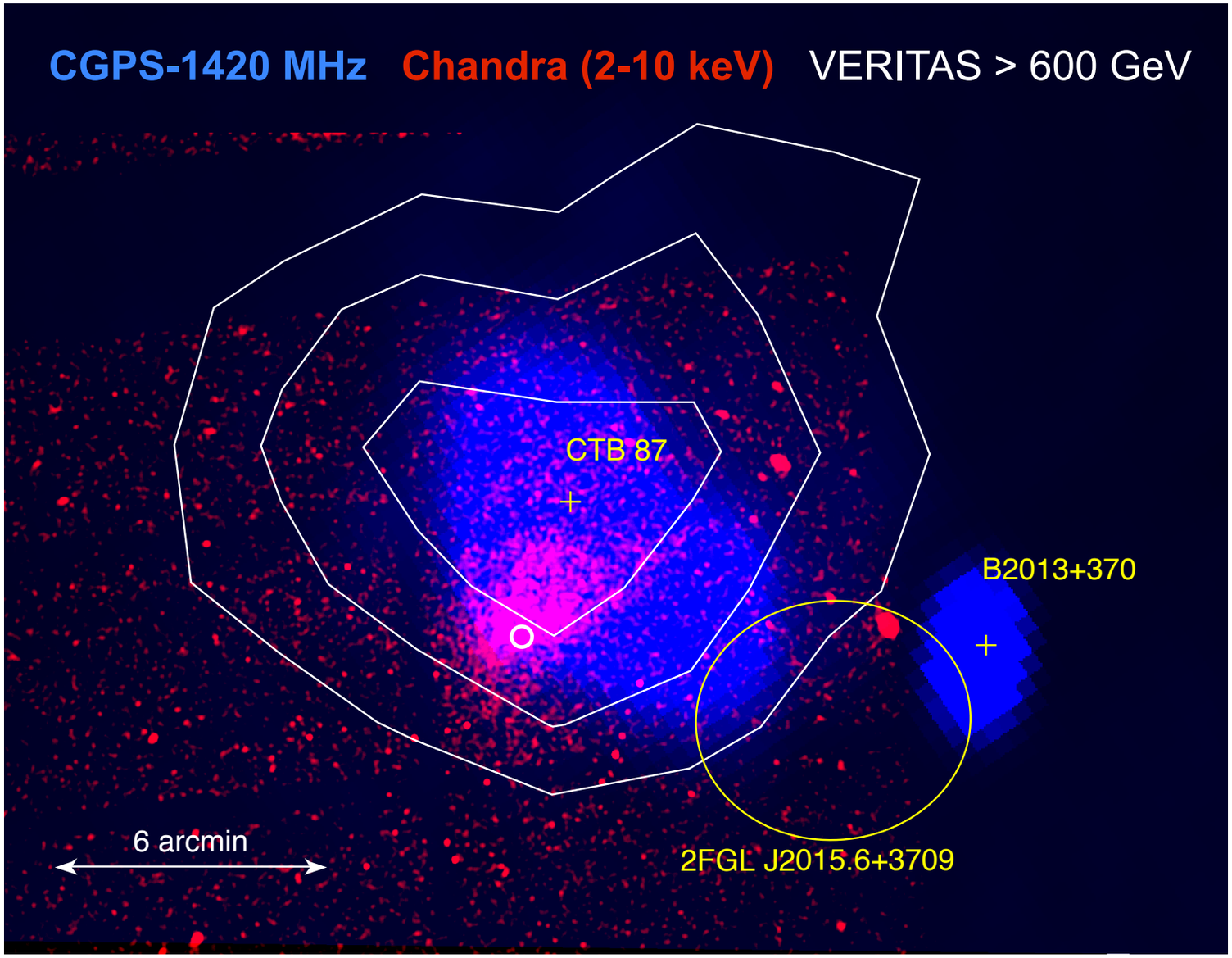
OUTLINE

CTB 87, another PWN

Collaborators: **Kargaltsev (U. Florida)**

VERITAS Coll. in preparation

- Point-like TeV emission at CTB 87 location (2D fit unc. excess events)
- X-rays/radio/TeV morphology suggest either bow shock PWN or asymmetrical reverse shock (but no SNR)
- 2FGL J2015.6+3709 likely unrelated



Archival CGPS and Chandra data in the CTB 87 region
VERITAS 3, 4, 5 sigma contours

Resolving Milagro Diffuse TeV sources with VERITAS

E. ALIU
Barnard College

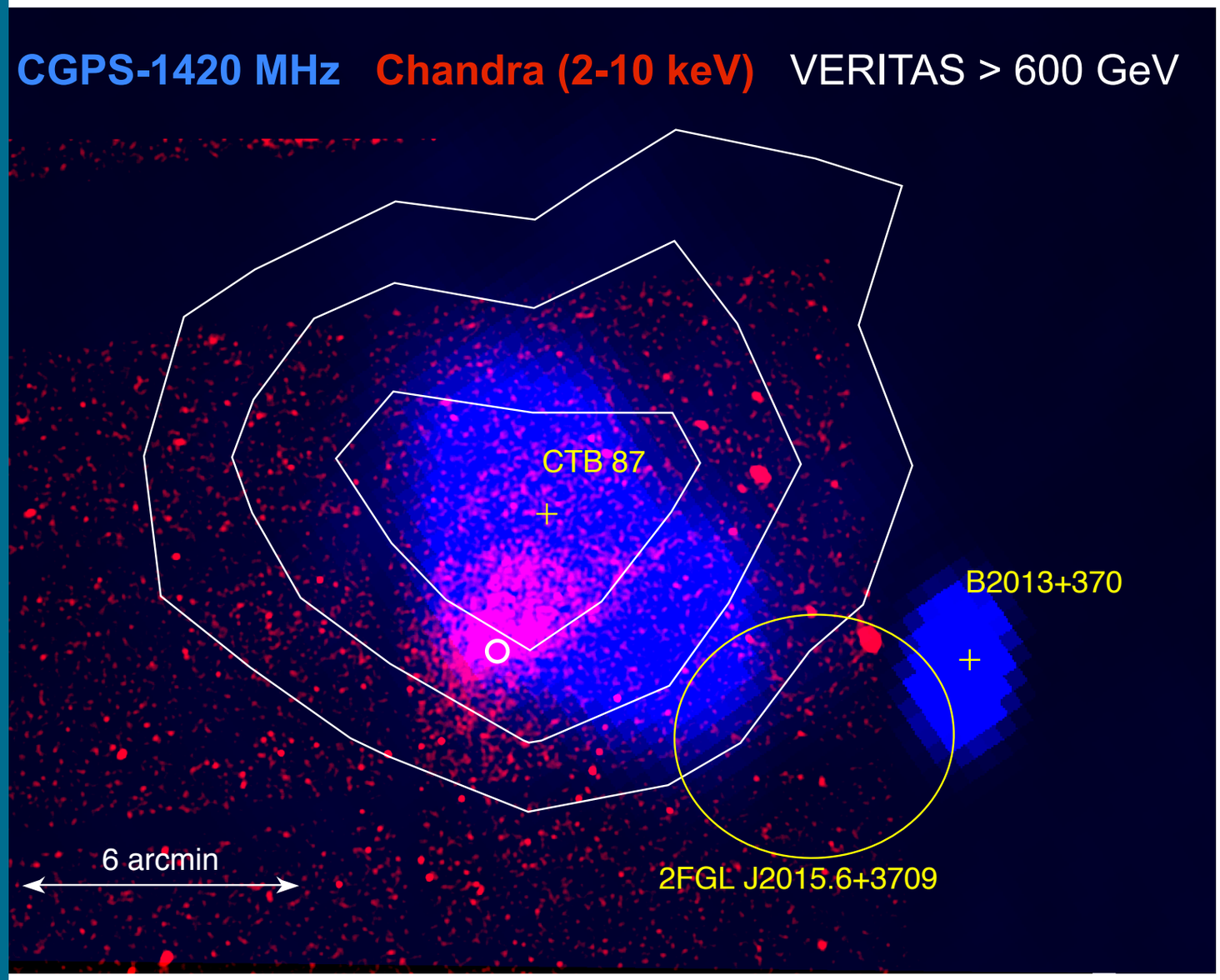
OUTLINE

CTB 87, another PWN

Collaborators: **Kargaltsev (U. Florida)**

VERITAS Coll. in preparation

- Point-like TeV emission at CTB 87 location (2D fit unc. excess events)
- X-rays/radio/TeV morphology suggest either bow shock PWN or asymmetrical reverse shock (but no SNR)
- 2FGL J2015.6+3709 likely unrelated



Archival CGPS and Chandra data in the CTB 87 region
VERITAS 3, 4, 5 sigma contours

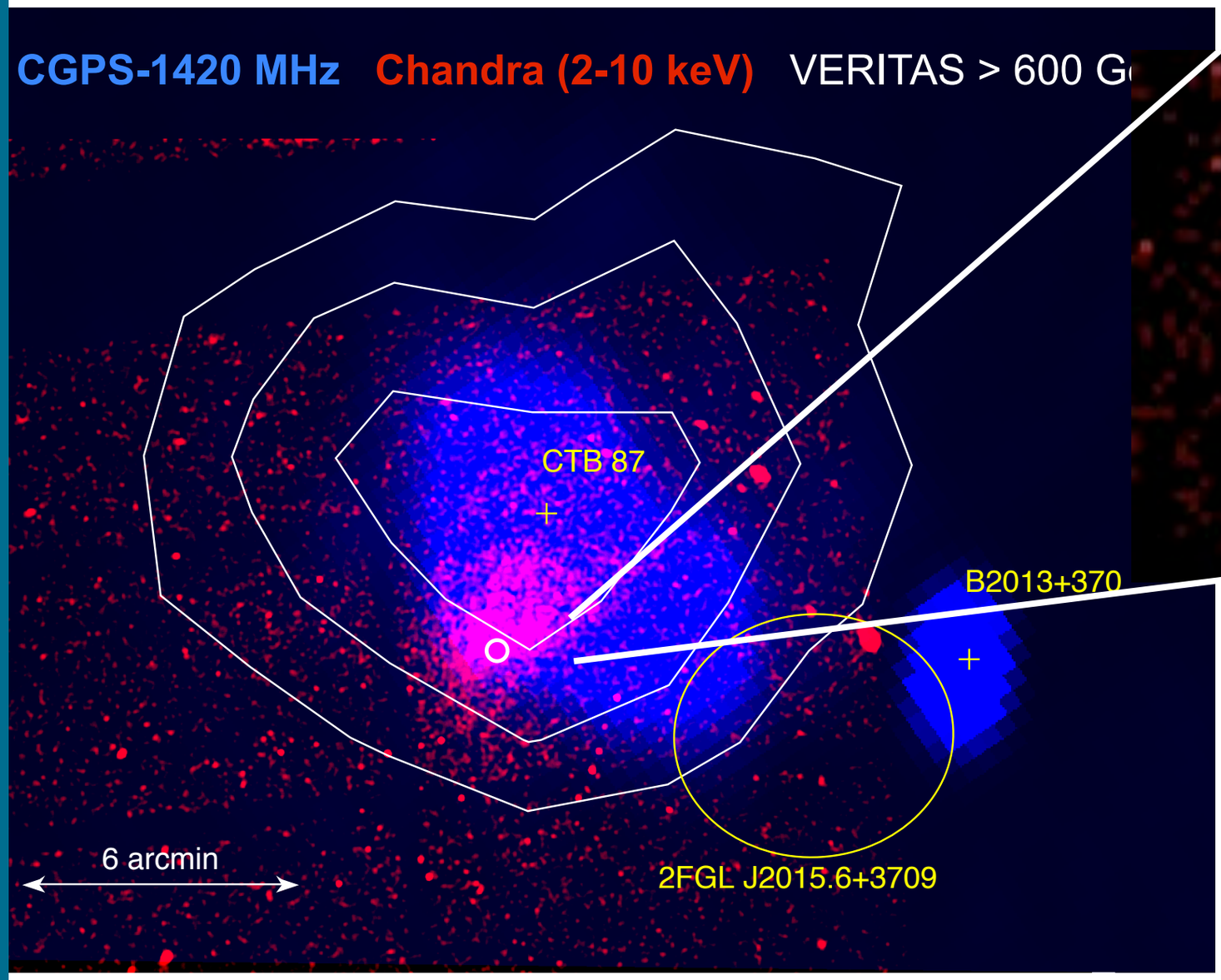
E. ALIU
Barnard College

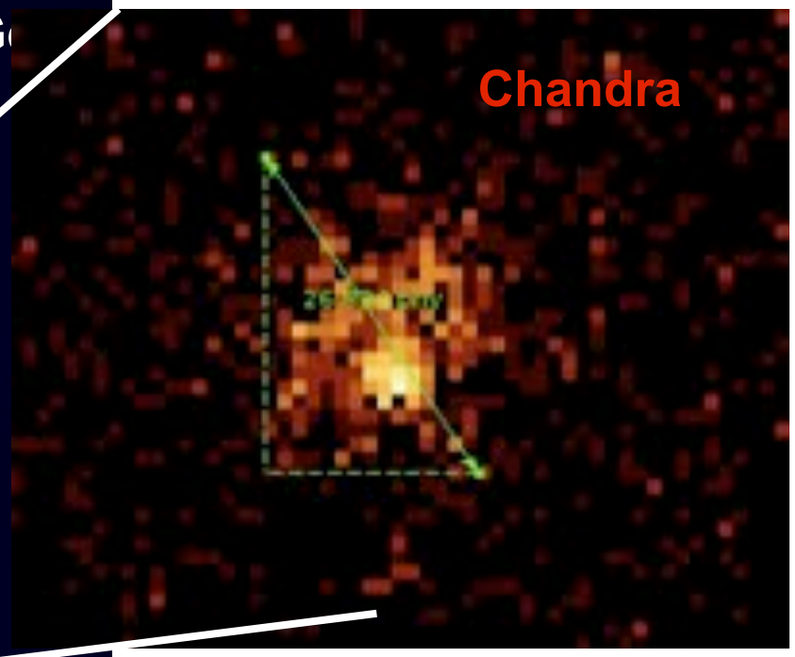
CTB 87, another PWN

Collaborators: **Kargaltsev (U. Florida)**

VERITAS Coll. in preparation

- Point-like TeV emission at CTB 87 location (2D fit unc. excess events)
- X-rays/radio/TeV morphology suggest either bow shock PWN or asymmetrical reverse shock (but no SNR)
- 2FGL J2015.6+3709 likely unrelated





Compact PWN
torus/jet structure
34 deg East of North
Pulsations not yet found!!

Archival CGPS and Chandra data in the CTB 87 region
VERITAS 3, 4, 5 sigma contours

Resolving Milagro Diffuse TeV sources with VERITAS

E. ALIU
Barnard College

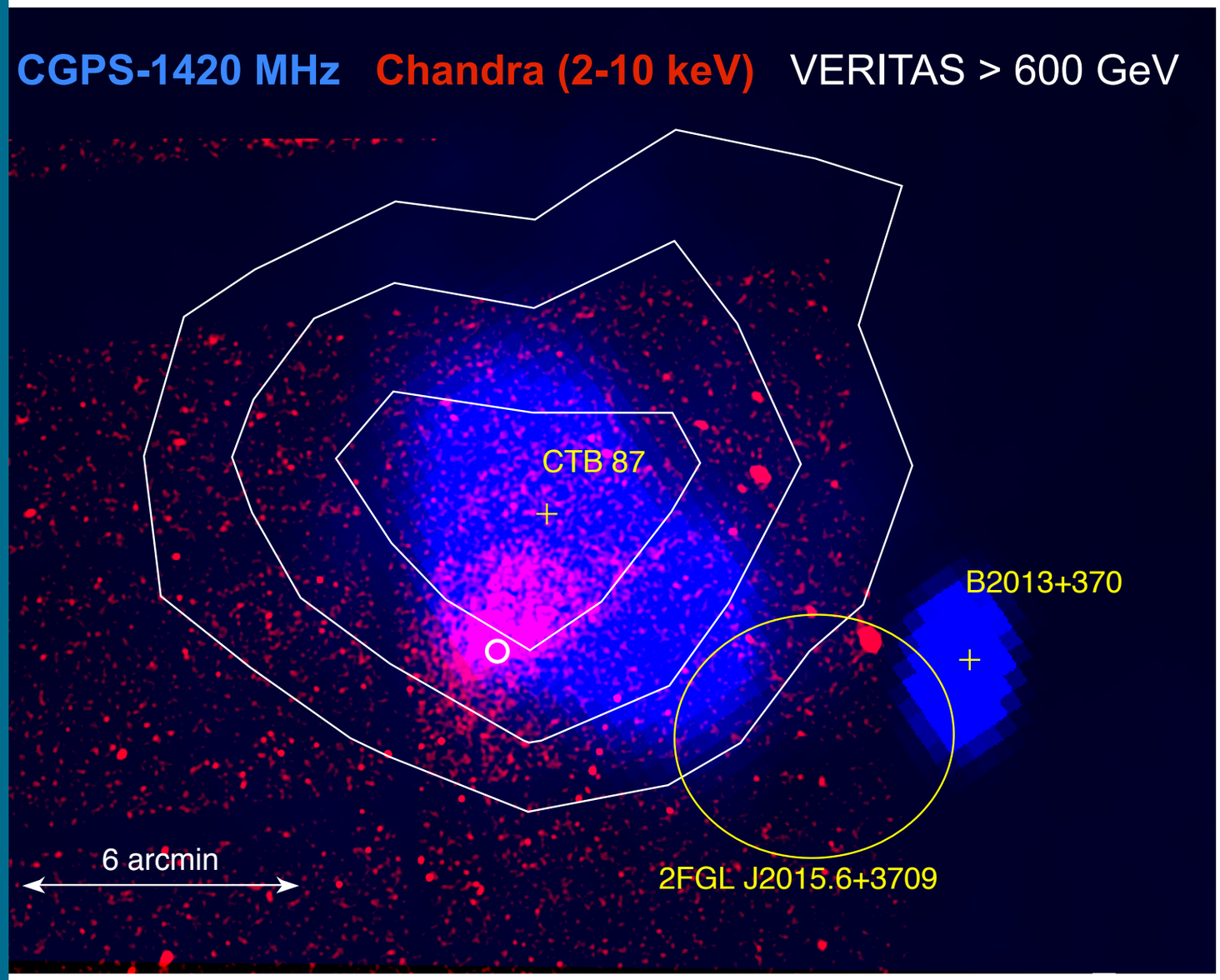
OUTLINE

CTB 87, another PWN

Collaborators: **Kargaltsev (U. Florida)**

VERITAS Coll. in preparation

- Point-like TeV emission at CTB 87 location (2D fit unc. excess events)
- X-rays/radio/TeV morphology suggest either bow shock PWN or asymmetrical reverse shock (but no SNR)
- 2FGL J2015.6+3709 likely unrelated



Archival CGPS and Chandra data in the CTB 87 region
VERITAS 3, 4, 5 sigma contours

Resolving Milagro Diffuse TeV sources with VERITAS

E. ALIU
Barnard College

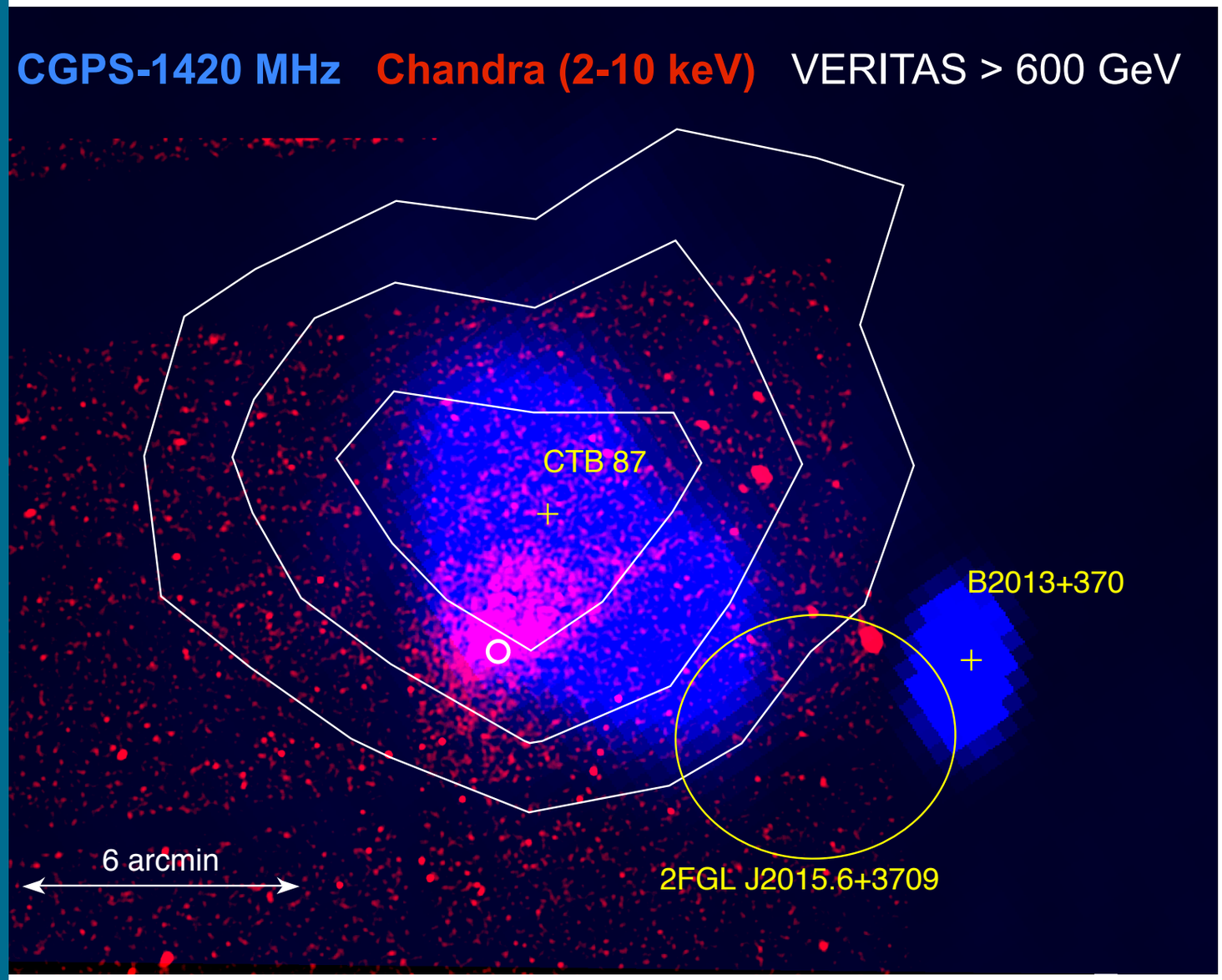
OUTLINE

CTB 87, another PWN

Collaborators: Kargaltsev (U. Florida)

VERITAS Coll. in preparation

- Point-like TeV emission at CTB 87 location (2D fit unc. excess events)
- X-rays/radio/TeV morphology suggest either bow shock PWN or asymmetrical reverse shock (but no SNR)
- 2FGL J2015.6+3709 likely unrelated



Archival CGPS and Chandra data in the CTB 87 region
VERITAS 3, 4, 5 sigma contours

Power-law spectrum for both TeV and X-rays

$\Gamma_g = 2.34 \pm 0.31_{stat}$

$L_{g(1\text{-}10\ TeV)} = 1.15 \times 10^{33}$ erg/s

$\Gamma_x = 1.60 \pm 0.04_{stat}$

$L_{x(0.5\text{-}8\ keV)} = (1.02 \pm 0.05) \times 10^{34}$ erg/s

Lx/Lg ~ 10

Resolving Milagro Diffuse TeV sources with VERITAS

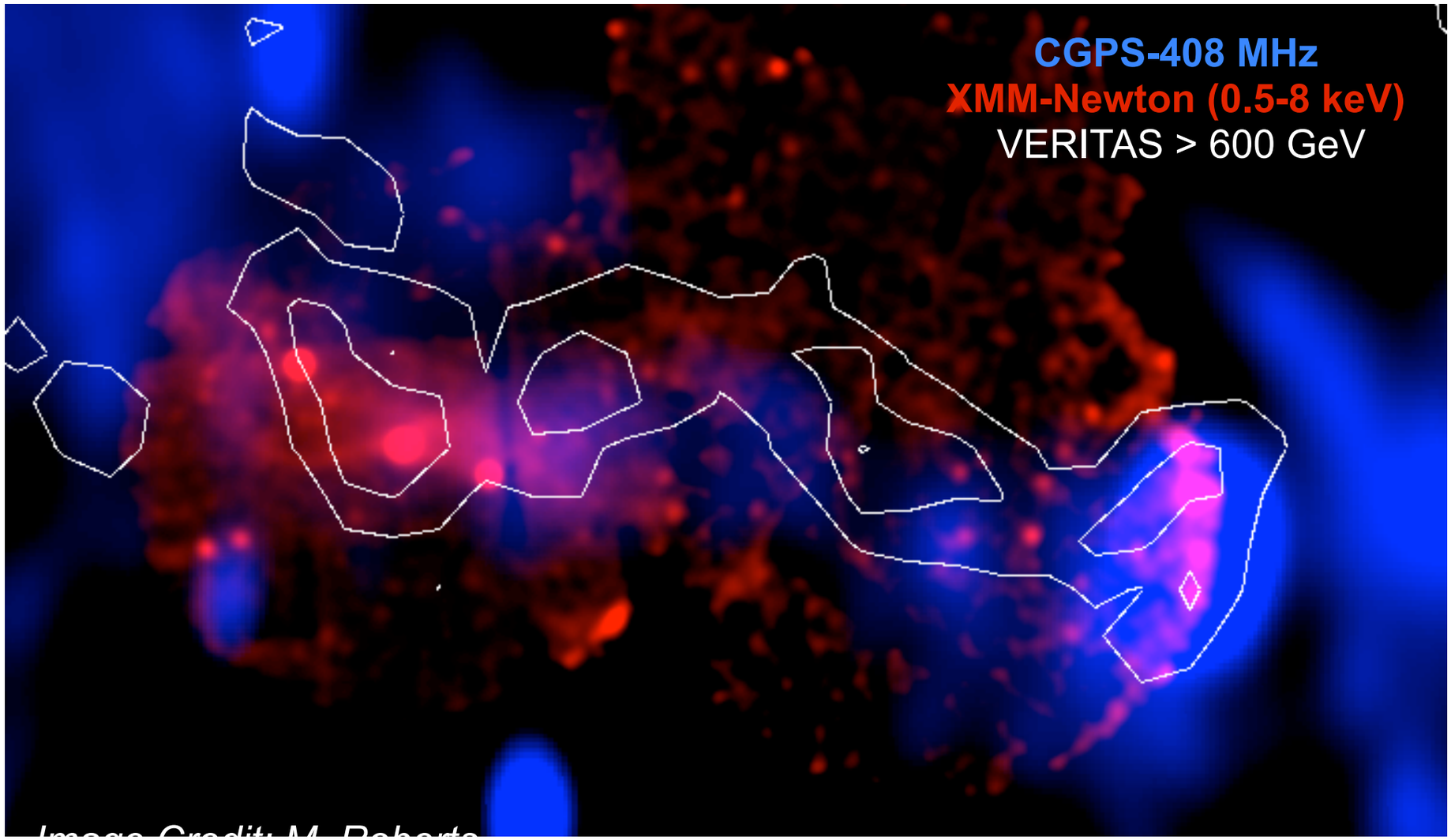
E. ALIU
Barnard College

OUTLINE

What about the central emission?

VERITAS Coll. in preparation

- half of the TeV emission could be reasonably attributed to a PWN associated with PSR J2021+3651
- no obvious point X-ray sources around the maximum of the TeV emission
- undiscovered nebulae ? wind collisions in WR 141 or in Sh-2 104 ?



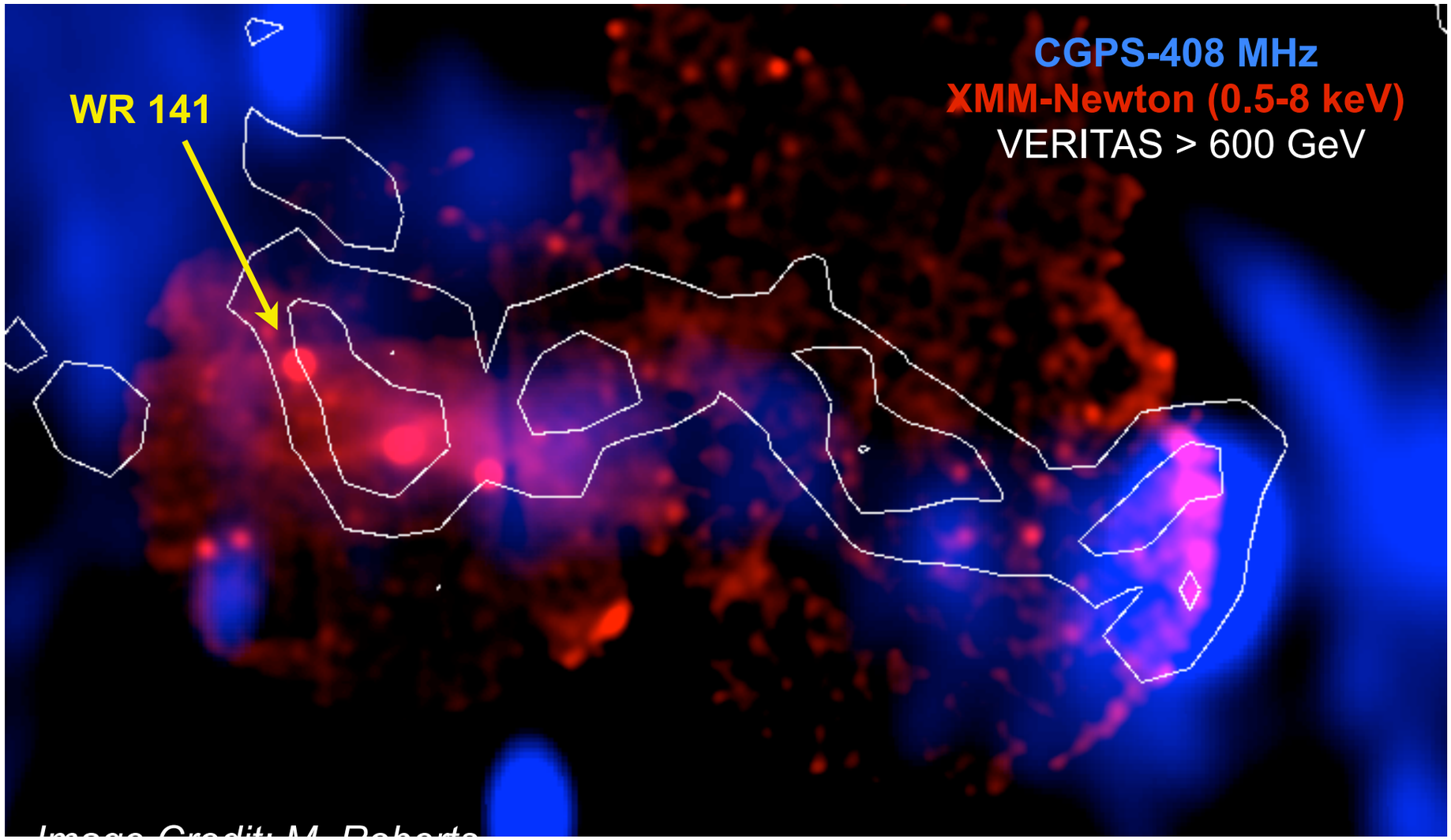
XMM-Newton data (PI: Roberts) + some archival to complete the mosaic

E. ALIU
Barnard College

What about the central emission?

VERITAS Coll. in preparation

- half of the TeV emission could be reasonably attributed to a PWN associated with PSR J2021+3651
- no obvious point X-ray sources around the maximum of the TeV emission
- undiscovered nebulae ? wind collisions in WR 141 or in Sh-2 104 ?



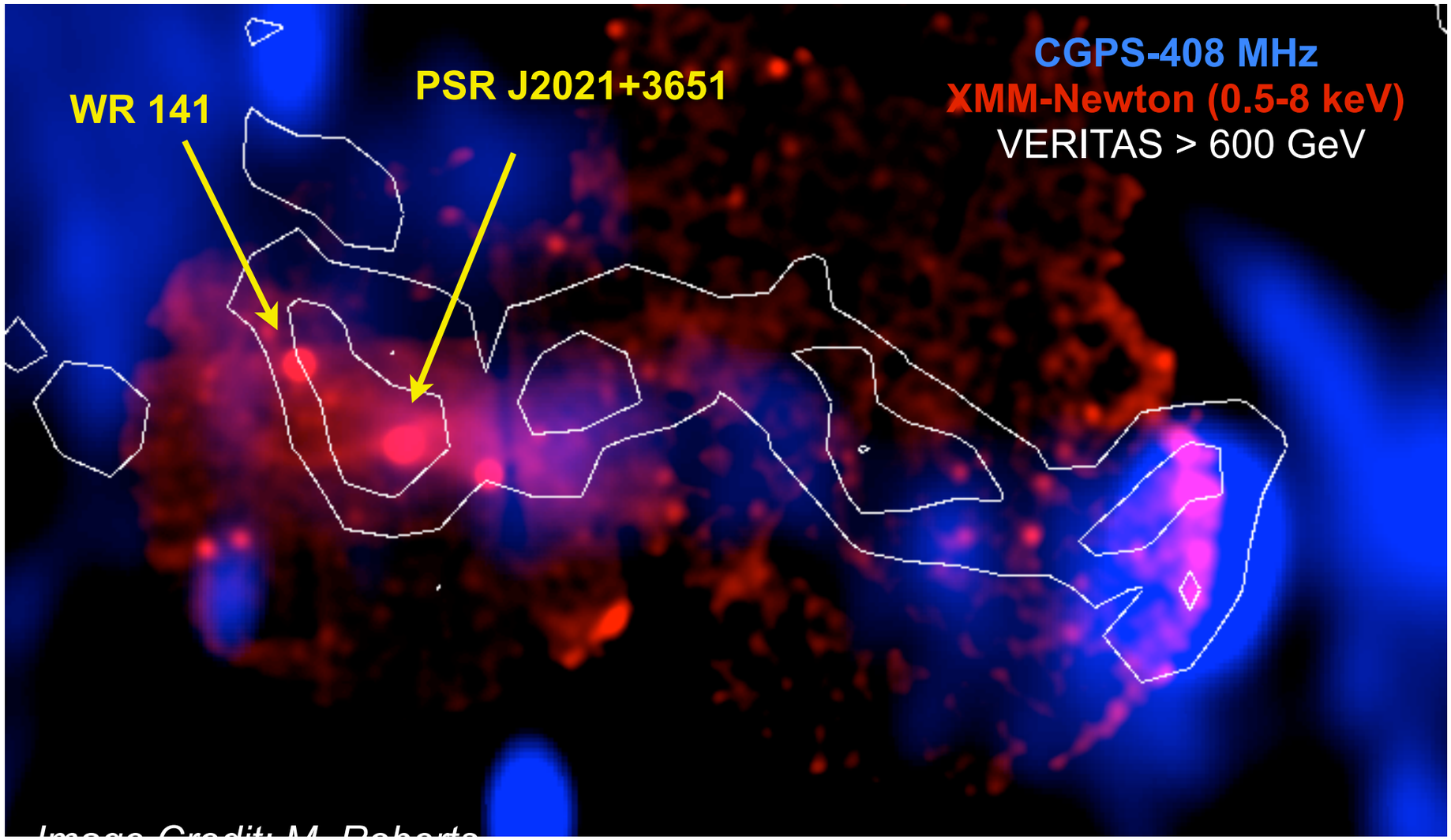
XMM-Newton data (PI: Roberts) + some archival to complete the mosaic

E. ALIU
Barnard College

What about the central emission?

VERITAS Coll. in preparation

- half of the TeV emission could be reasonably attributed to a PWN associated with PSR J2021+3651
- no obvious point X-ray sources around the maximum of the TeV emission
- undiscovered nebulae ? wind collisions in WR 141 or in Sh-2 104 ?



XMM-Newton data (PI: Roberts) + some archival to complete the mosaic

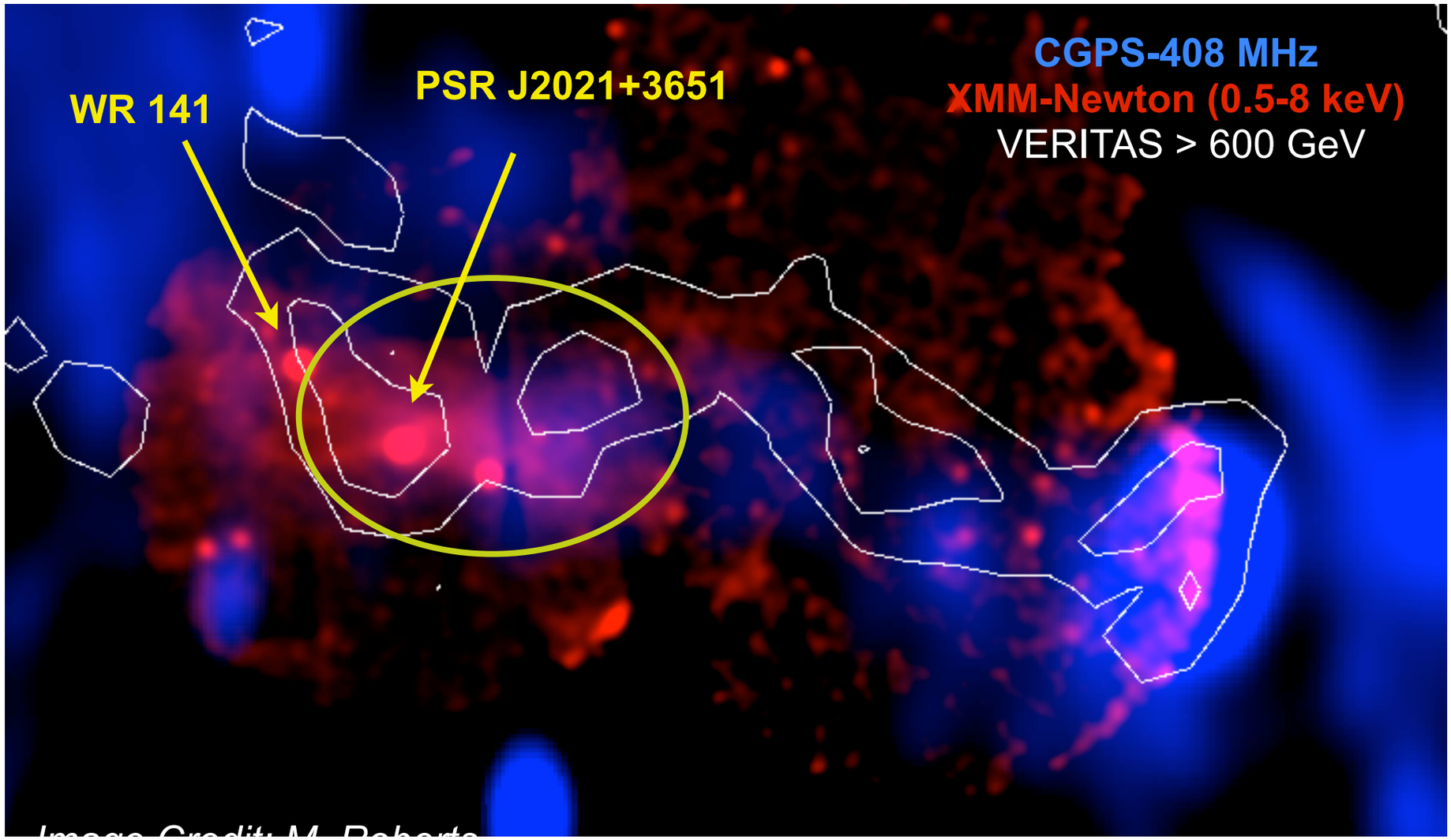
Resolving Milagro Diffuse TeV sources with VERITAS

E. ALIU
Barnard College

What about the central emission?

VERITAS Coll. in preparation

- half of the TeV emission could be reasonably attributed to a PWN associated with PSR J2021+3651
- no obvious point X-ray sources around the maximum of the TeV emission
- undiscovered nebulae ? wind collisions in WR 141 or in Sh-2 104 ?



XMM-Newton data (PI: Roberts) + some archival to complete the mosaic

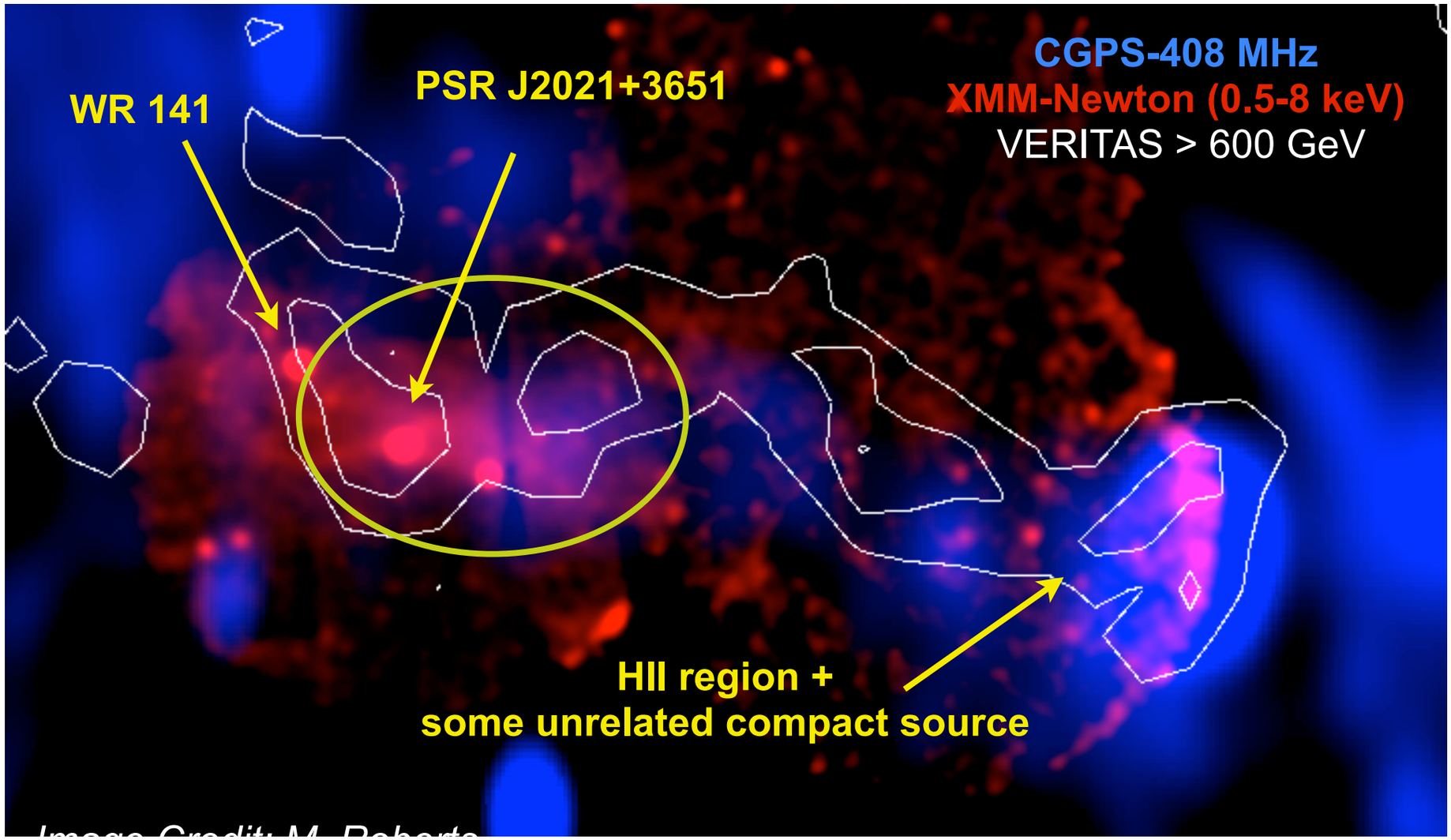
Resolving Milagro Diffuse TeV sources with VERITAS

E. ALIU
Barnard College

What about the central emission?

VERITAS Coll. in preparation

- half of the TeV emission could be reasonably attributed to a PWN associated with PSR J2021+3651
- no obvious point X-ray sources around the maximum of the TeV emission
- undiscovered nebulae ? wind collisions in WR 141 or in Sh-2 104 ?



XMM-Newton data (PI: Roberts) + some archival to complete the mosaic

Resolving Milagro Diffuse TeV sources with VERITAS

E. ALIU
Barnard College

OUTLINE

PSR J2229+6114

$\dot{E} = 2.2 \times 10^{37}$ erg/s

Milagro

E ~ 20 TeV

Milagro Coll. ApJ 91L:664 (2007)
- association with pulsar

Largest Milagro diffuse source, **extent 3.5 deg**

62
61
60
59
58
340
338
336
334
-1
0
1
2
3
4
5
6

C4 / MGRO J2228+61

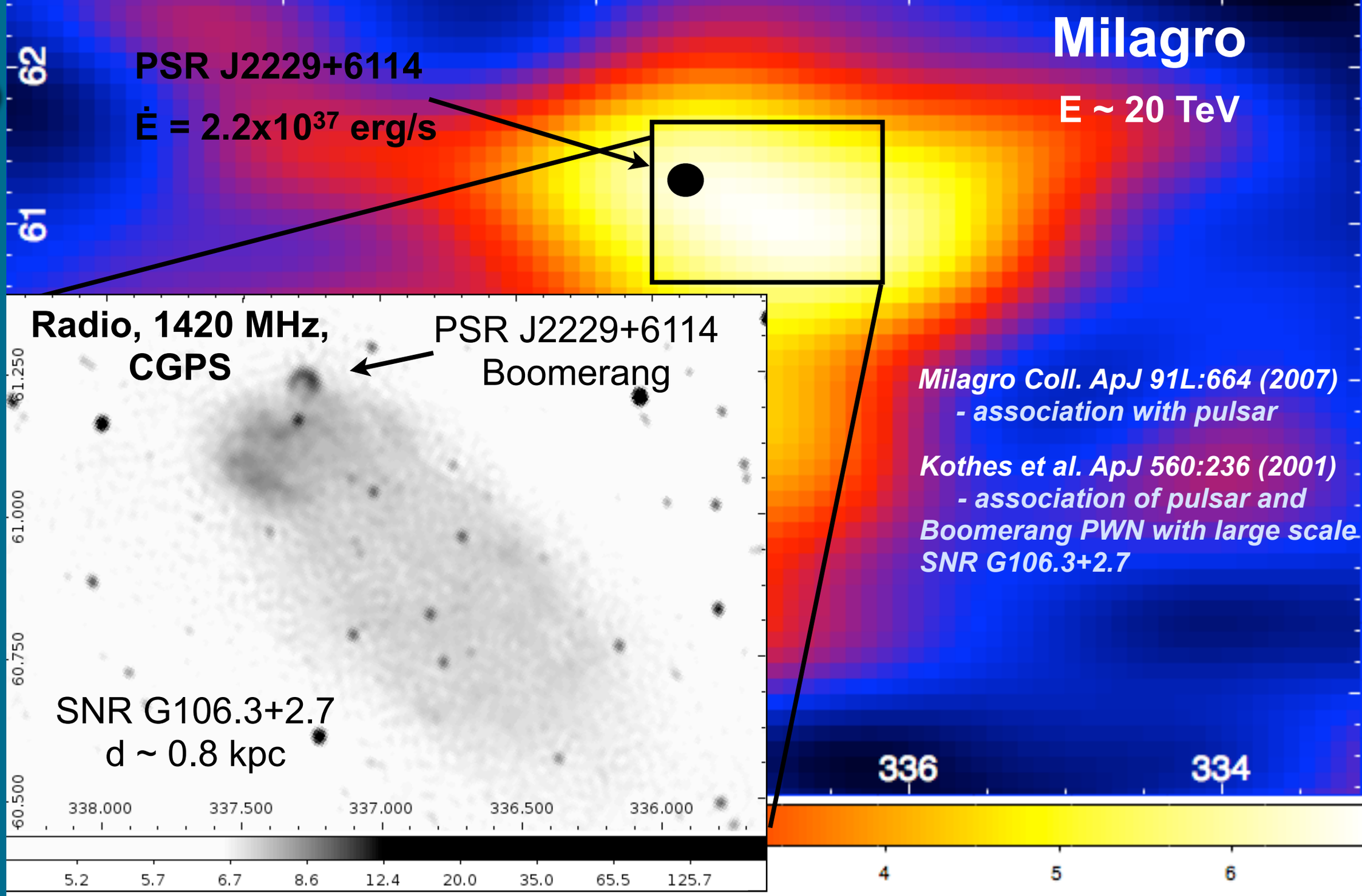
ATel #2172
Milagro Coll. ApJ 700L:127 (2009)

- **Evolved pulsar wind nebula crushed by interaction of asymmetric reverse shock ?** ***(leptonic)***
- **A new member of the selected group of SNR interacting with dense medium ?** ***(hadronic)***

Resolving Milagro Diffuse TeV sources with VERITAS

E. ALIU
Barnard College

OUTLINE



Milagro Coll. ApJ 91L:664 (2007)
- association with pulsar

Kothes et al. ApJ 560:236 (2001)
- association of pulsar and Boomerang PWN with large scale SNR G106.3+2.7

C4 / MGRO J2228+61

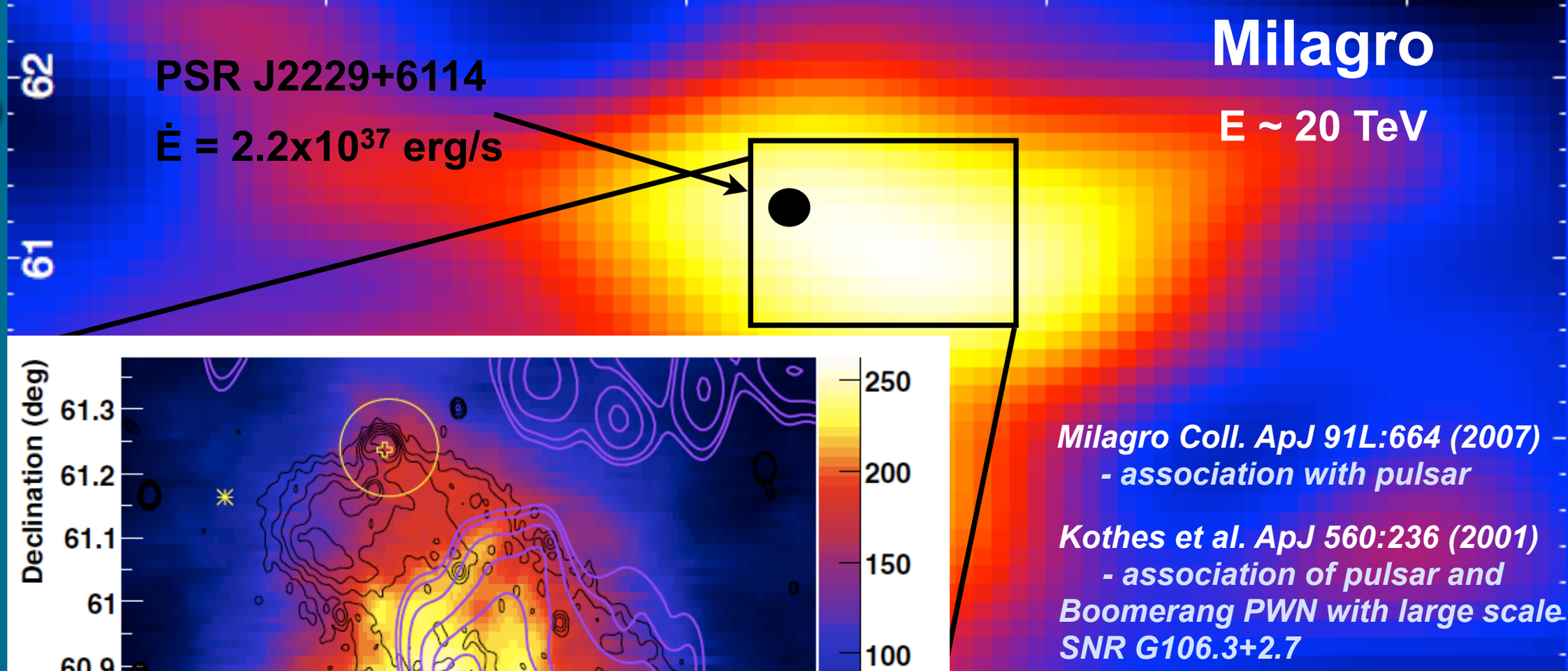
ATel #2172
Milagro Coll. ApJ 700L:127 (2009)

- **Evolved pulsar wind nebula crushed by interaction of asymmetric reverse shock ?** ***(leptonic)***
- **A new member of the selected group of SNR interacting with dense medium ?** ***(hadronic)***

Resolving Milagro Diffuse TeV sources with VERITAS

E. ALIU
Barnard College

OUTLINE



C4 / MGRO J2228+61

ATel #2172
Milagro Coll. ApJ 700L:127 (2009)

- Evolved pulsar wind nebula crushed by interaction of asymmetric reverse shock ? *(leptonic)*
- A new member of the selected group of SNR interacting with dense medium ? *(hadronic)*

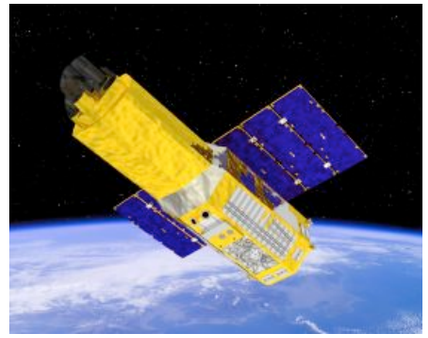
Resolving Milagro Diffuse TeV sources with VERITAS

E. ALIU
Barnard College

OUTLINE

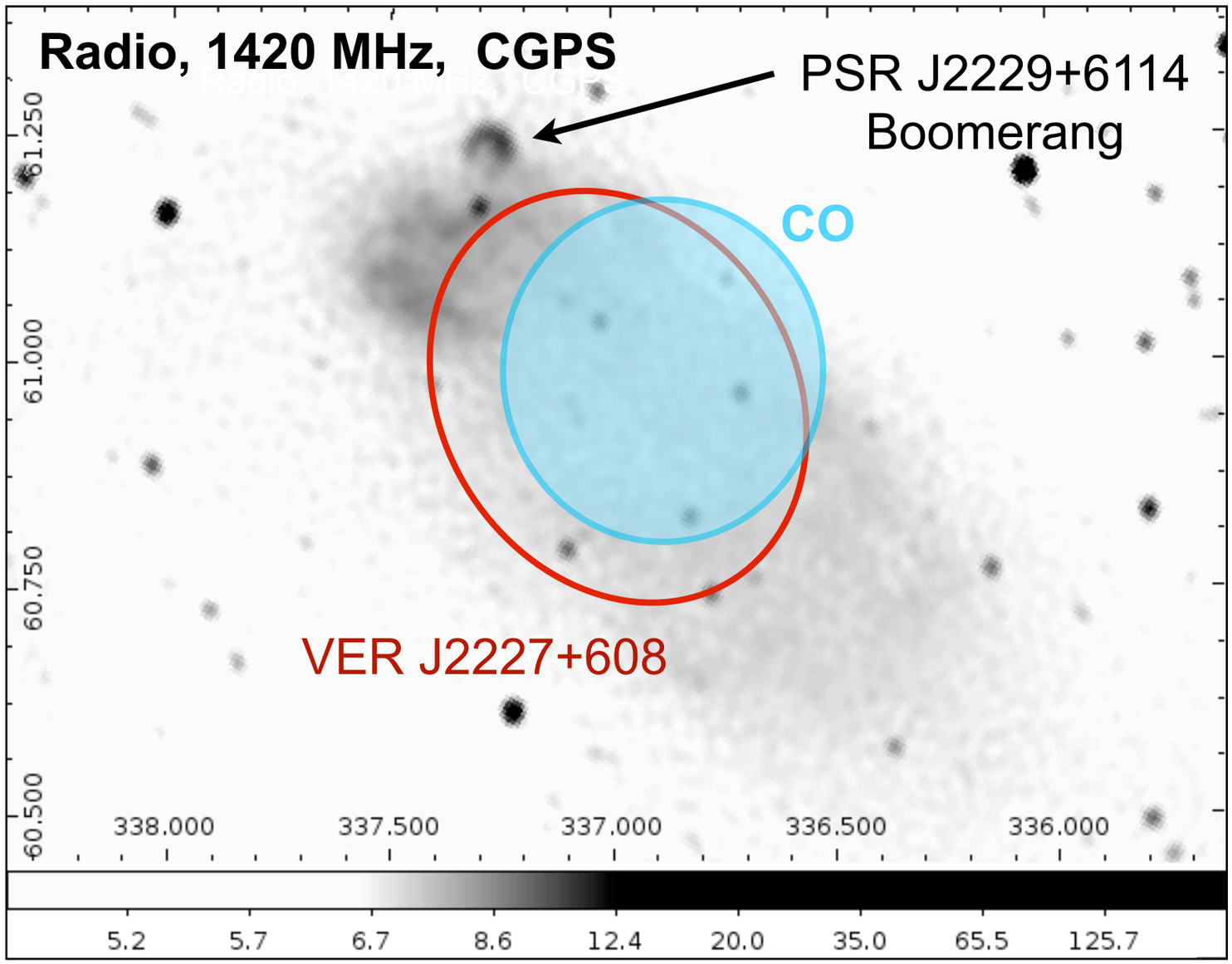
Suzaku X-ray mapping of SNR G106.3+2.7

Collaborators: Gotthelf & Halpern (Columbia U.), Wakely (U. Chicago), Roberts (Eureka Scientific)



PI Aliu, Suzaku Cycle AO5, Awarded 100 ks

- Search for diffuse X-ray emission to discriminate between the two proposed mechanisms for gamma-ray production in the region



Resolving Milagro Diffuse TeV sources with VERITAS

E. ALIU
Barnard College

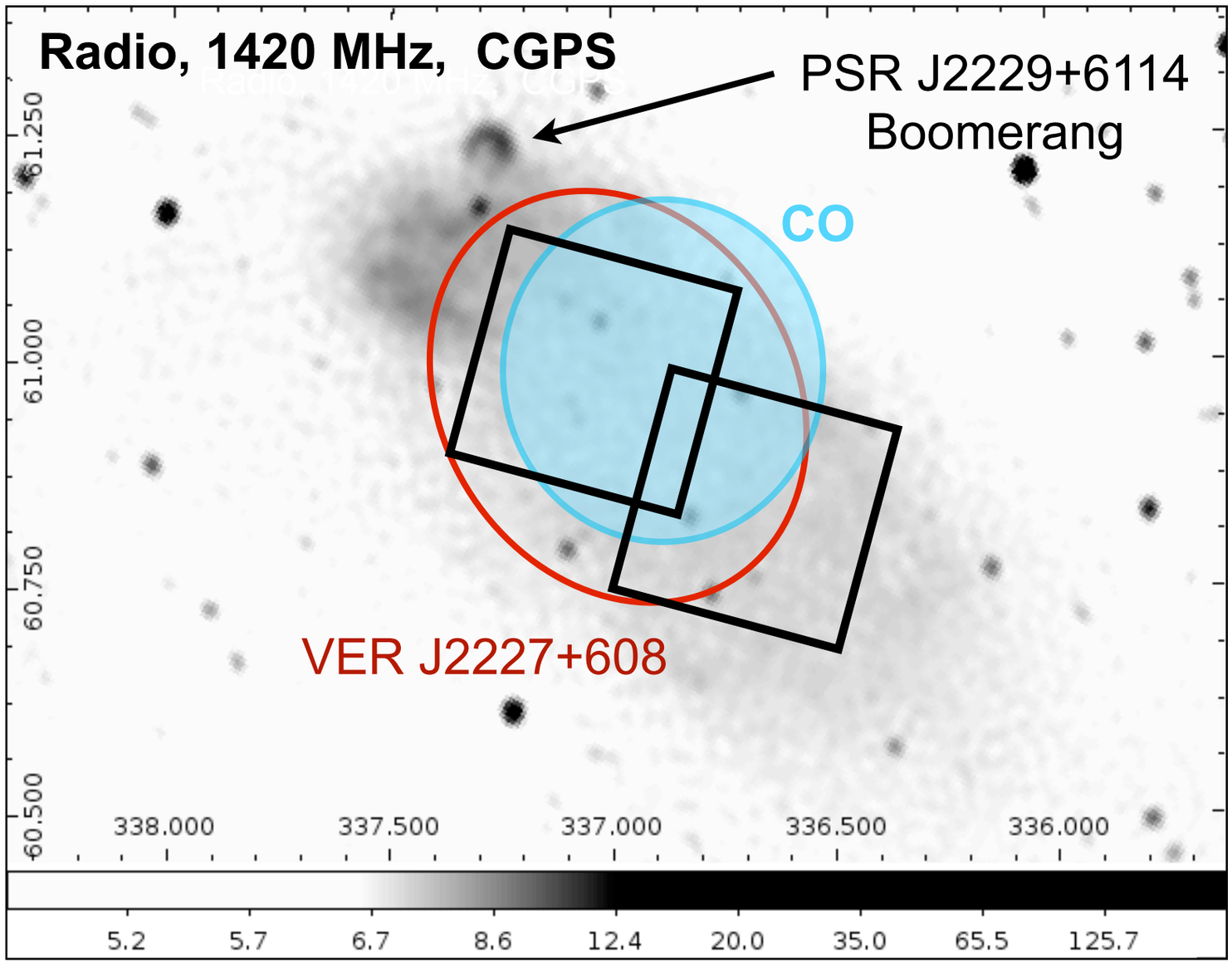
OUTLINE

Suzaku X-ray mapping of SNR G106.3+2.7

Collaborators: Gotthelf & Halpern (Columbia U.), Wakely (U. Chicago), Roberts (Eureka Scientific)

PI Aliu, Suzaku Cycle AO5, Awarded 100 ks

- Search for diffuse X-ray emission to discriminate between the two proposed mechanisms for gamma-ray production in the region

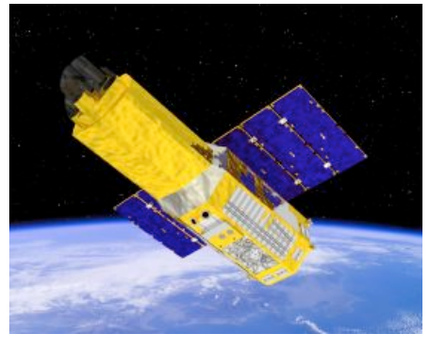


Resolving Milagro Diffuse TeV sources with VERITAS

E. ALIU
Barnard College

OUTLINE

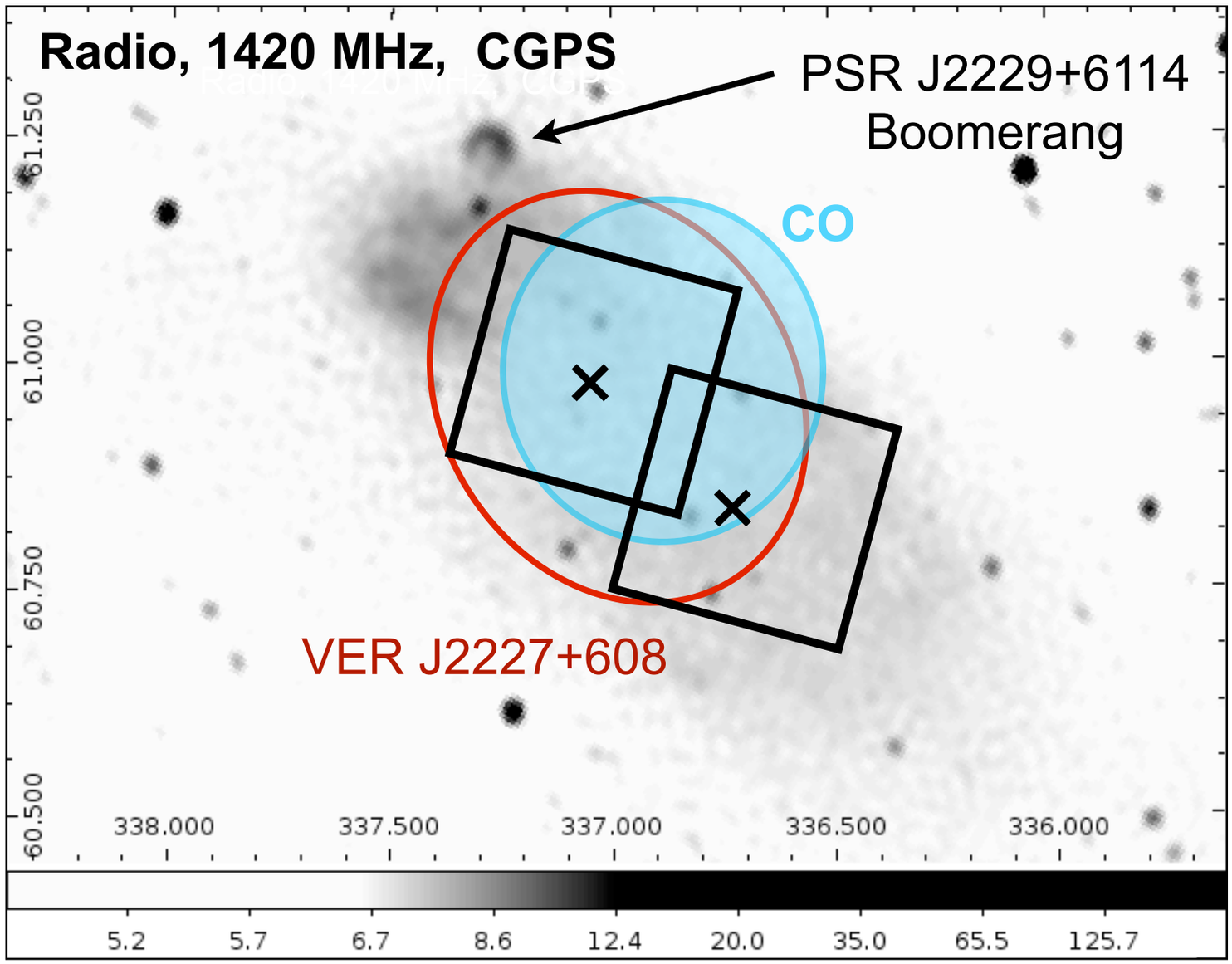
Suzaku X-ray mapping of SNR G106.3+2.7



PI Aliu, Suzaku Cycle AO5, Awarded 100 ks

Collaborators: Gotthelf & Halpern (Columbia U.), Wakely (U. Chicago), Roberts (Eureka Scientific)

- Search for diffuse X-ray emission to discriminate between the two proposed mechanisms for gamma-ray production in the region



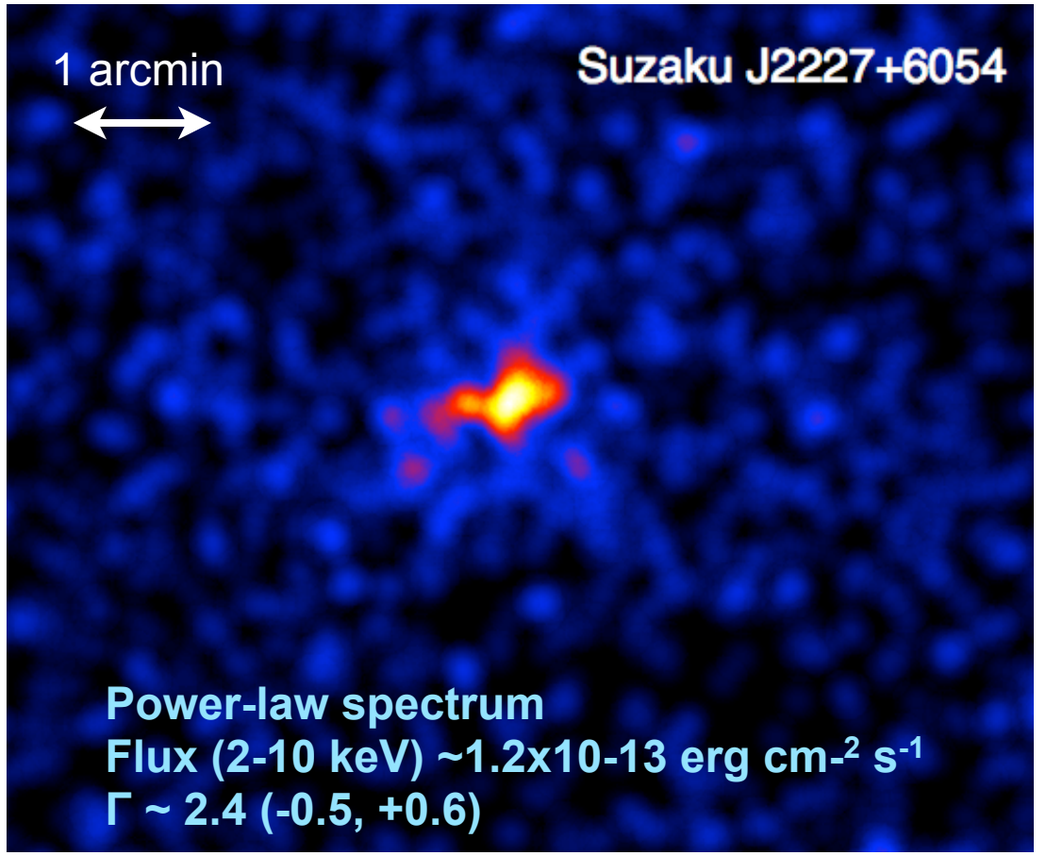
Resolving Milagro Diffuse TeV sources with VERITAS

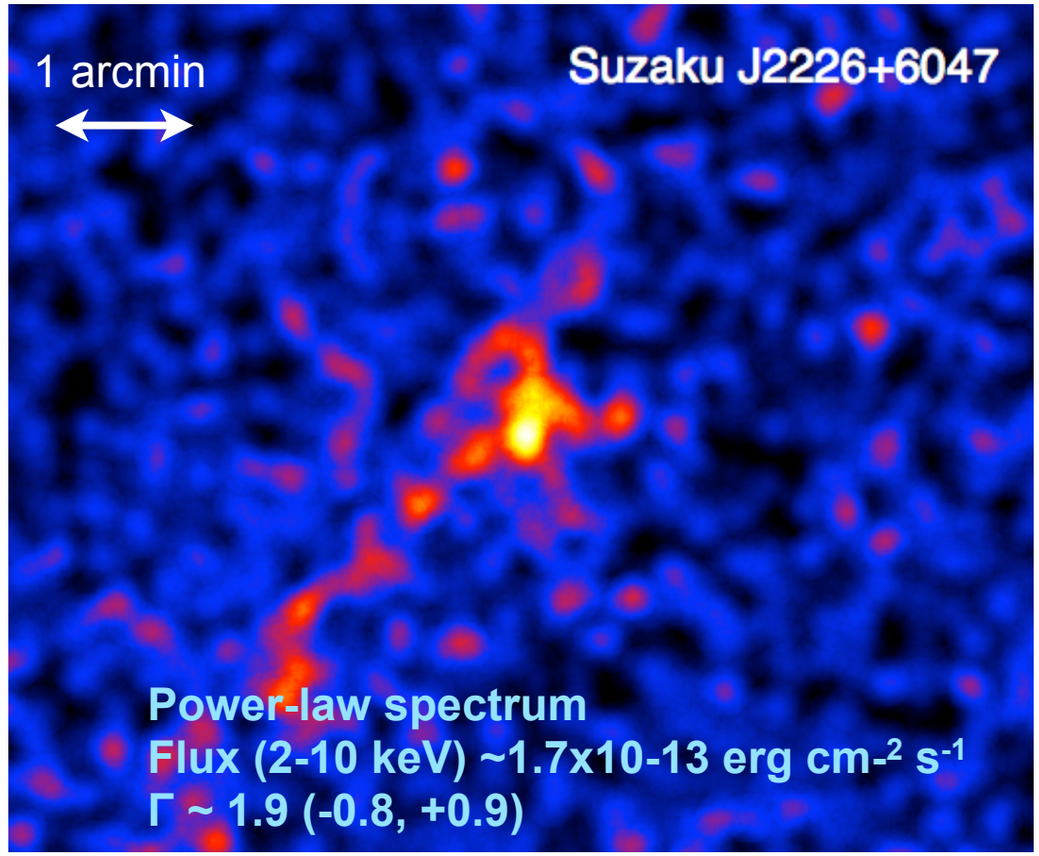
E. ALIU
Barnard College

OUTLINE

Two new pulsar candidates for MGRO J2228+61

Aliu et al. in preparation





- Is SNR G106.3+2.7 really connected to PSR J2229+6114 & Boomerang ?
- Is this another complex/busy region on the plane ?

Next Step?

Identify the new X-ray sources with Chandra (arcsec resolution) - approved targets for this year !

Rethink TeV interpretation, and also that of SNR

Better imaging in radio (eVLA) and TeV (VERITAS) of the whole region

To take home

- VERITAS has **improved the location of the TeV gamma-rays** from two Milagro sources, MGRO J2019+37 and MGRO J2228+61.

- This improved location, extended in nature as well, has been used to search for counterparts at other wavelengths.

- **MGRO J2019+37 is a very crowded place of the Cygnus region**, the extended TeV emission is likely the result of source confusion, being pulsar wind nebulae responsible for a significant fraction of it.

- **MGRO J2228+61 is an understudied region in the direction of the Cepheid clouds.** The identification of the newly discovered hard X-ray sources and a better imaging of the radio and TeV emission might allow to confirm another crowded region.

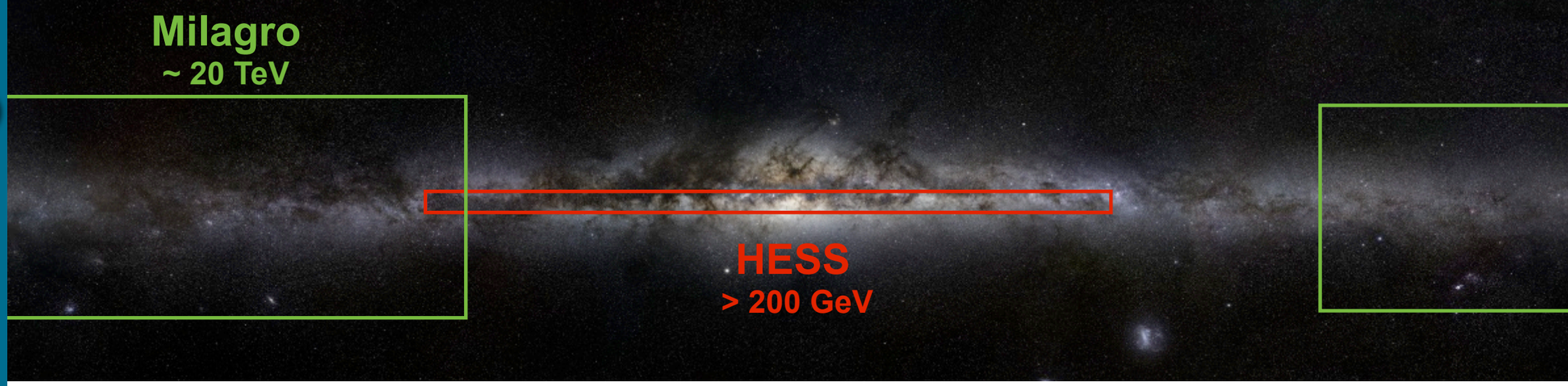
Thanks !

BACKUP SLIDES

Resolving Milagro Diffuse TeV sources with VERITAS

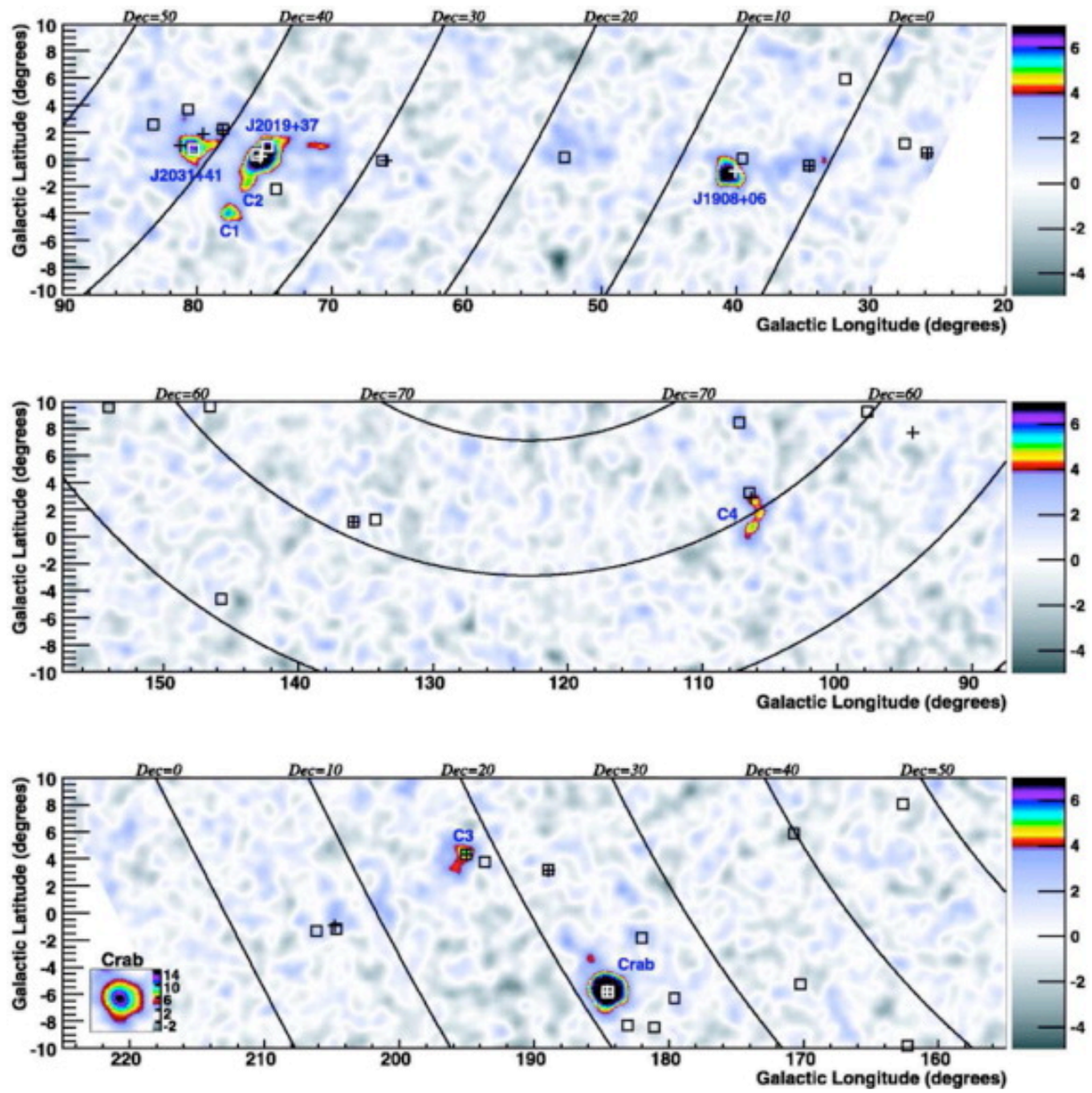
E. Aliu
Barnard College

OUTLINE



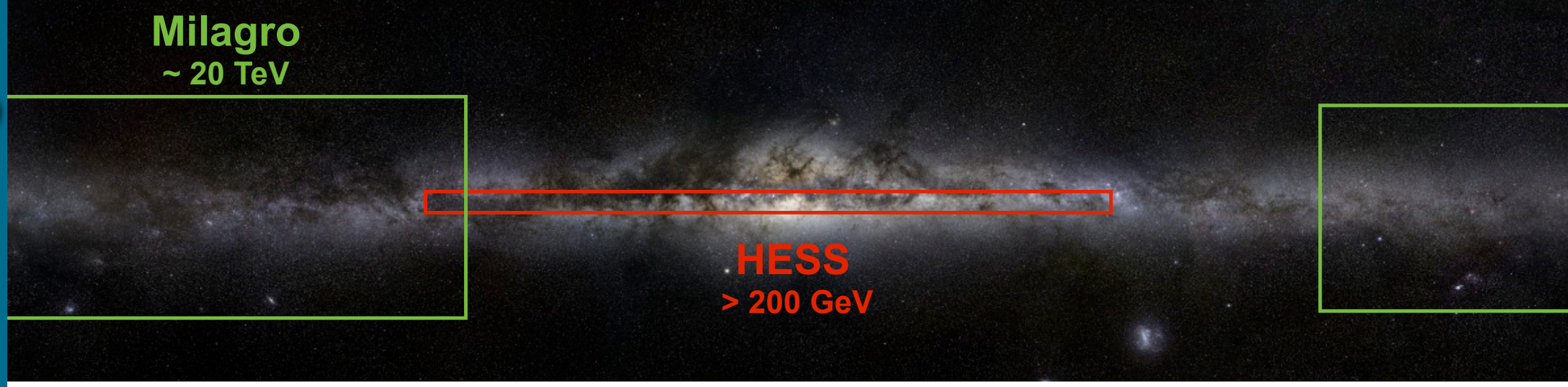
- 8 years of survey
- Crab Nebula and **7 new TeV sources** along the Plane
- Extents 1.1° - 3.5° , fluxes 25% - 80% C.U.
- **Many counterparts for each source**
- Exploited a **new technique to detect TeV gamma-rays**

Milagro Collaboration
ApJ 664:L91-L94 (2007)



Resolving Milagro Diffuse TeV sources with VERITAS

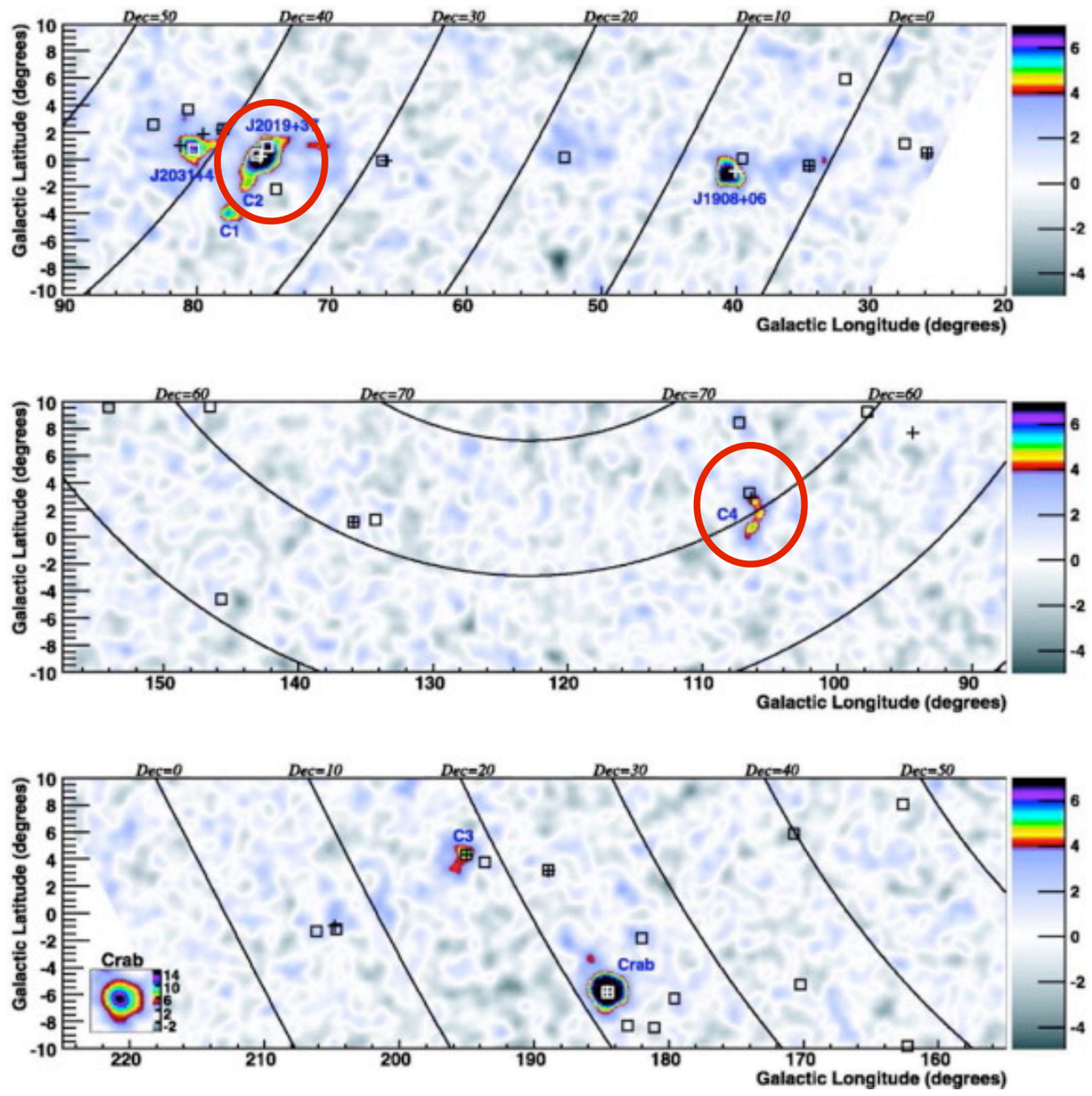
E. Aliu
Barnard College



OUTLINE

- 8 years of survey
- Crab Nebula and **7 new TeV sources** along the Plane
- Extents 1.1° - 3.5° , fluxes 25% - 80% C.U.
- **Many counterparts for each source**
- Exploited a **new technique to detect TeV gamma-rays**

Milagro Collaboration
ApJ 664:L91-L94 (2007)



Resolving Milagro Diffuse TeV sources with VERITAS

E. Aliu
Barnard College

OUTLINE

TeV Experiments

Imaging Air Cerenkov Telescopes
Cherenkov light in the EAS
- large mirrors, stereoscopic technique, fine pixels, fast cameras (~ns)

Particle detectors - particles in the EAS
- RPC, water cherenkov detectors

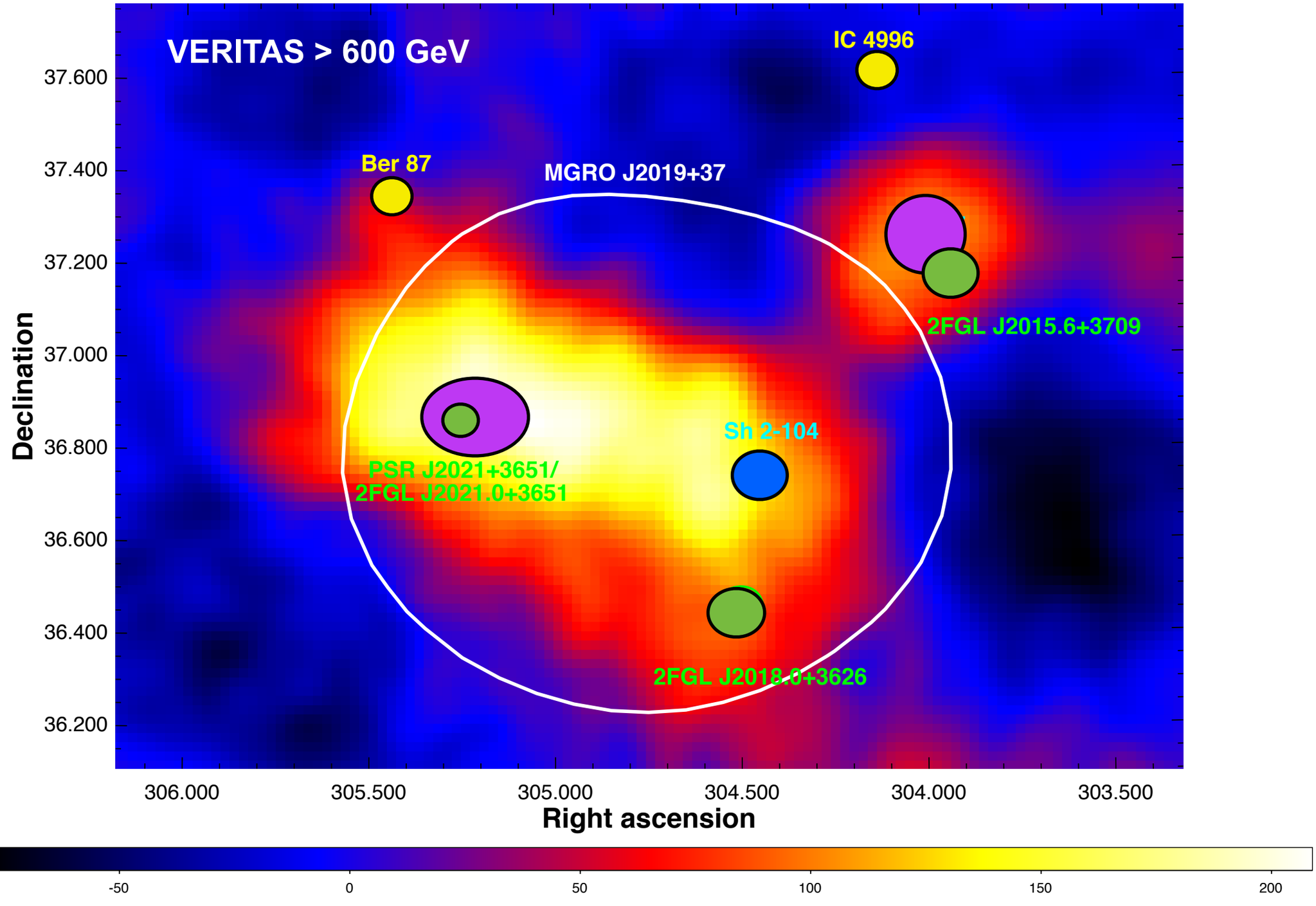
Large FoV, overhead sky
High duty cycle
Poor Angular resolution ~0.5 deg

Small FoV (3.5°- 5°), limited survey regions
Observing during clear, moonless nights
Angular resolution < 0.1deg ~ 5’

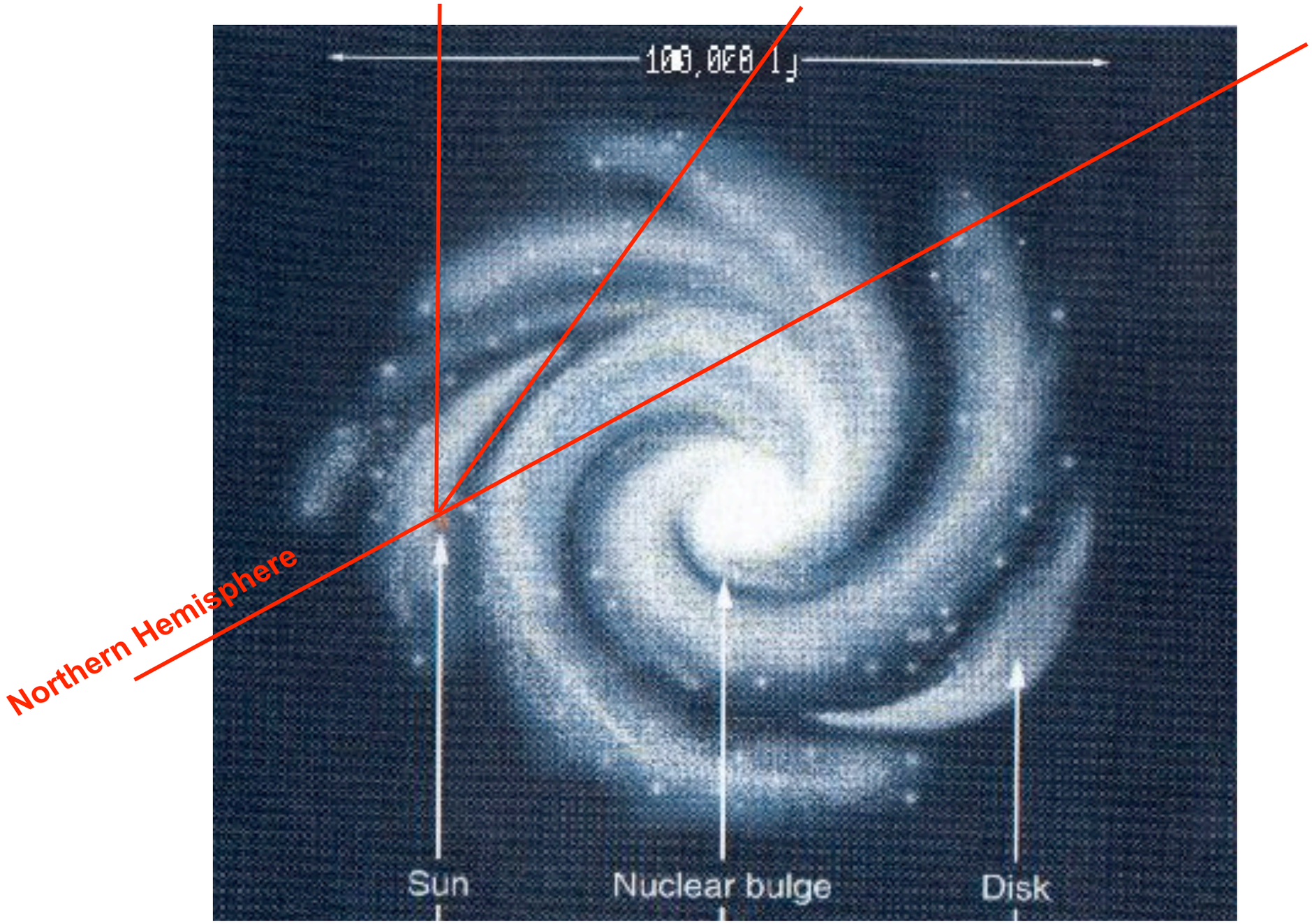
Search radius ~ 0.23 deg (standard extended source search)

VERITAS Coll. in preparation

- Some emission starts to be resolved
- Extended elongated emission in the center (~8.2 σ)



Cygnus Region



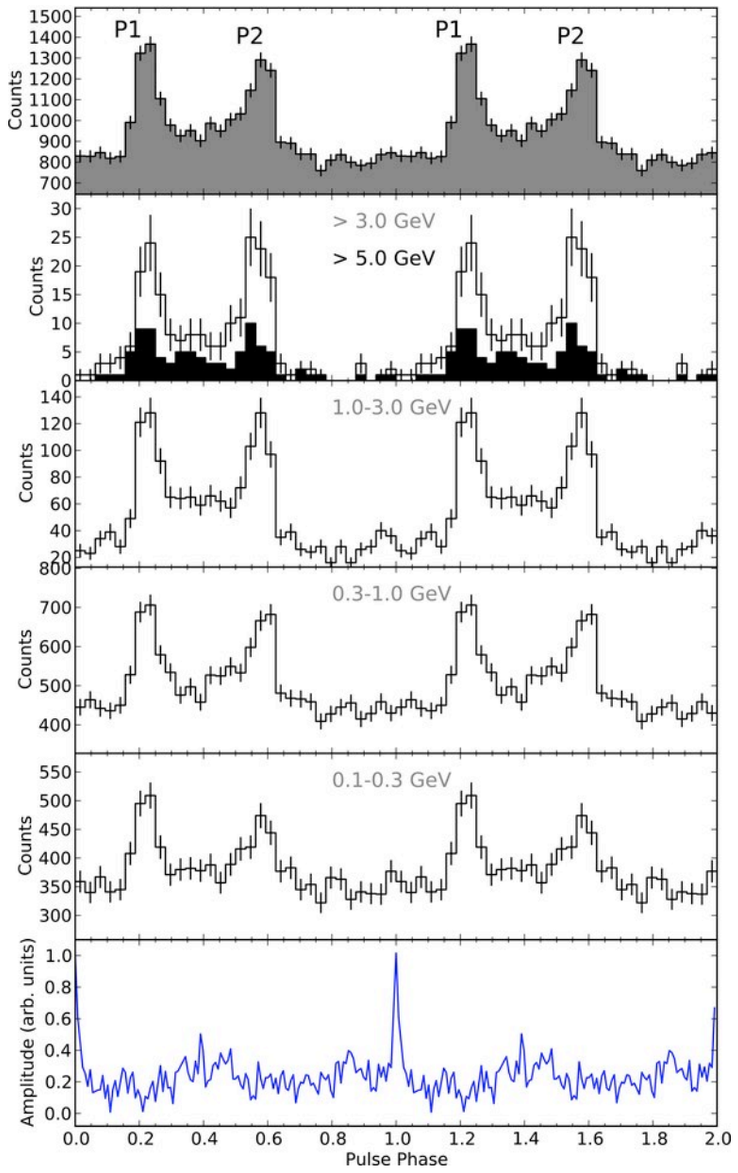
New pulsars coincident with Milagro sources and hotspots

Resolving Milagro Diffuse TeV sources with VERITAS

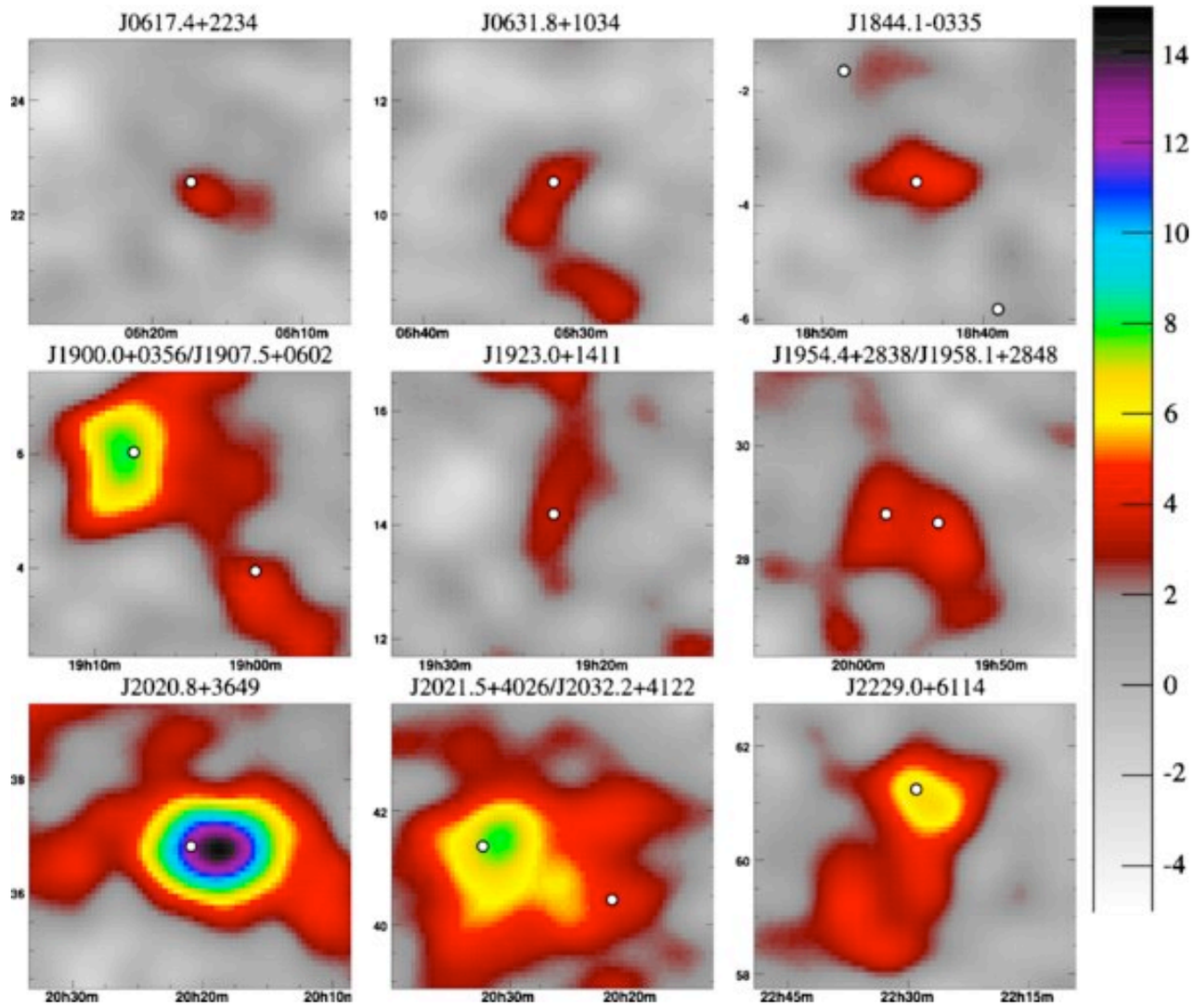
E. Aliu
Barnard College

Fermi Collab. Science 325:840 (2009)

A radio faint gamma-ray pulsar found within the extent of MGRO J1908+06



Milagro Coll. ApJ 700L:127 (2009)



Correlation between Fermi sources and Milagro significance > 3σ is dominated by pulsars

Resolving Milagro Diffuse TeV sources with VERITAS

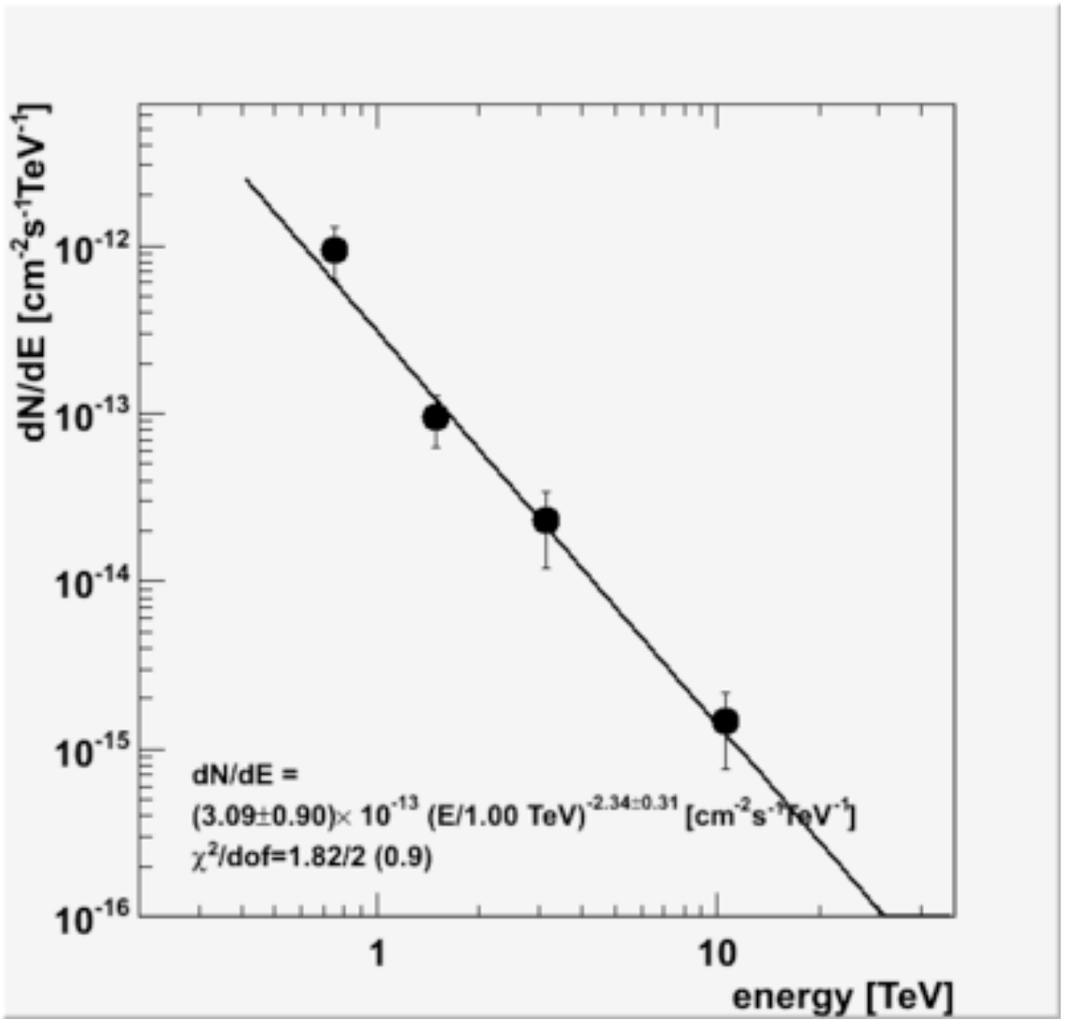
E. Aliu
Barnard College

CTB 87, energetics

VERITAS Coll. in preparation

Collaborators: **Kargaltsev (U. Florida)**

- Unknown spindown energy
- X to TeV luminosity similar to other detected TeV PWNe



Power-law spectrum
for both TeV and X-rays

$\Gamma_g = 2.34 \pm 0.31_{stat}$

$L_{g(1\text{-}10\ TeV)} =$
1.15×10^{33} erg/s

$\Gamma_x = 1.60 \pm 0.04_{stat}$

$L_{x(0.5\text{-}8\ keV)} =$
$(1.02 \pm 0.05) \times 10^{34}$ erg/s

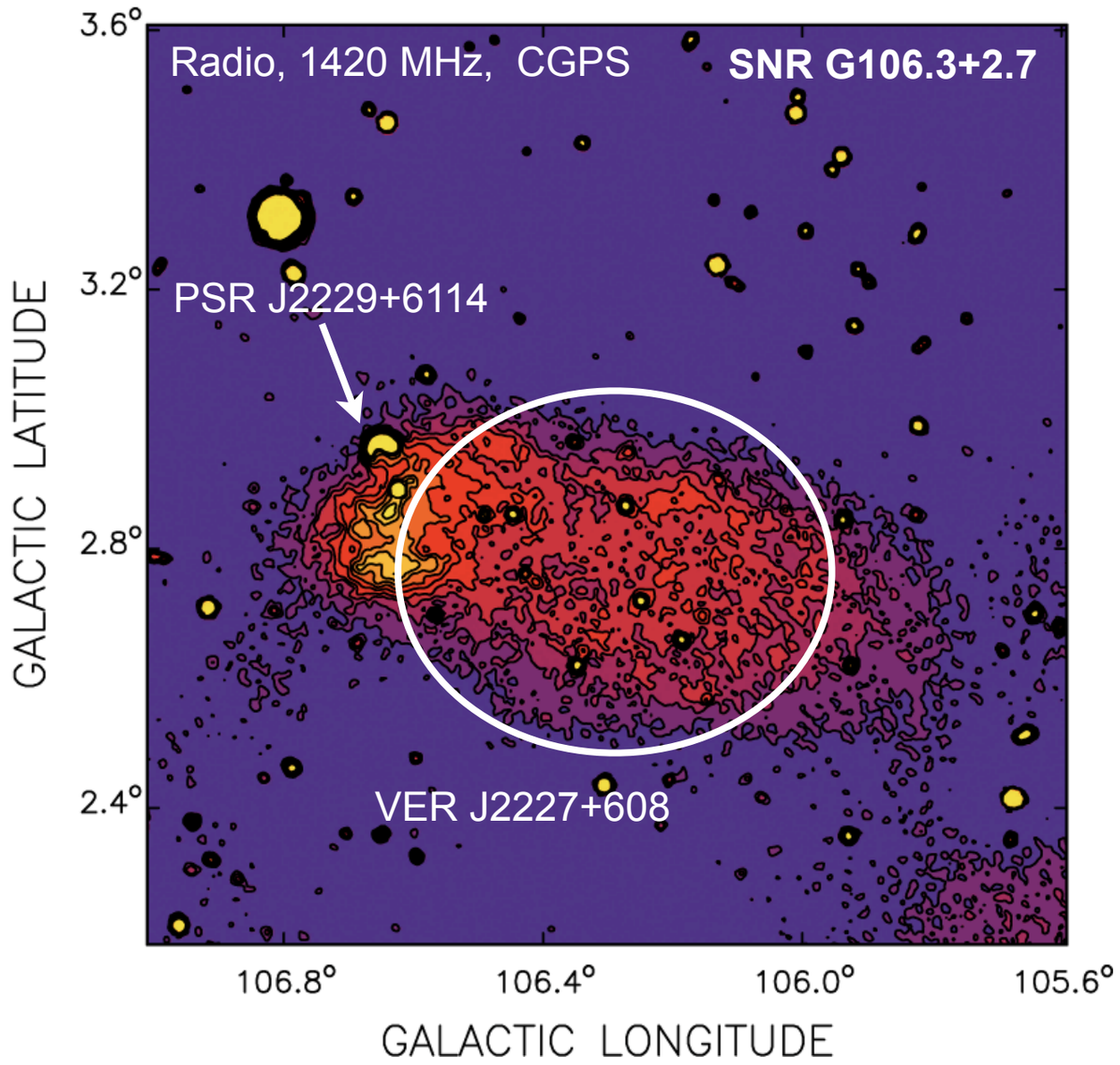
Lx/Lg ~ 10

TeV interpretation: leptonic vs hadronic

VERITAS Coll. ApJ 703:L6 (2009)

- VERITAS detected extended emission (0.4° x 0.6°) south of pulsar
- Coincident with SNR G106.3+2.7 and a molecular cloud

  ➔ **SNR interaction with dense medium ?**
- Spectrum extrapolation compatible with the Milagro flux point at 35 TeV

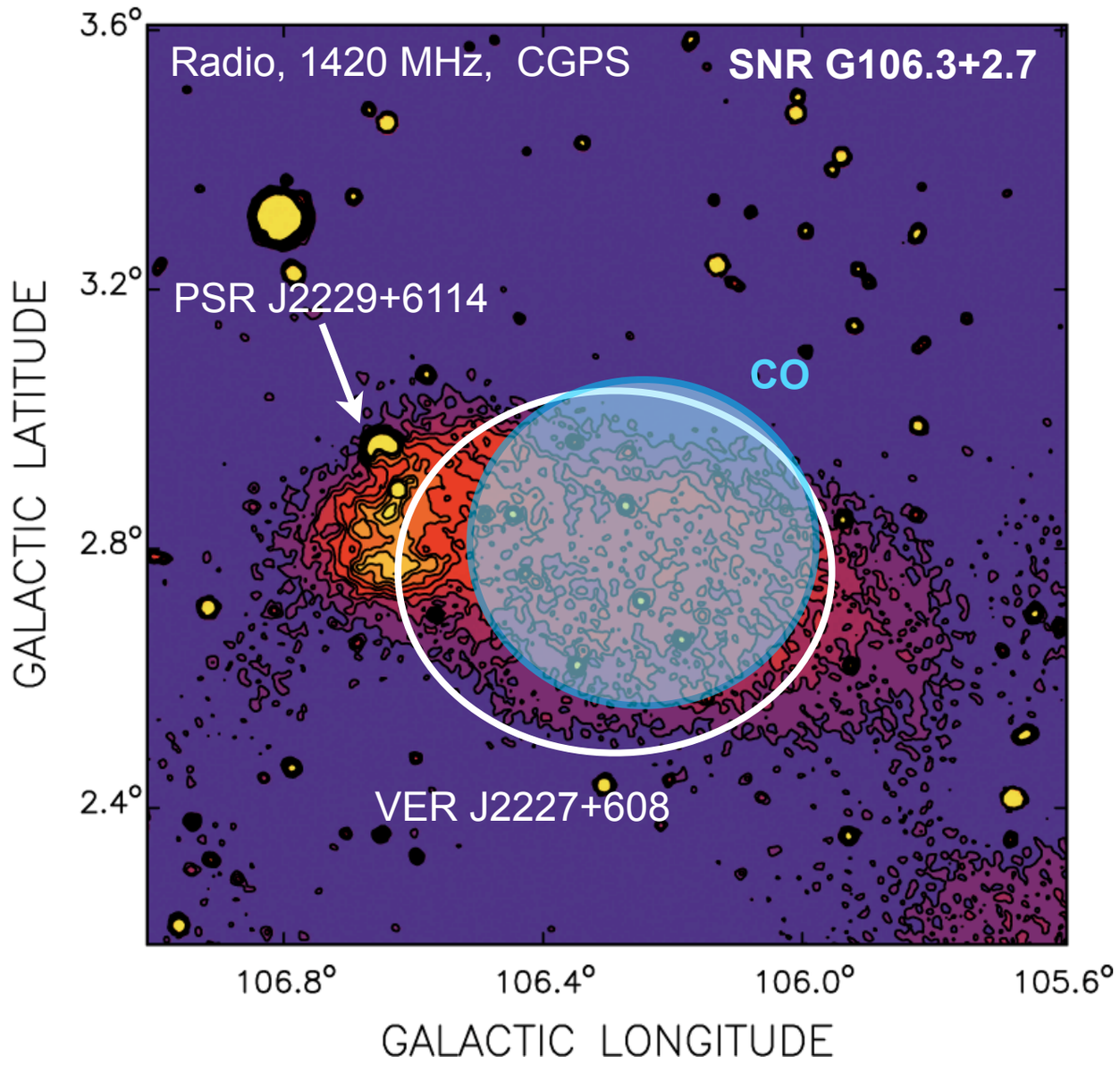


TeV interpretation: leptonic vs hadronic

VERITAS Coll. ApJ 703:L6 (2009)

- VERITAS detected extended emission (0.4° x 0.6°) south of pulsar
- Coincident with SNR G106.3+2.7 and a molecular cloud

  ➔ **SNR interaction with dense medium ?**
- Spectrum extrapolation compatible with the Milagro flux point at 35 TeV



Resolving Milagro Diffuse TeV sources with VERITAS

E. Aliu
Barnard College

OUTLINE

TeV interpretation: leptonic vs hadronic

VERITAS Coll. ApJ 703:L6 (2009)

- VERITAS detected extended emission (0.4° x 0.6°) south of pulsar
- Coincident with SNR G106.3+2.7 and a molecular cloud

  ➔ **SNR interaction with dense medium ?**
- Spectrum extrapolation compatible with the Milagro flux point at 35 TeV