HAWC Observatory: Status

David Guevel for the HAWC Collaboration

Lake Louise Winter Institute

March 5, 2026

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High Altitude Water Cherenkov
Gamma-Ray Observatory

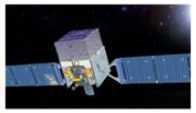
1885 Michigan Tech

Gamma-Ray Observatory Landscape

- Wide field of view
- High duty cycle (~95%)
- Good sensitivity

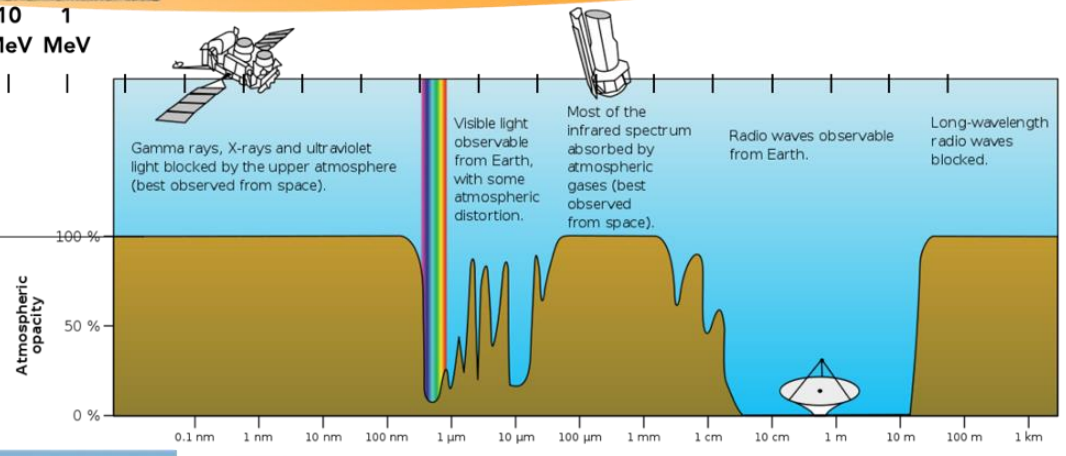
100 TeV | 10 TeV | 1 TeV | 100 GeV | 10 GeV | 1 GeV | 100 MeV | 10 MeV | 1 MeV

HAWC



LHAASO | Fermi-LAT

IACTs



- Narrow field of view
- Limited duty cycle (~15%)
- Excellent sensitivity

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HAWC Gamma-Ray Observatory

Pico de Orizaba
Puebla, Mexico (19°N)

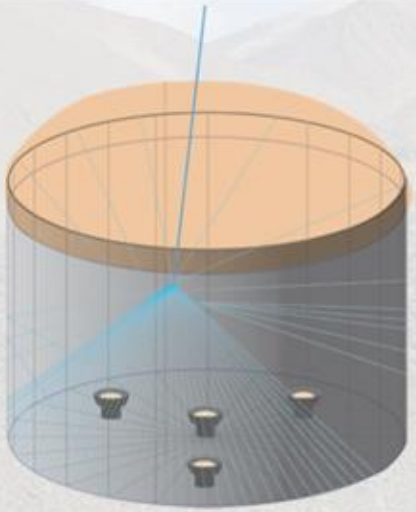
Energy range:
~300 GeV - >100TeV

Field of view:
45° from zenith

Observing time:
>95% of the time

Angular resolution:
~0.1° - 1°

300 ×



5m tall, 7.3 m diameter
~200,000 L of water

4 PMTs facing upwards collect Cherenkov light produced by secondary particles

22,000 m²

T-rex for scale

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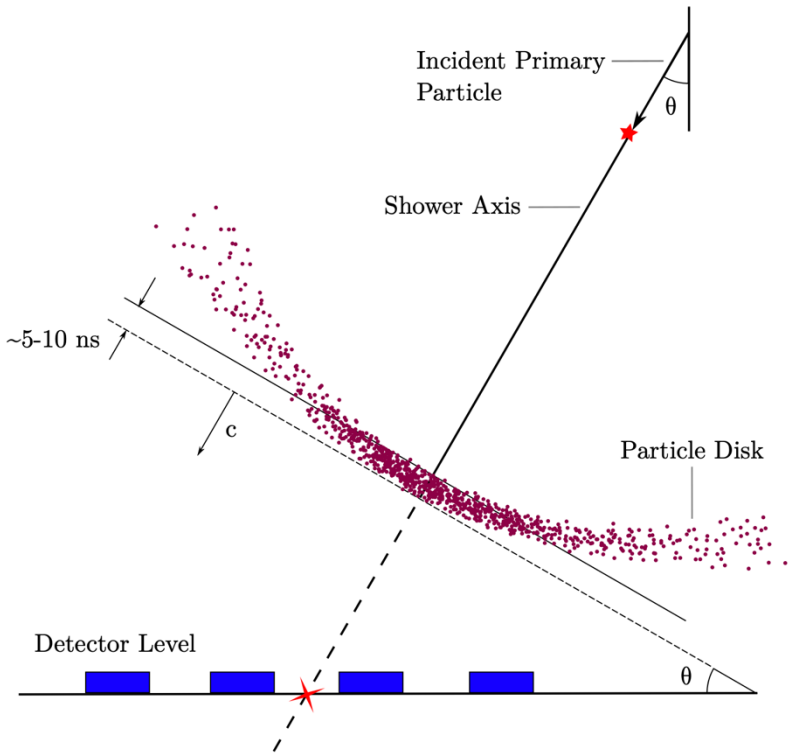
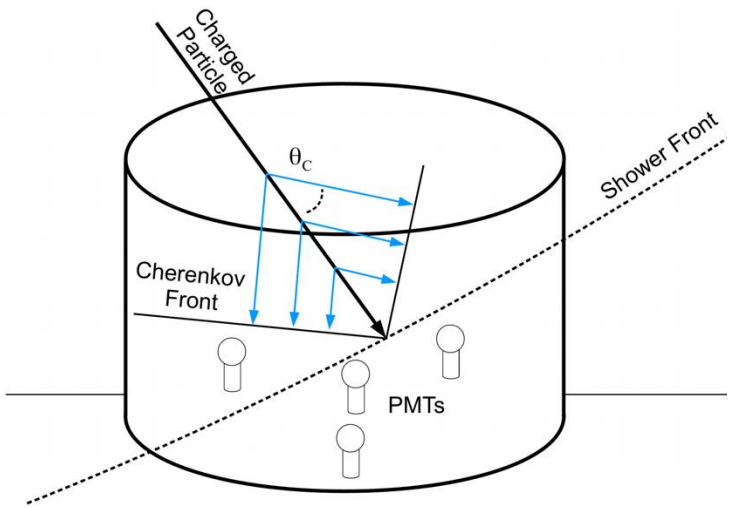
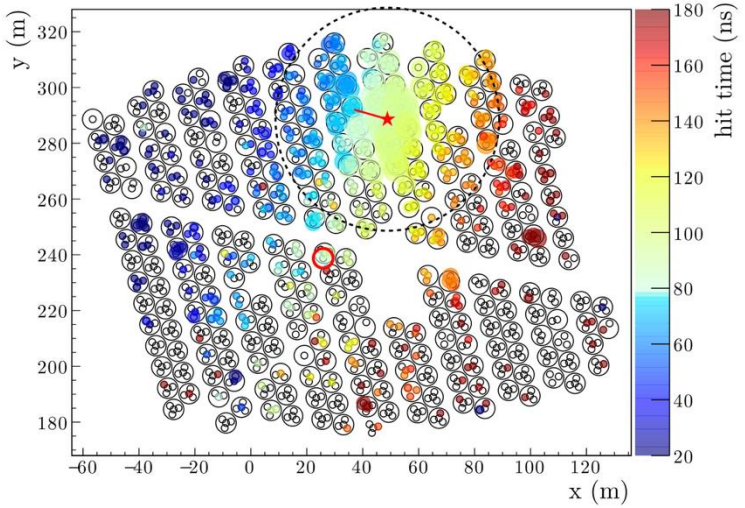
4,100 m.a.s.l.

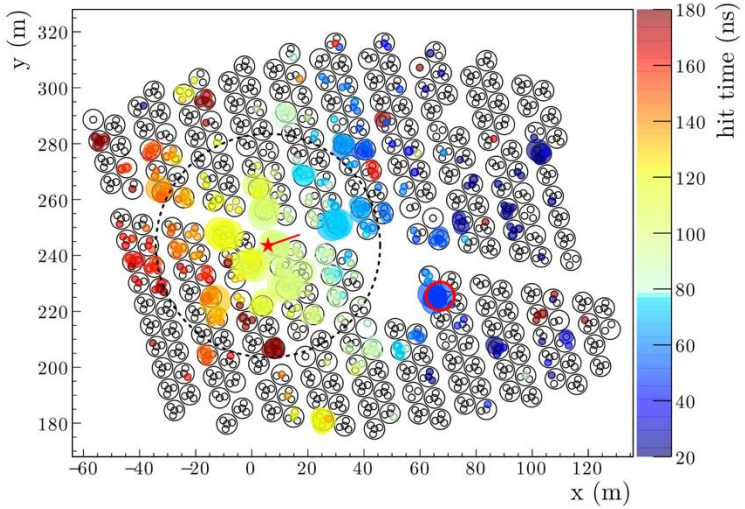
Extensive Air Showers







Smooth, symmetric gamma-ray EAS footprint



Clumpy, asymmetric cosmic-ray EAS footprint

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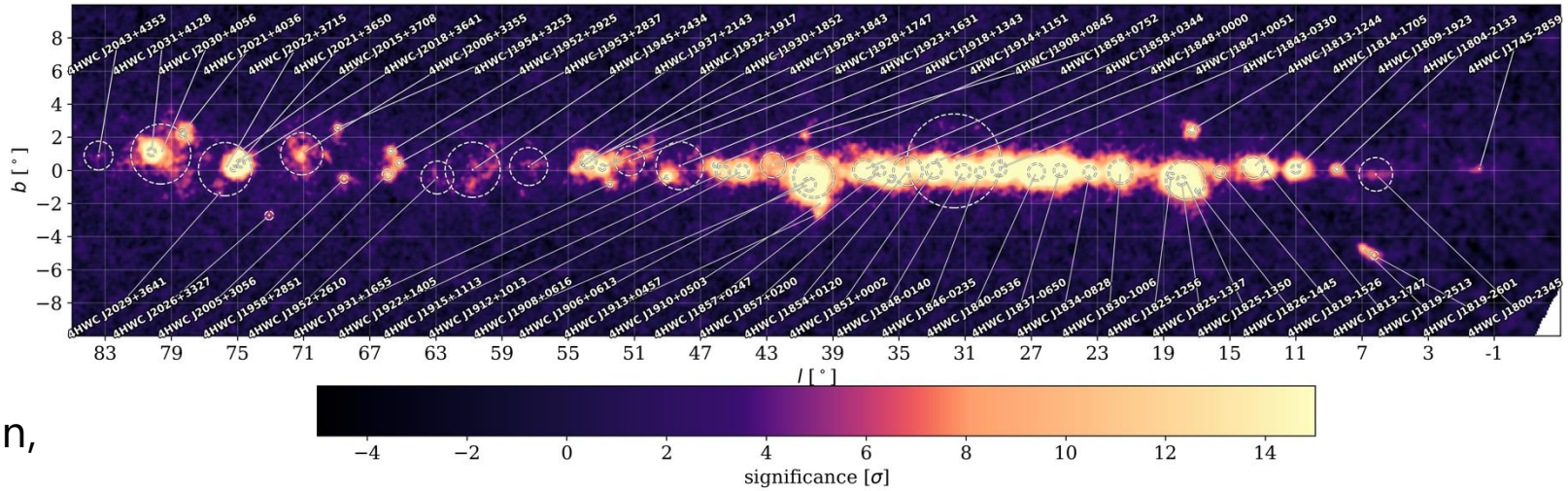
4HWC Catalog

- Fourth HAWC catalog (4HWC) is posted to arXiv.
- 85 sources found:
  - 22 supernova remnants
  - 34 pulsars
  - 5 low mass X-ray binaries
  - 9 high mass X-ray binaries
  - 15 without galactic association, 5 at high galactic latitude



Alfaro et al 2025 arXiv:2602.00263

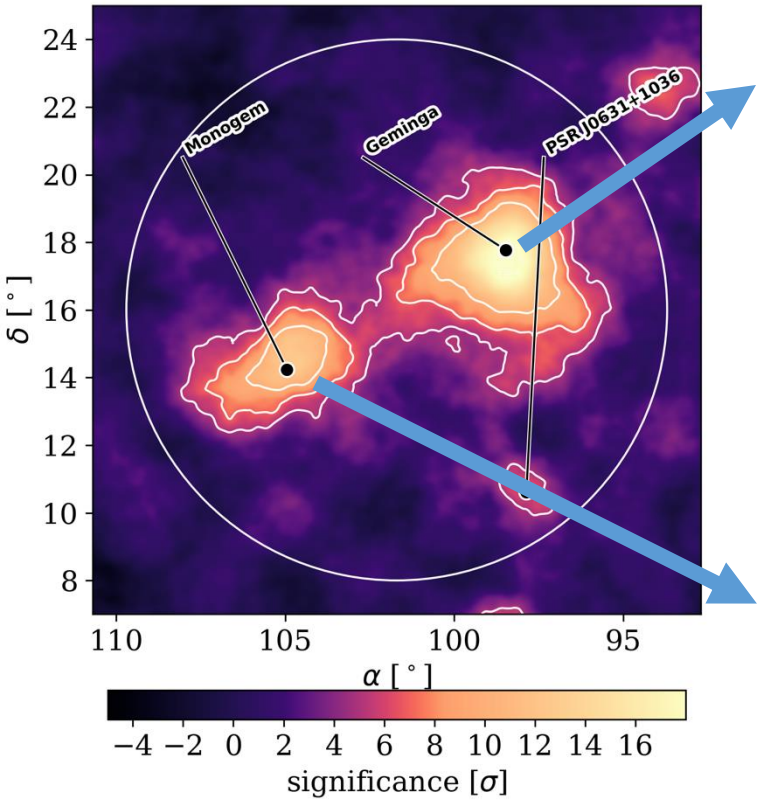
Data Release Plans

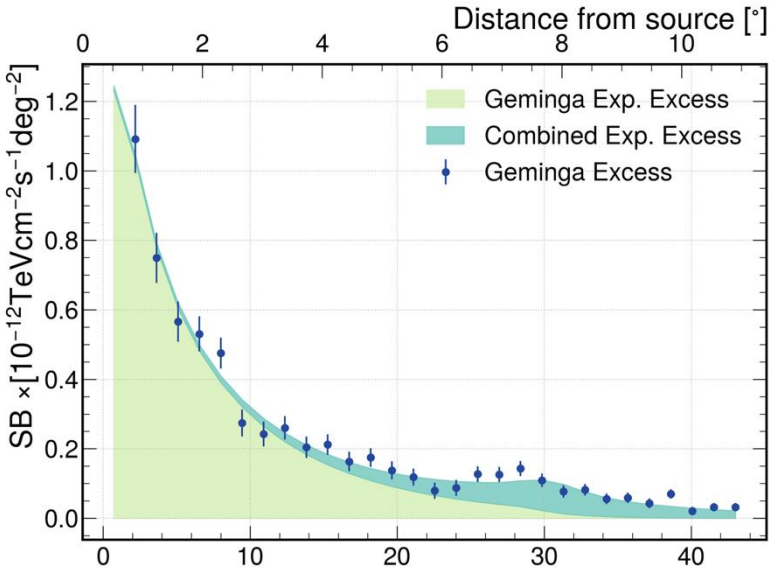
- Data release planning is in early stages.
- Two phases release are planned.
  - Phase A (late 2026): Pass 5 daily and integrated maps and analysis software for 3ML and GammaPy.
  - Phase B (2027): Pass 6 (including outrigger array).

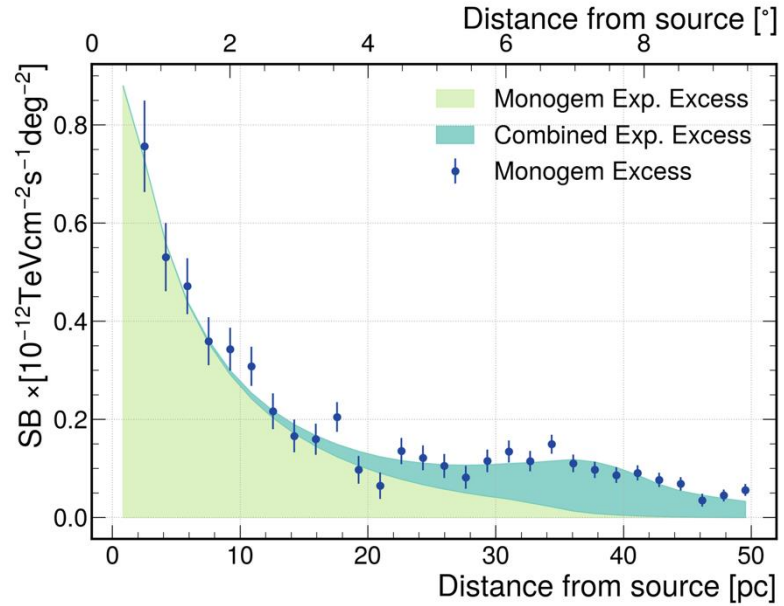
TeV Halos

- 30 pc TeV halos of e^- and e^+ surrounding pulsars.
- TeV emission is produced by e^- and e^+ inverse Compton scattering with CMB.
- Can the e^+ explain the positron excess observed by AMS-02?
  - e^- and e^+ diffusion is 100-1000 times slower than galactic average suggesting that they do not efficiently escape the halo.

Geminga and Monogem Halos





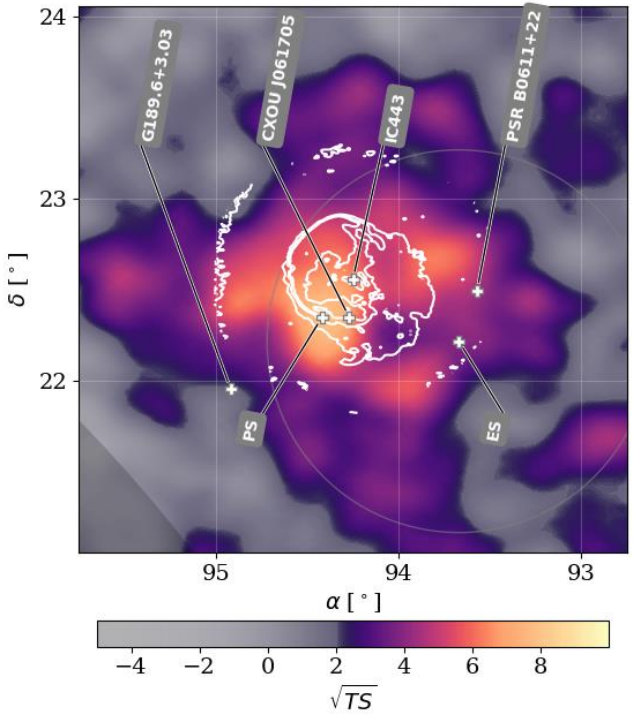


Albert et al 2024 *ApJ* **974** 246
Albert et al 2025 *Phys. Rev. Lett.* **134**, 171005

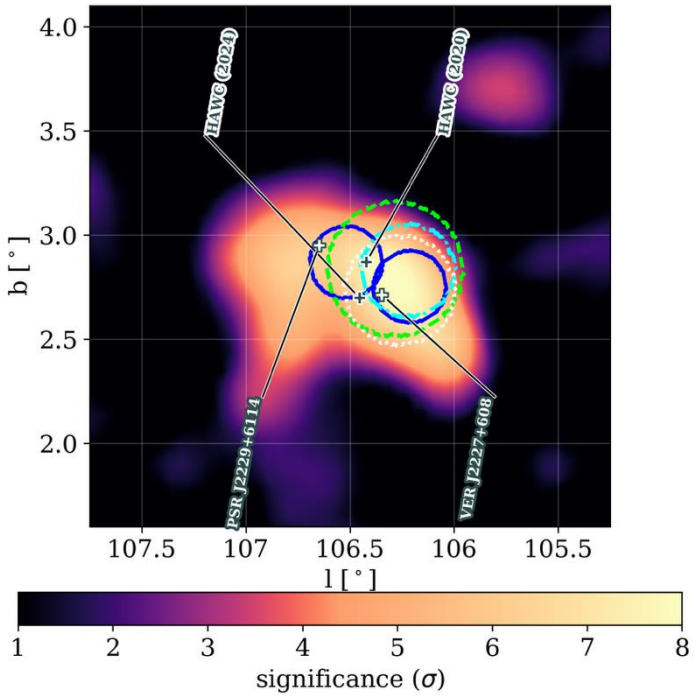
PeV Supernova Remnants

- Rule of thumb: Gamma-rays carry ~10% of the cosmic ray energy (Kelner et al 2006).
- **IC 433**
  - SNR + Molecular cloud.
  - Gamma-rays up to 30 TeV.
- **G106.3+2.7**
  - SNR + PWN + Molecular cloud.
  - >100 TeV gamma-rays suggest >1 PeV proton acceleration.

IC 433

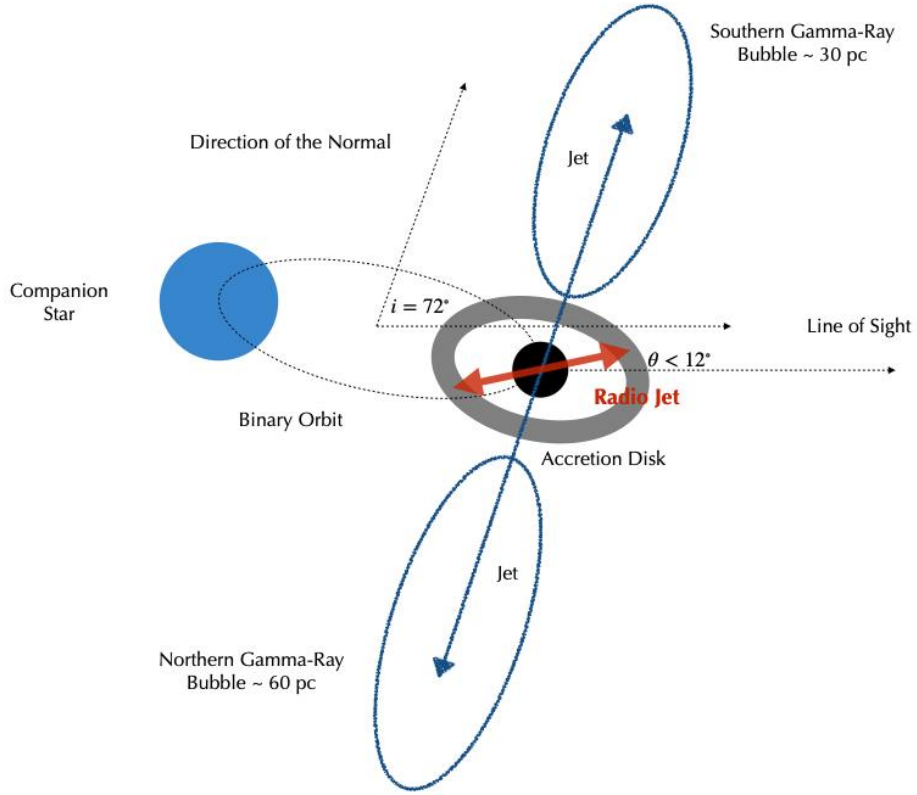


G106.3+2.7

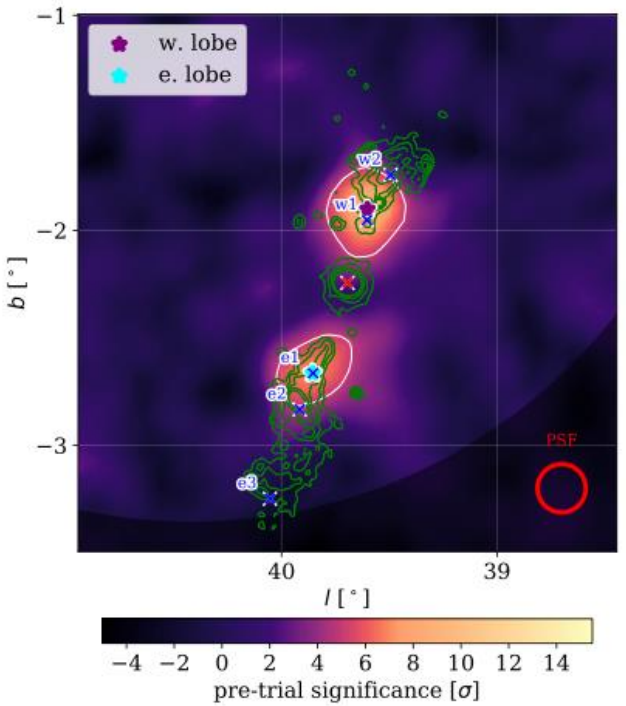


Alfaro et al 2025 *ApJ* **992** 22
Alfaro et al 2024 *A&A* 691, A89

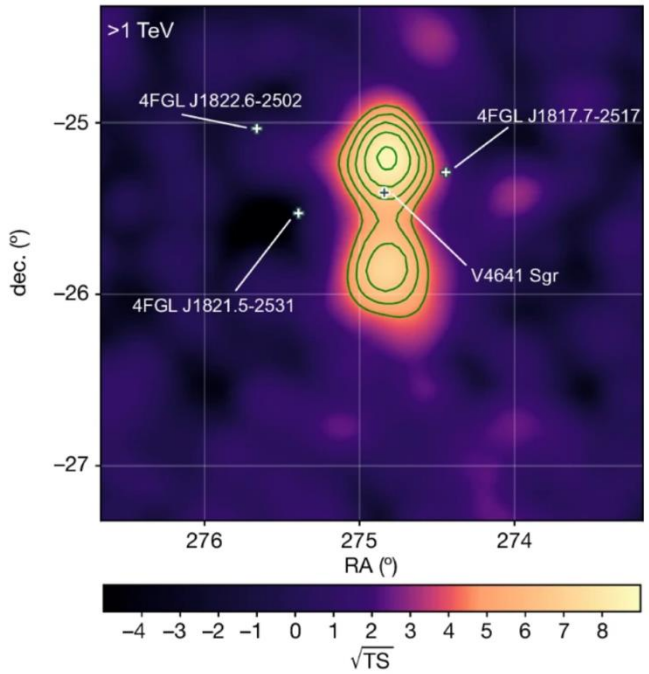
Microquasars



SS 433



V4641 Sgr



Jetted X-ray binary systems show PeV cosmic ray proton production and interaction with molecular clouds.

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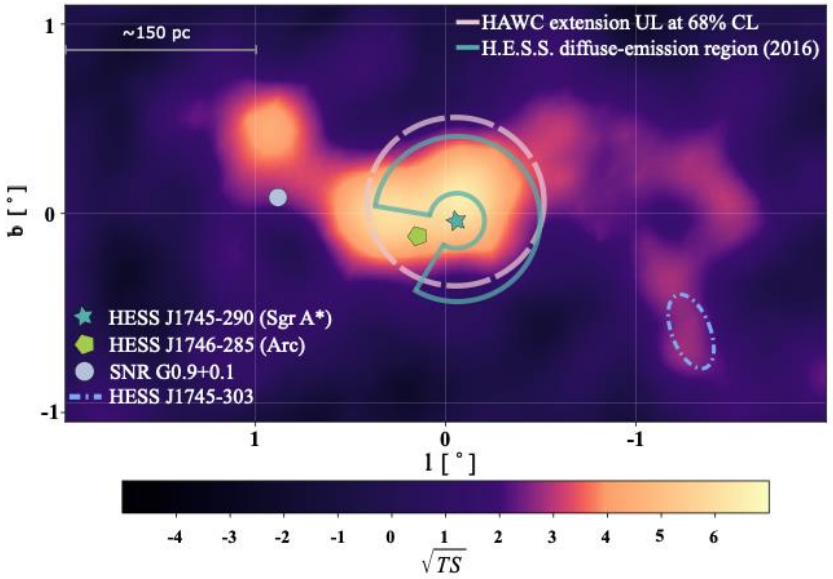
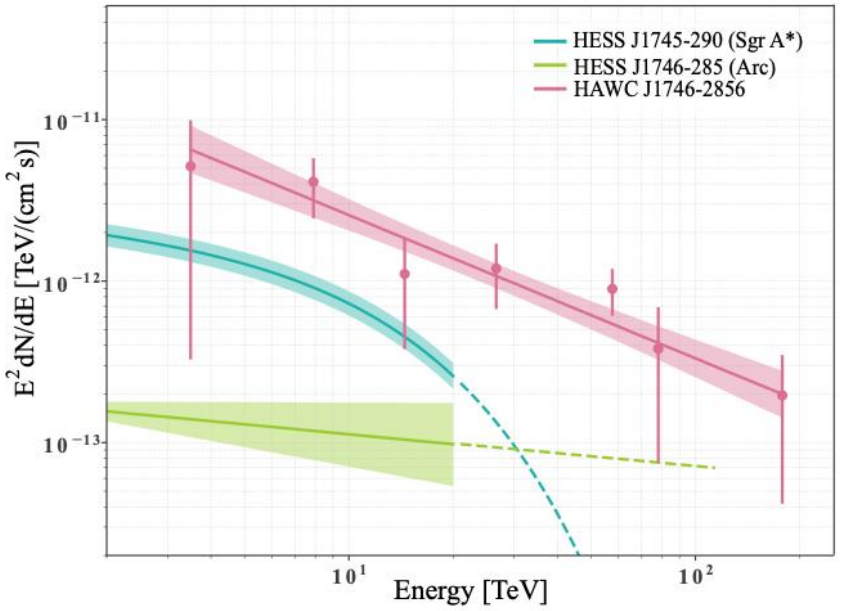
Alfaro et al 2025 *ApJL* **987** L42
Alfaro et al 2024 *ApJ* **976** 30
Alfaro et al 2024 *Nature* **634**, 557–560

Galactic Center PeVatron

- >100 TeV gamma-rays are produced by collisions of PeV cosmic rays with molecular gas.
- The accelerator of PeV cosmic rays is unclear.
  - Sgr A*
  - Young stellar clusters

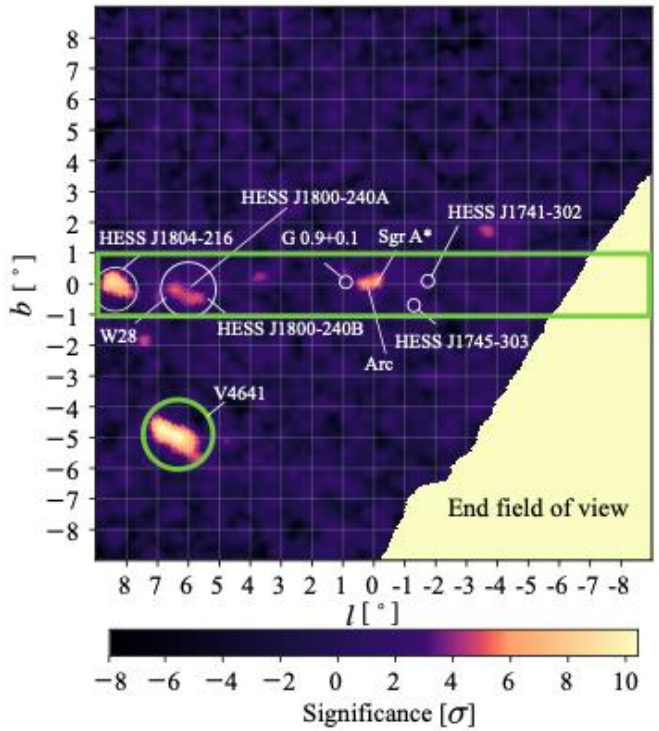


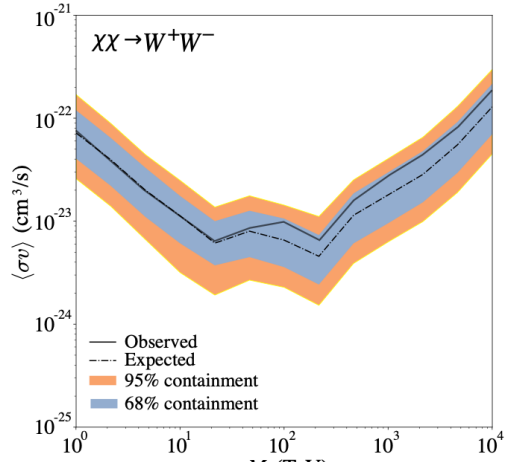


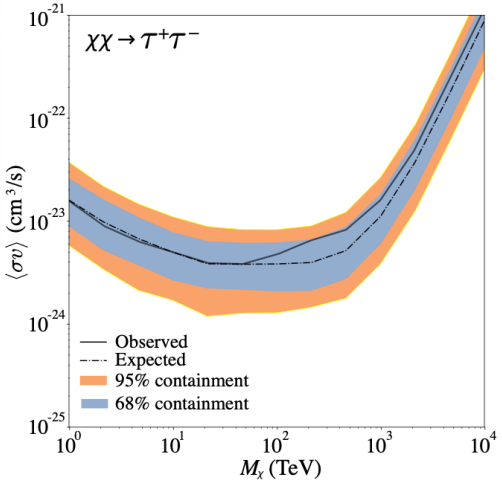
Albert *et al* 2024 *ApJL* **973** L34

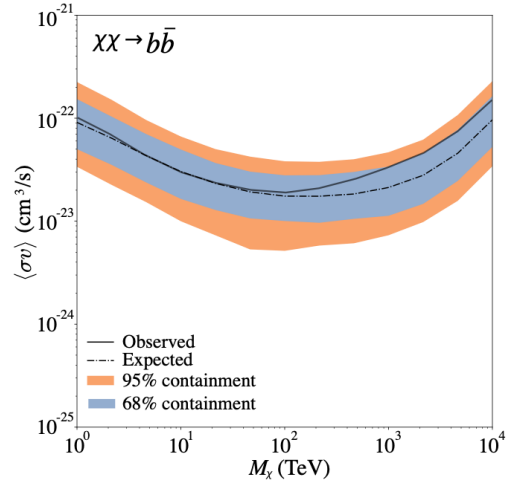
Galactic Center WIMP Search

- Search for dark matter decay through three decay channels.
- Three density profiles:
  - NFW, Einasto, Burkert
- Spectral models from HDMSpectra.
- No evidence for WIMP signatures.









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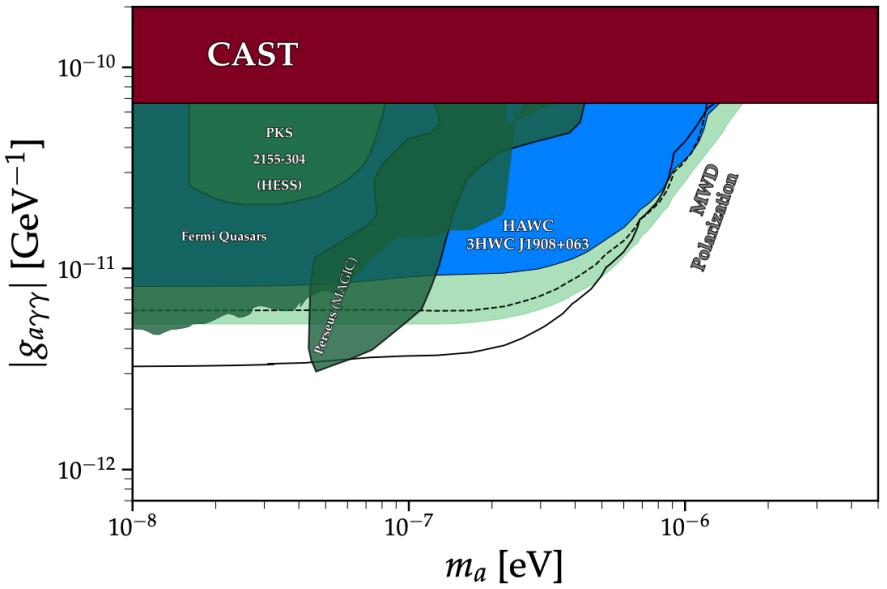
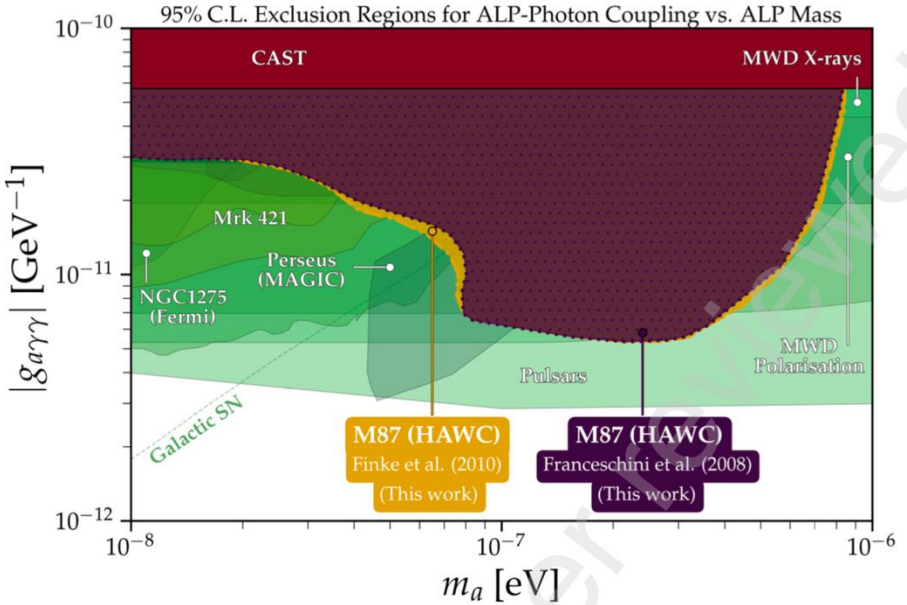
Alfaro et al 2025 arXiv:2509.06210 (Accepted by PRL)

Axion-Like Particle Searches

3HWC J1908+063



M87



Photon-ALP coupling could occur in astrophysical magnetic fields. We searched for ALP signatures from **M87** and **3HWC J1908+063**. No evidence was found.

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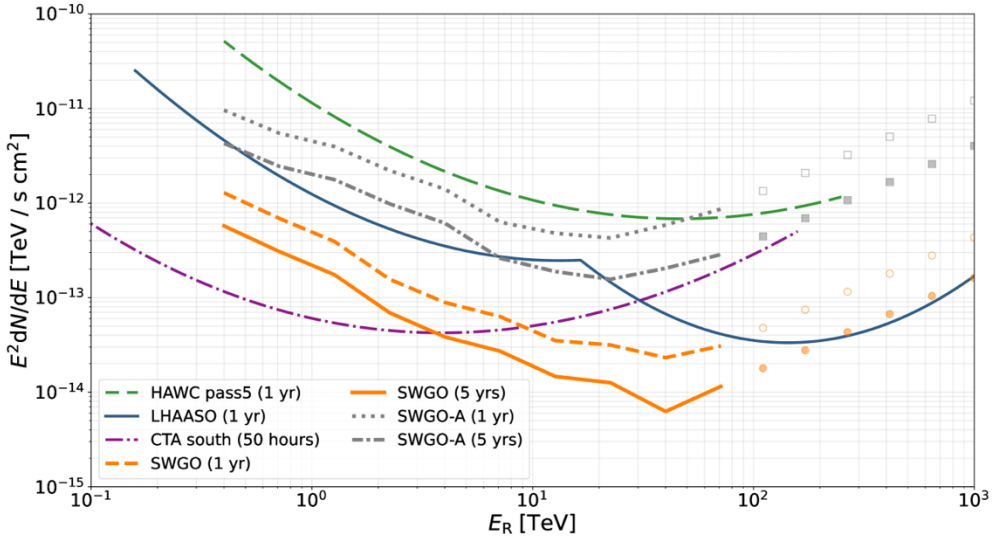
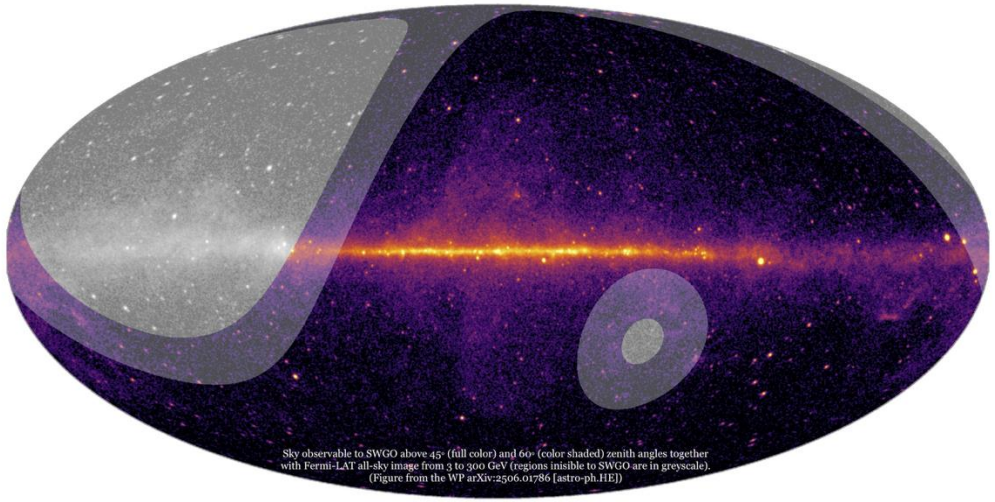
Alfaro et al 2026 arXiv:2601.14661
Serna-Franco et al 2025 SSRN (Accepted by Phys. Dark Univ.)

Southern Wide-Field Gamma-Ray Observatory

- Expected SWGO 1 year sensitivity >10 times HAWC 1 year sensitivity.
- SWGO site in Chile is ideal for galactic astrophysics and dark matter searches in the galactic center.





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SWGO Collaboration et al 2025 arXiv:2506.01786

Summary

- HAWC continues to contribute to multi-messenger and gamma-ray astrophysics as well as particle physics.
- New 4HWC catalog is on arXiv.
- Data release expected late 2026 and 2027.
- SWGO will have improved sensitivity with better galactic plane visibility.

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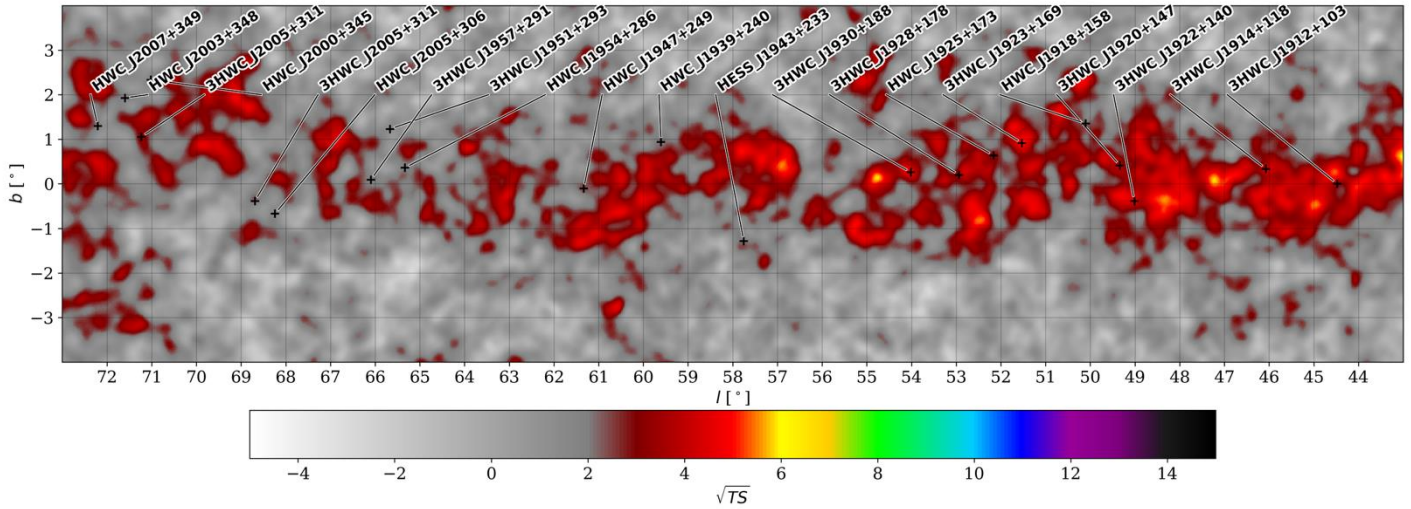
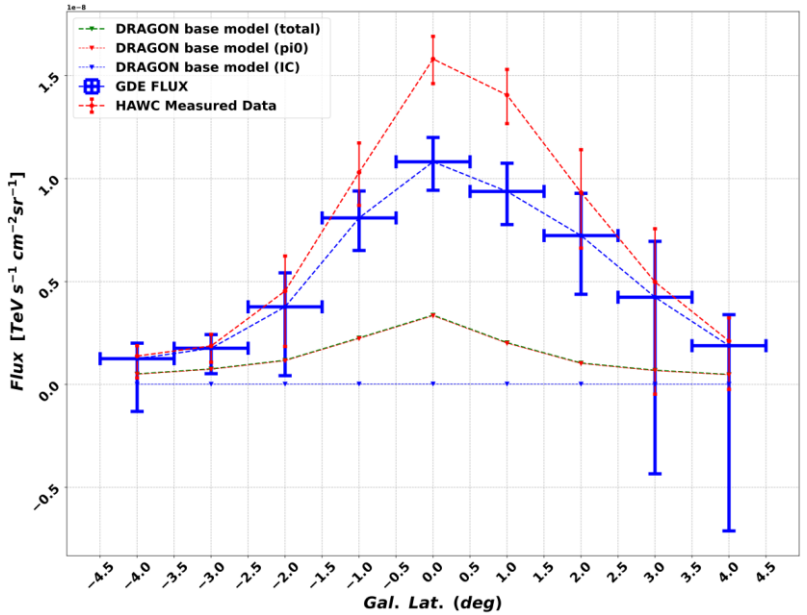
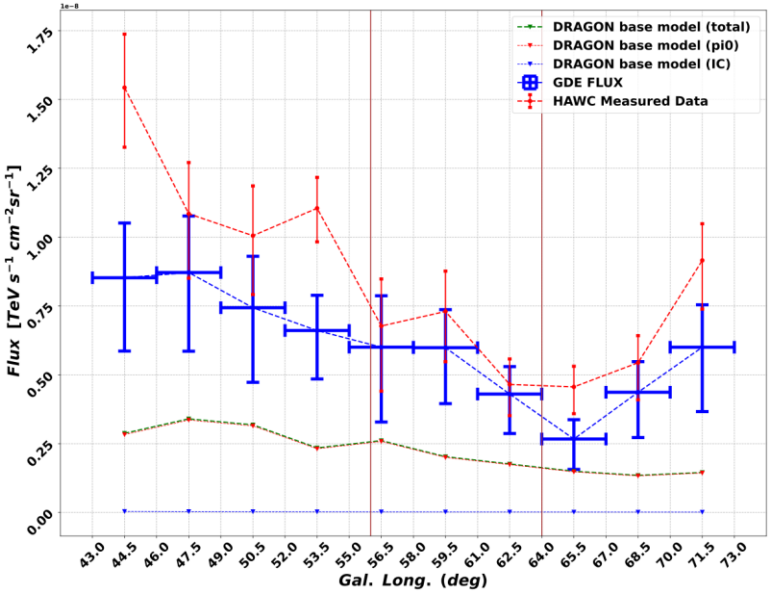
Backup

Galactic Diffuse Emission

- Pion decay with the cosmic ray sea
- Inverse Compton scattering with ISRF and CMB







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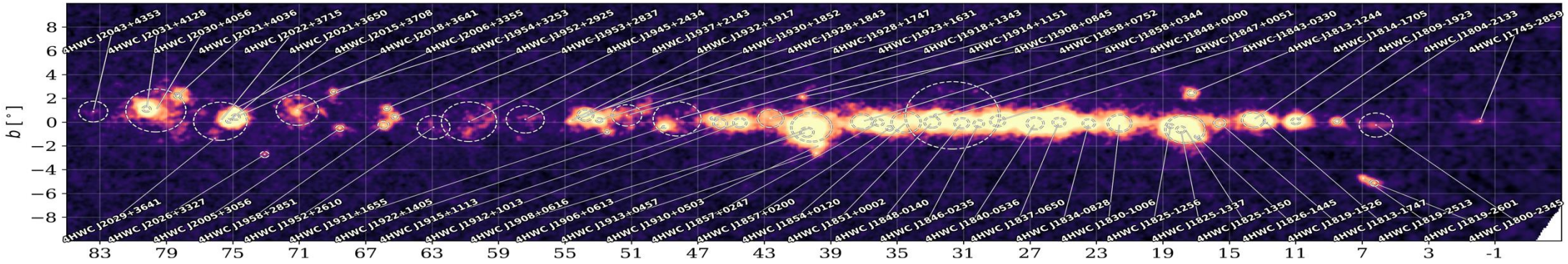
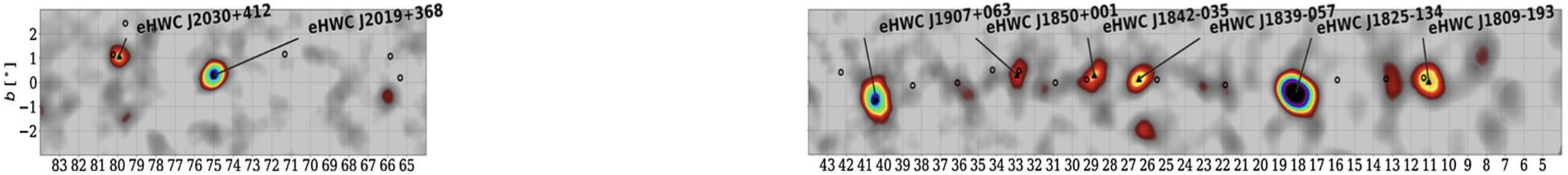
Alfaro et al 2024 *ApJ* **961** 104

HAWC View of the Galactic Plane

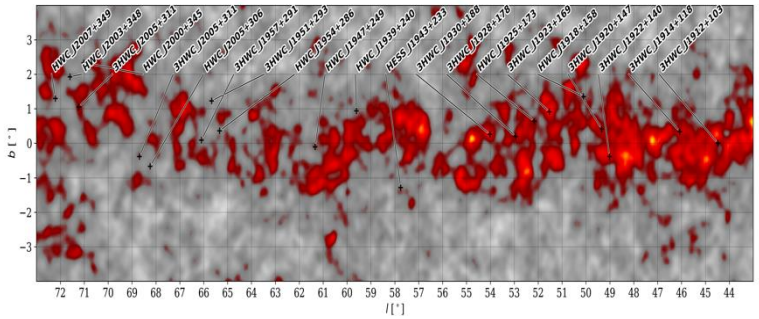
4HWC



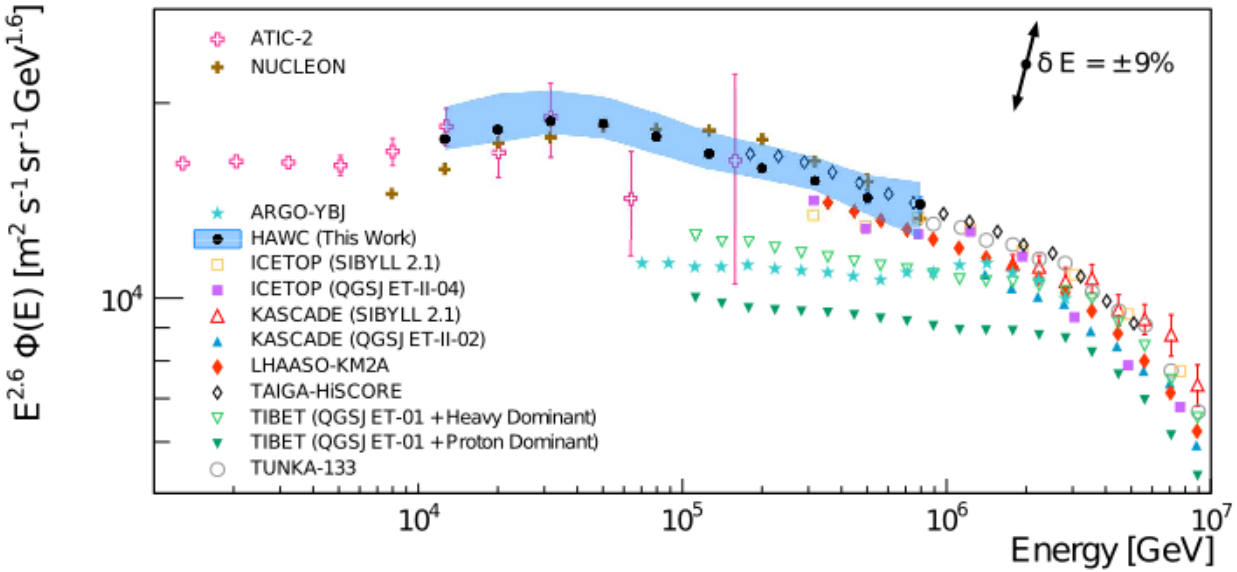
eHWC

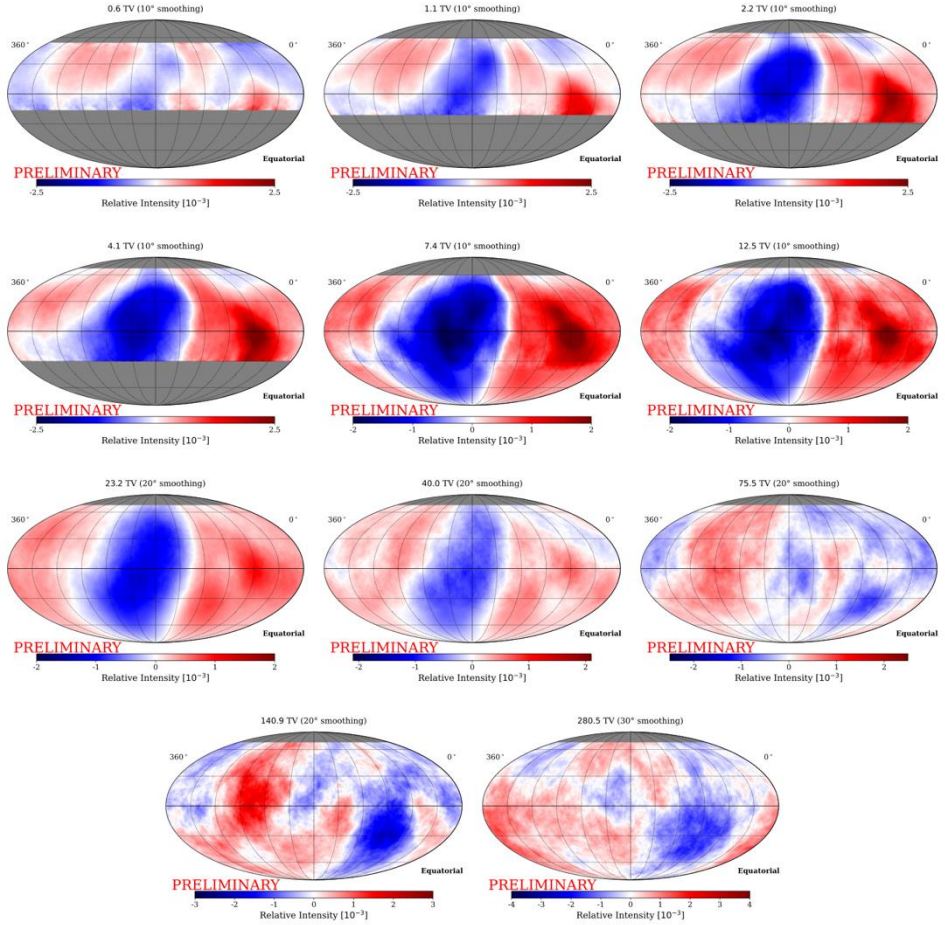


GDE



CR Spectrum and Anisotropy

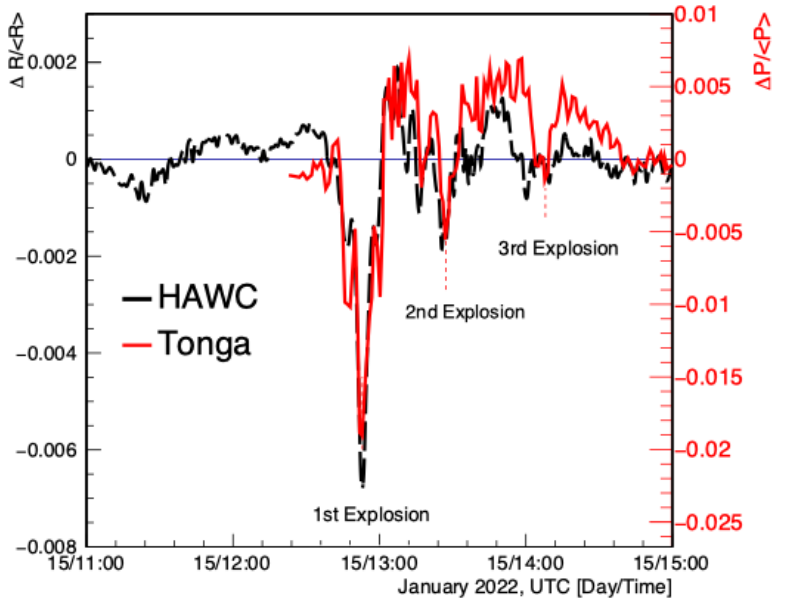


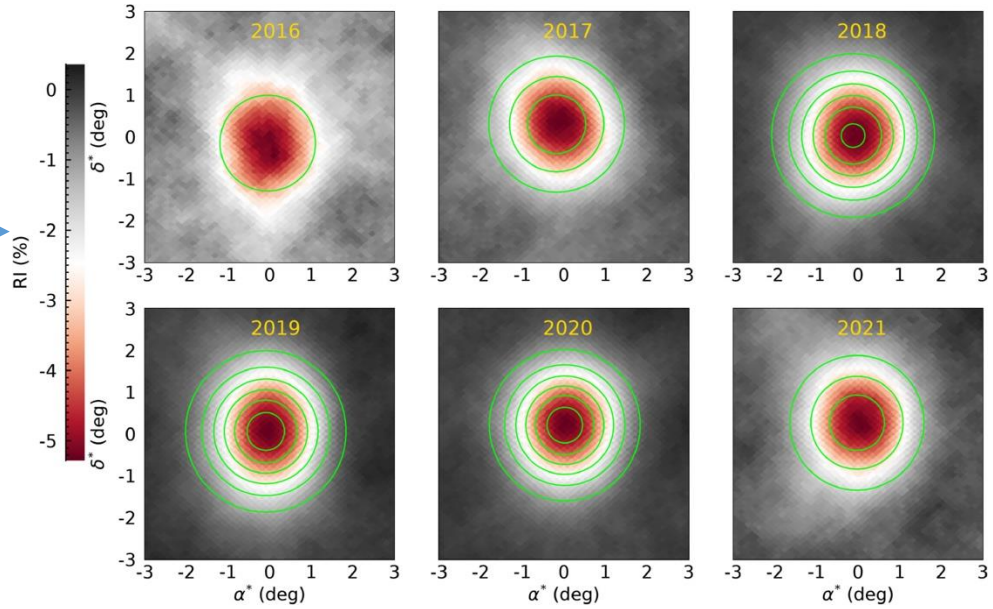


[Alfaro et al 2025 Aph 167, 103077](#)
[Diaz-Velez et al 2025 PoS-ICRC2025-244](#)

Cosmic Ray Science

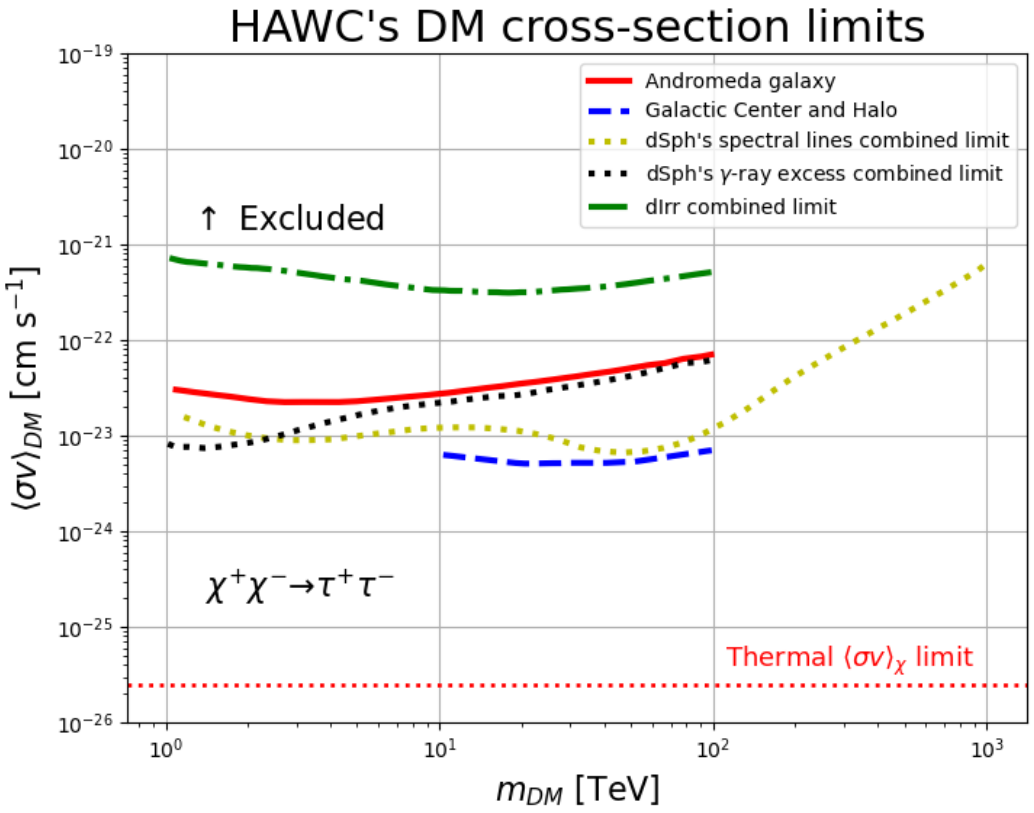
- Observable pressure waves from the 2022 Hunga volcanic eruption
- Solar cycle modulation changes cosmic ray rates.

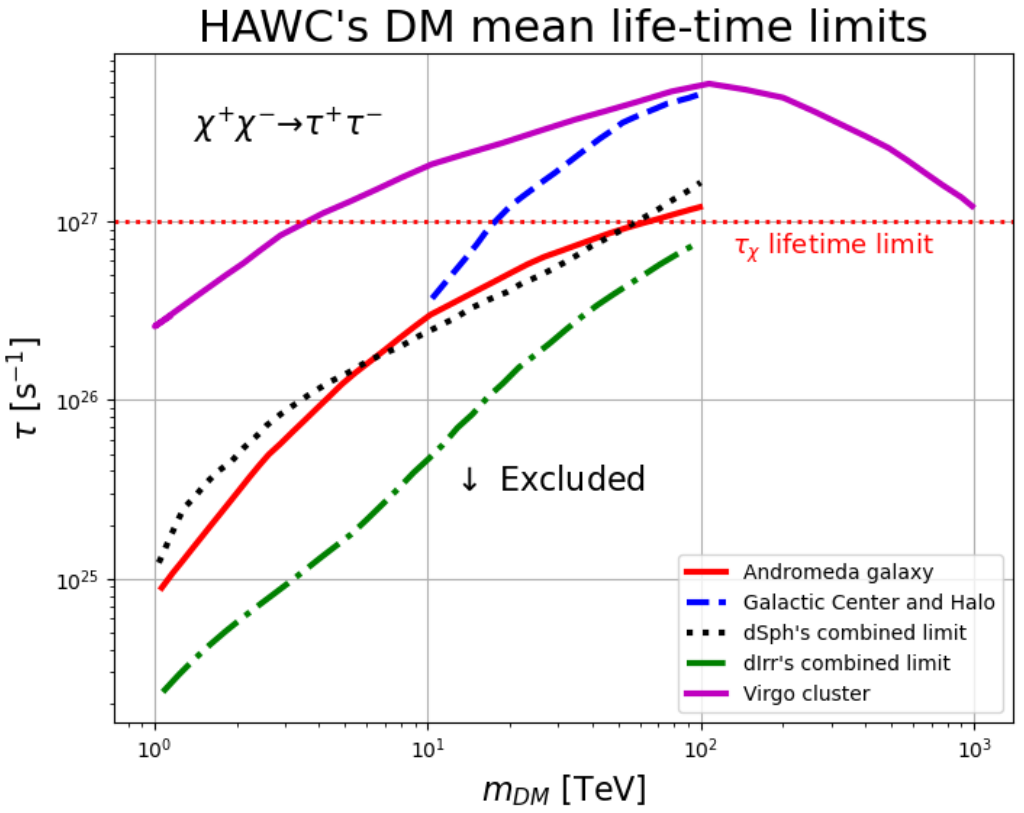




Alfaro et al 2024 *ApJ* **966** 67
Alfaro et al 2024 AdSpR,73,1083

Previous Dark Matter Results





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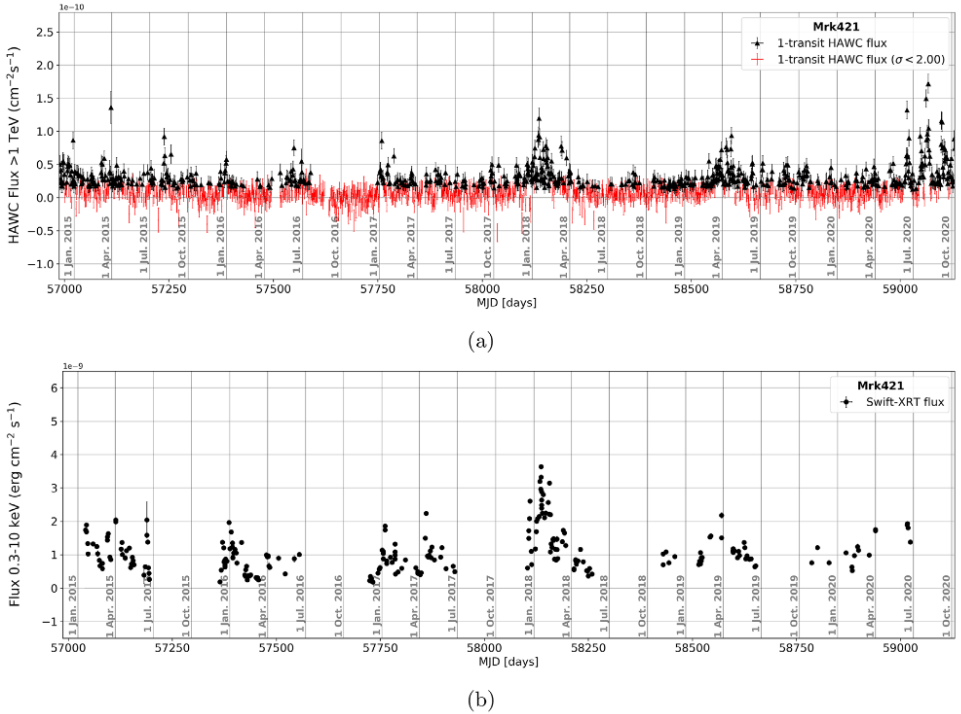
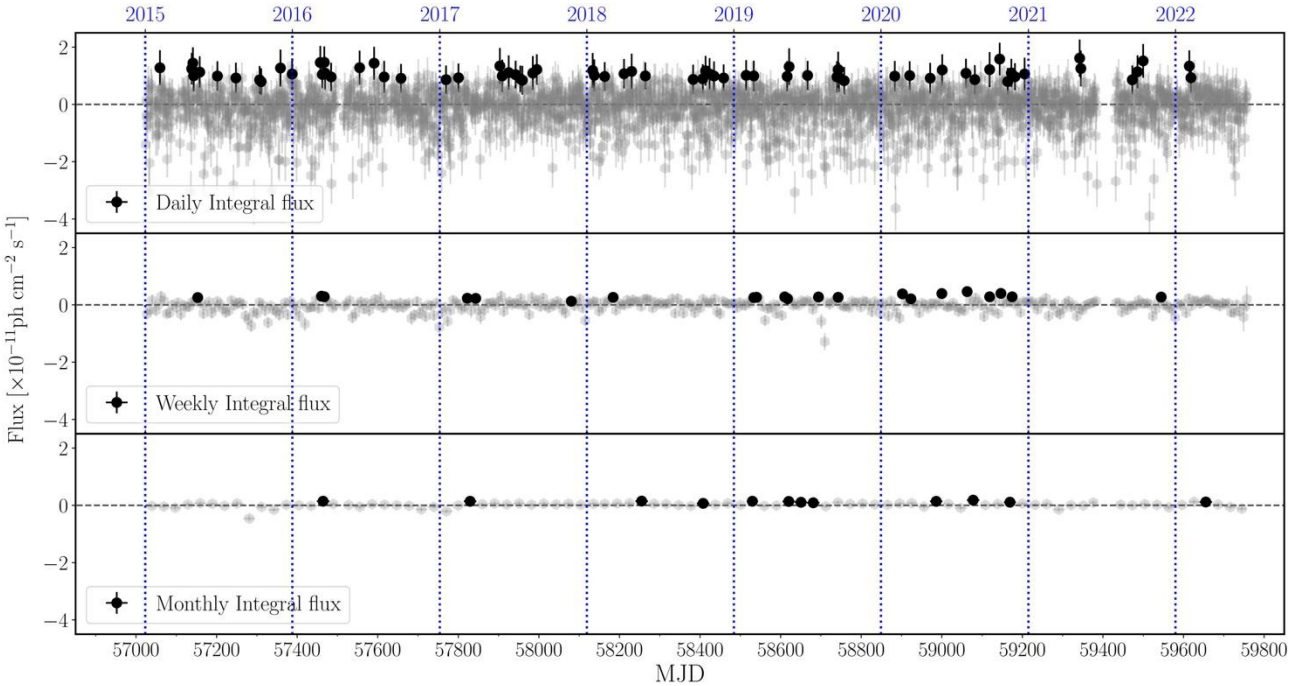
Blazars and Radio Galaxies

Mrk 421



M87



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Alfaro et al 2025 *ApJ* **980** 88
Alfaro et al 2025 *ApJ* **994** 191