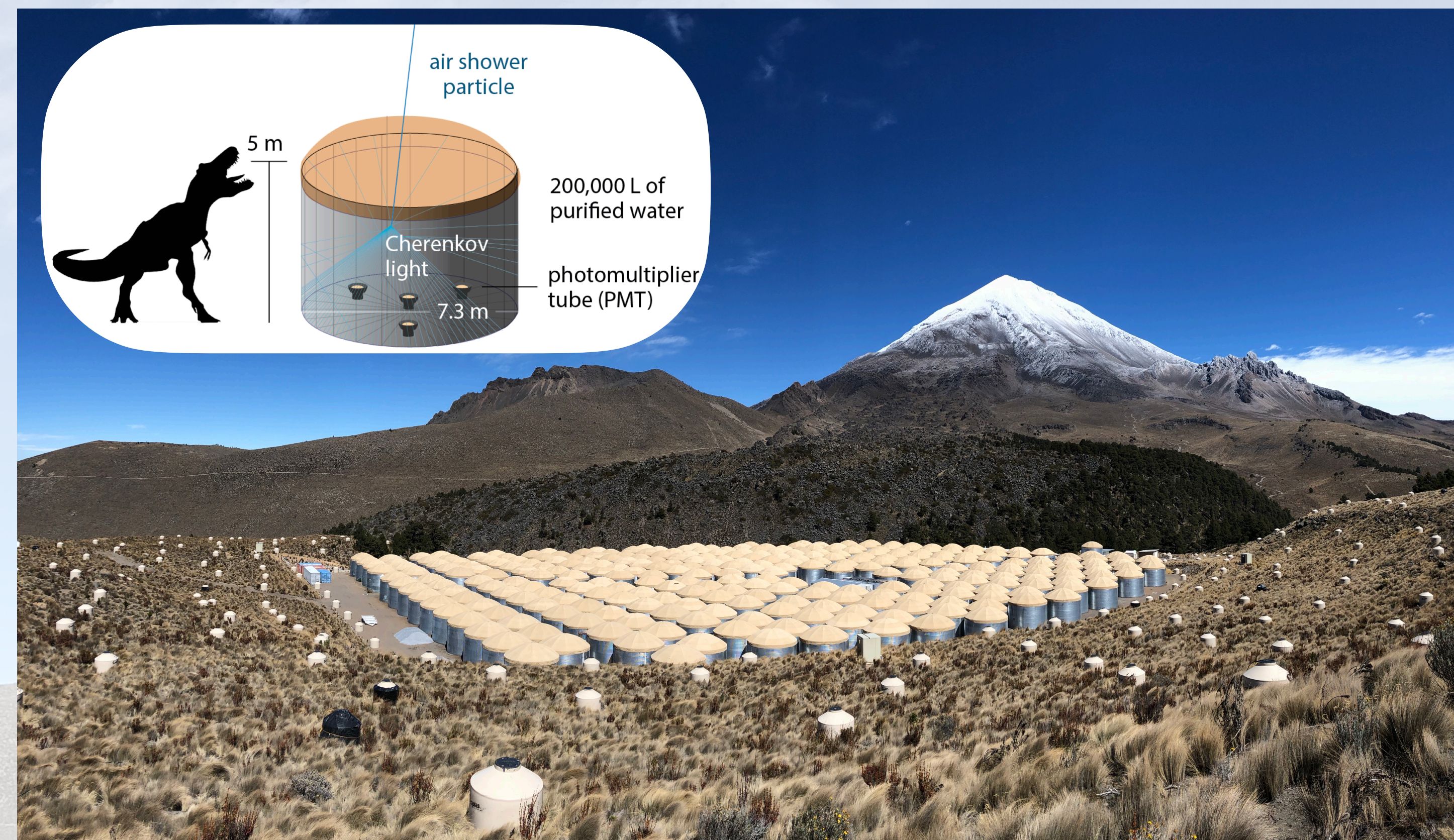


## Abstract:

Although at extreme energies ( $>50$  TeV)  $\gamma$ -ray sources generally have large angular separations from one another as observed on Earth, at lower energies in the galactic plane this is often not the case. HAWC observes extended emission from the source eHWC J1850+001 exceeding 50 TeV, and at lower energies this region appears to consist of multiple sources of  $\gamma$ -ray emission. These include the 3HWC J1849+001 source but also two nearby H.E.S.S. sources observed in their Galactic Plane Survey. Therefore, a full description of the region requires a morphological study including the full energy range of HAWC data. Understanding the spatial features of the emission in this region is important to associate the sources observations at other wavelengths, which may point to hadronic or leptonic origins for the  $\gamma$ -ray emission. There are multiple pulsar wind nebulae and super nova remnant systems in the vicinity that may be responsible for the emission in this region, including the pulsar PSR J1849+001 and its pulsar wind nebula, which is a likely candidate for the  $>50$  TeV energy emission seen by HAWC.

## The HAWC Observatory:

- High Altitude Water Cherenkov (HAWC)
- 4100 m above sea level
- Located on Sierra Negra in Puebla, Mexico
- Instantaneous FoV  $\sim 2$  sr
- Energy Range: 300 GeV to  $> 100$  TeV
- $>95\%$  uptime
- Angular resolution  $\sim 0.1^\circ$  for best reconstructed events
- Observed Declination range:  $-25^\circ$  to  $65^\circ$



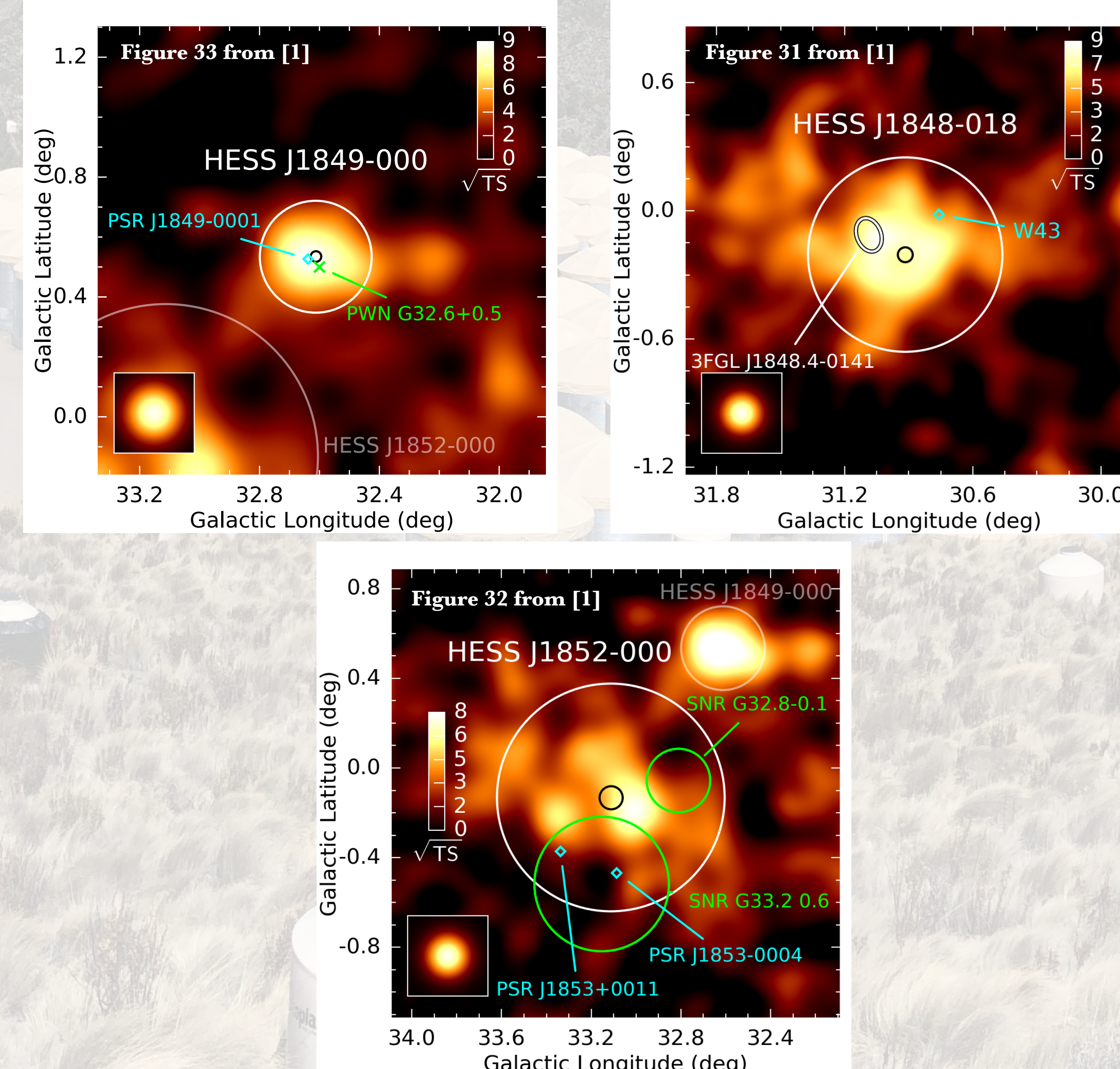
## Analysis Details

The region is well fit to the following model:

- Galactic diffuse emission
- 3 Sources:
  - One point source (HAWC J1849)
  - Two extended sources with gaussian morphology

## Potential Associations in HESS Galactic Plane Survey

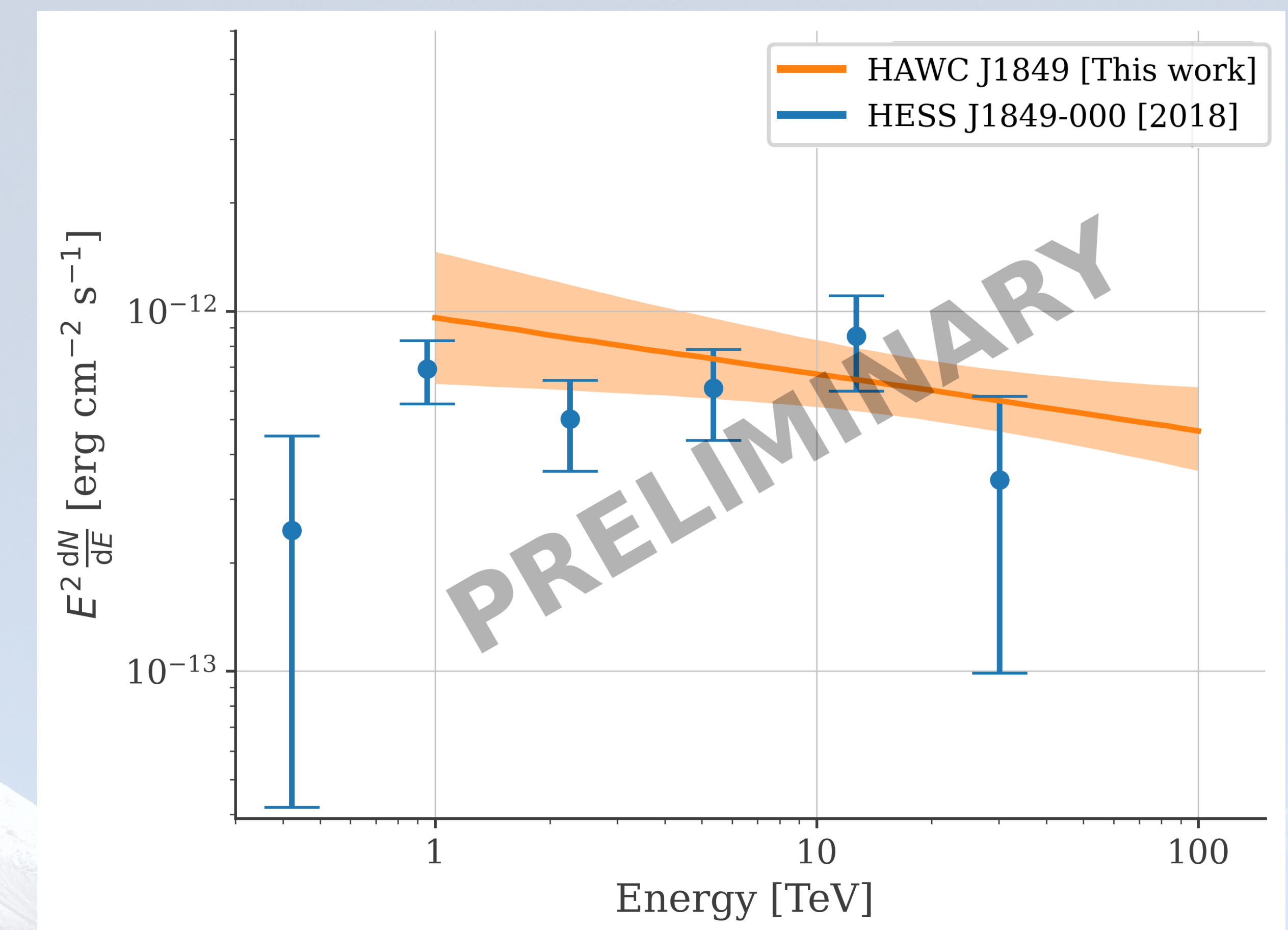
- HESS J1849-000 (firmly associated)
  - PSR J1849-0001 & PWN G32.6+0.5
- HESS J1852-000 (Unidentified)
  - PSR J1853-0004 & PSR J1852+0011
  - SNR G32.8-0.1 & SNR G33.2-0.6
- HESS J1842-018 (Unidentified)
  - W43
  - 3FGL J1842.8-0141



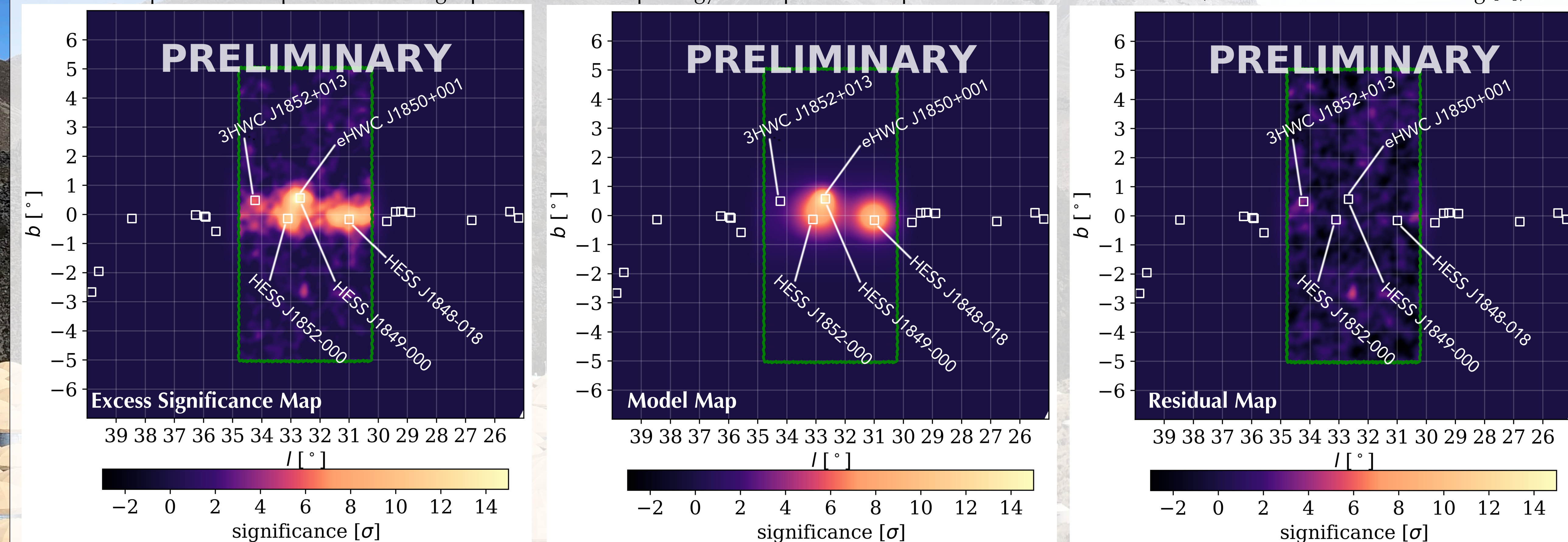
## Results:

The three sources in the best-fit model are spatially correlated with HESS J1849-000, HESS J1852-000, and HESS J1848-018. HAWC J1849 matches well with the spectrum for HESS J1849-000 in the HESS Galactic Plane survey [1].

In [2], this region was fit with a single gaussian source model, and claimed an extent of  $0.37^\circ$  for the eHWC source correlated with HESS J1849-000. With this improved model, with multiple extended sources, HAWC J1849 is better fit as a point source.



The maps below are plotted assuming a point source morphology and a power law spectrum with an index of -2.5 (similar to the 3HWC catalog [3])



## Future Work:

We plan to further develop this model for this whole region. This will include the investigation of a potential small extent for HAWC J1849, a better understanding of the diffuse emission in this region, and a clearer understanding of the region near HESS J1848-018. A new reconstruction effort will also greatly benefit this analysis by improved energy reconstruction, and providing superior PSF at large zenith angles.

## References:

- [1] Abdalla, H. et al. The H.E.S.S. Galactic plane survey. *Astron. Astrophys.* 612, A1 (2018).
- [2] Abeysekara, A. U. et al. Multiple Galactic Sources with Emission Above 56 TeV Detected by HAWC. *Phys. Rev. Lett.* 124, (2020).
- [3] Albert, A. et al. 3HWC: The Third HAWC Catalog of Very-high-energy Gamma-Ray Sources. *Astrophys. J.* 905, 76 (2020).