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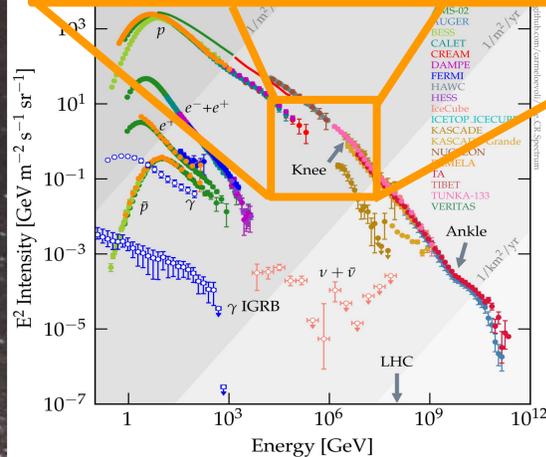
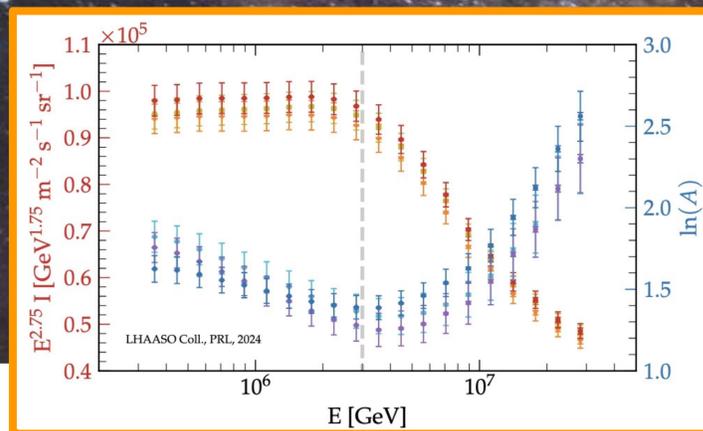
Galactic Cosmic Rays

New observations of cosmic rays across the knee [1,2] are confronting our understanding of their Galactic population and its transition to cosmic rays of extragalactic origin.

Is the cosmic ray knee associated to the maximum energy of Galactic sources (PeVatrons) or to changes in propagation?

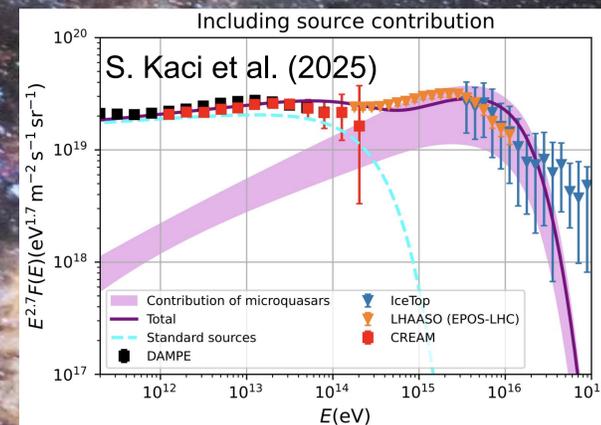
Does propagation in turbulent magnetic fields fully describes the observed spectral features?

These and newer models can be tested analytically, numerically and/or phenomenologically.

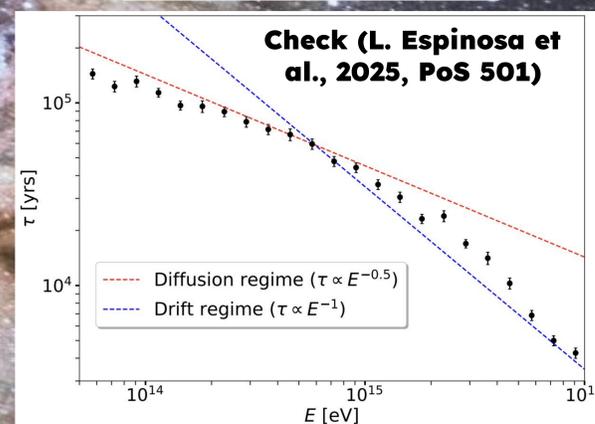


C. Evoli (2020)

Knee due to sources...



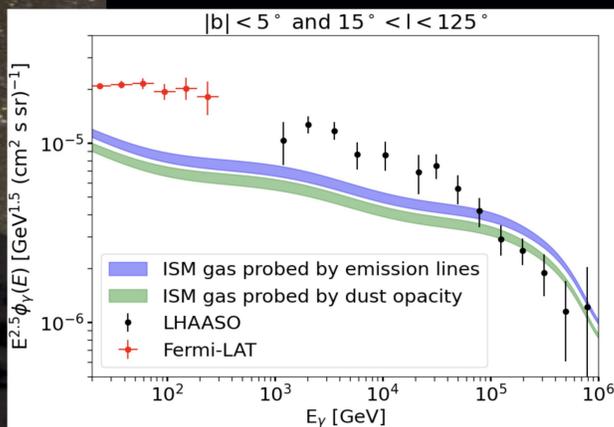
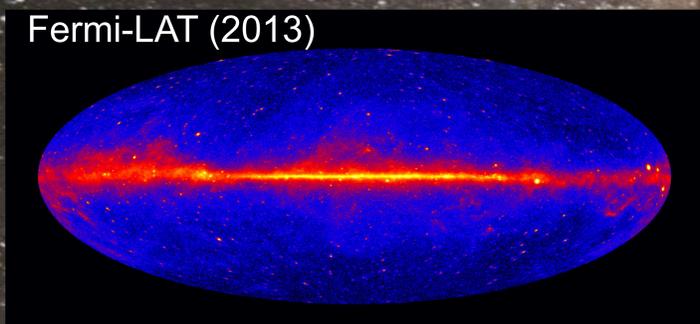
... or propagation?



Diffuse Gamma-Rays

Secondary gamma-rays can be used as probe of the cosmic ray distribution and spectrum across the Milky Way. And now we have observations up to PeV energies [3].

Fermi-LAT (2013)

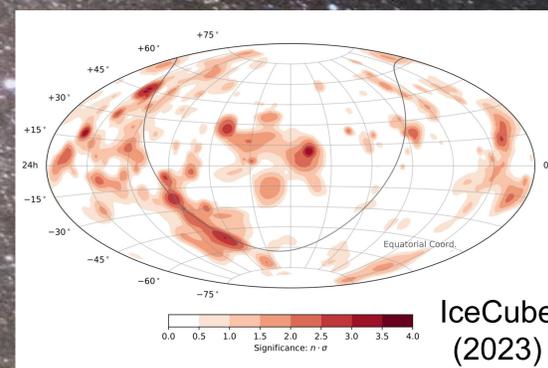


Check (L. Espinosa et al., 2025, MNRAS Lett 20) for further discussion

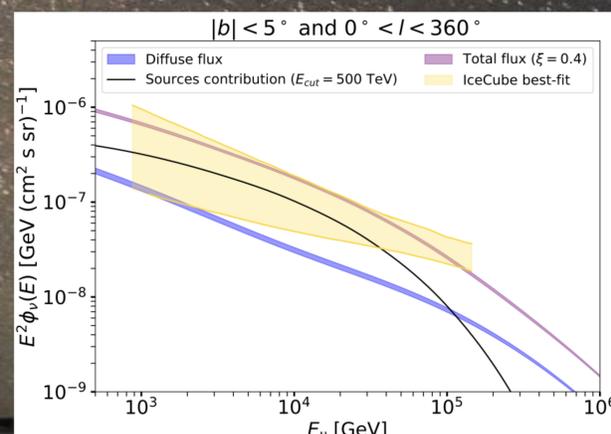
However, discrepancies between predicted diffuse emission and observations have been found, possibly related to unresolved sources [4] or non-homogenous distributions.

Diffuse Neutrinos

We also start to have high precision observations of the TeV Galactic sky in neutrinos [5].



Neutrinos are useful to constrain the contribution of unresolved sources and distinguish if they are hadronic or leptonic [6].



References

[1] LHAASO Coll. (2024). PRL 132, 131002

[3] LHAASO Coll. (2025). PRL 134, 081002

[5] IceCube Coll. (2023). Science 380, 6652

[2] LHAASO Coll. (2025). Sci. Bull. 70, 24

[4] V. Vecchiotti, et al. (2025). JCAP 2025, 09

[6] V. Vecchiotti, et al. (2023). ApJL 956, 2