



Department of Physics
UNIVERSITY OF WISCONSIN-MADISON

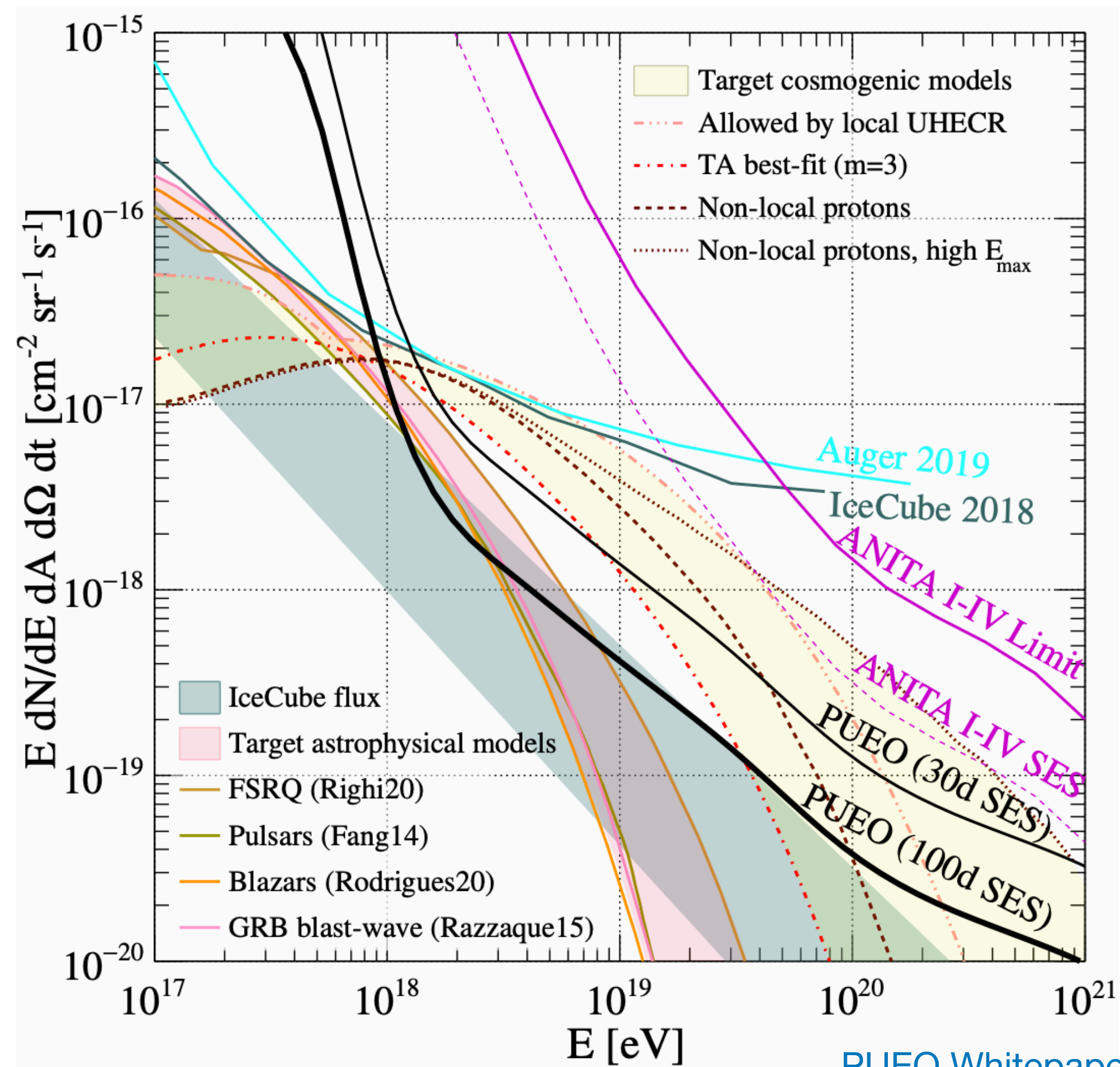


The Sensitivity of PUEO to Cosmogenic Neutrinos and Exotic Physics Scenarios

Angelina Sherman | apartenheime@wisc.edu

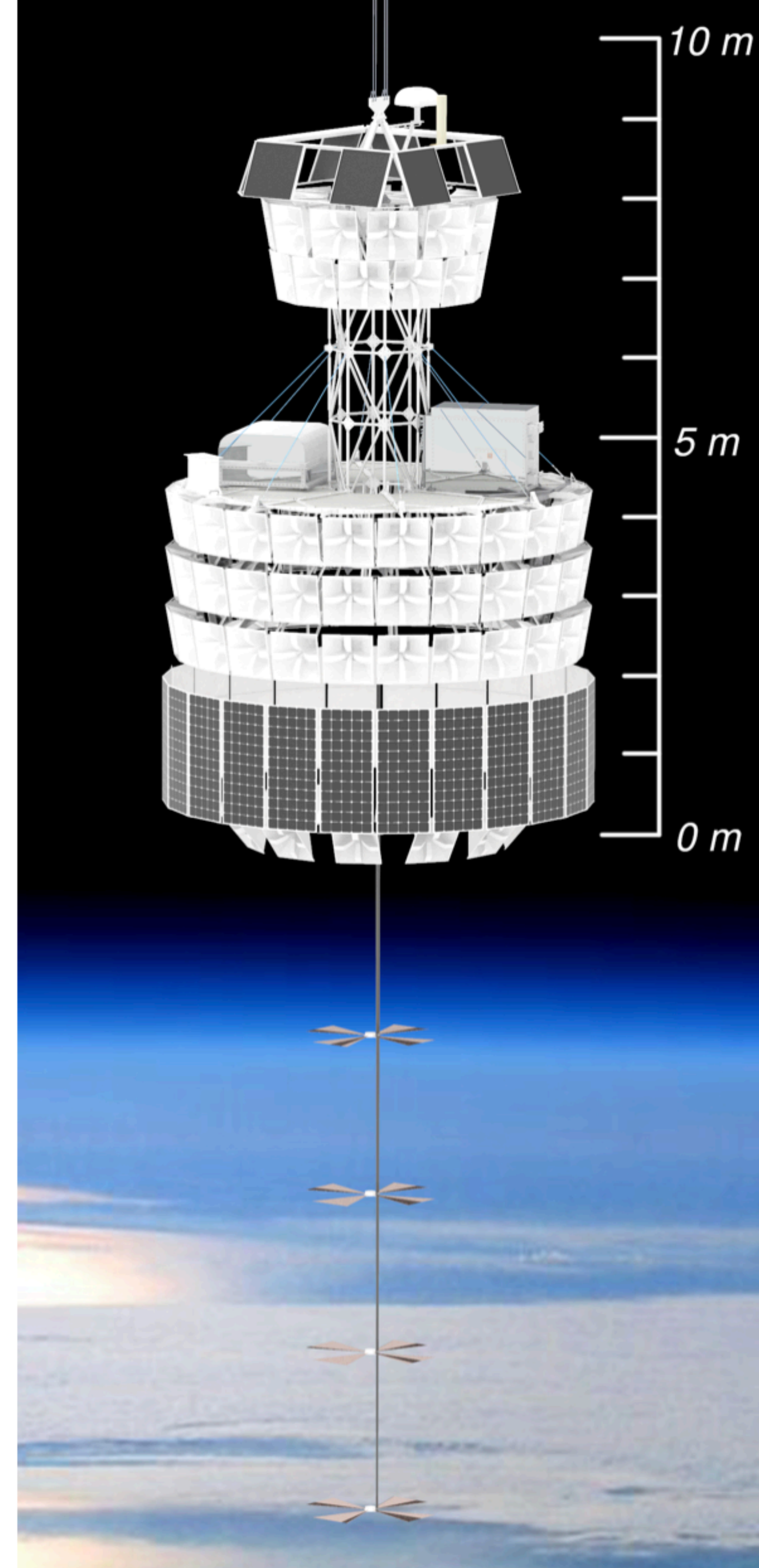
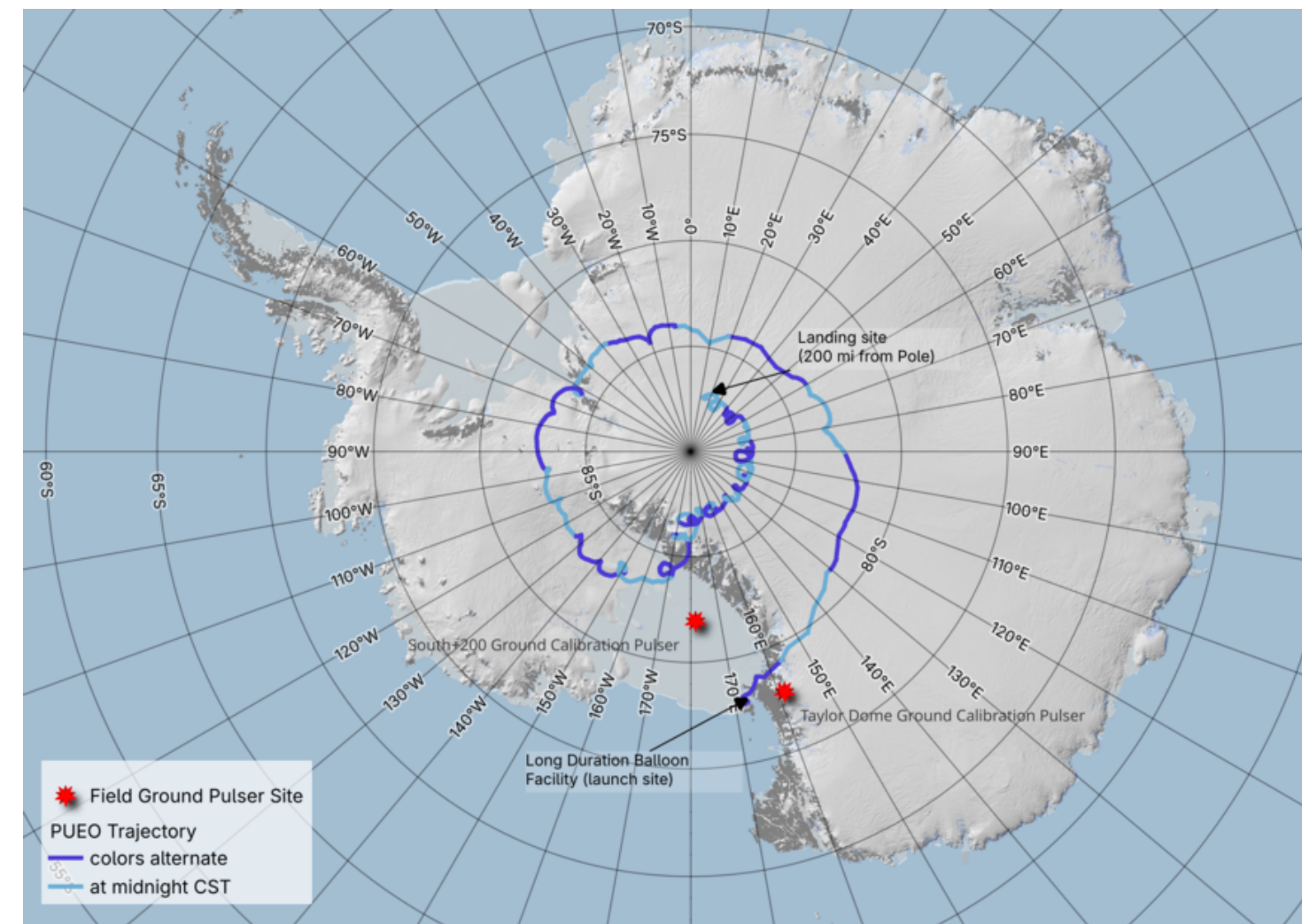
Payload for Ultrahigh Energy Observations (PUEO)

- PUEO: balloon experiment that completed a ~30-day flight over Antarctica (December 2025)
- Uses Askaryan radiation to search for ultrahigh energy neutrinos



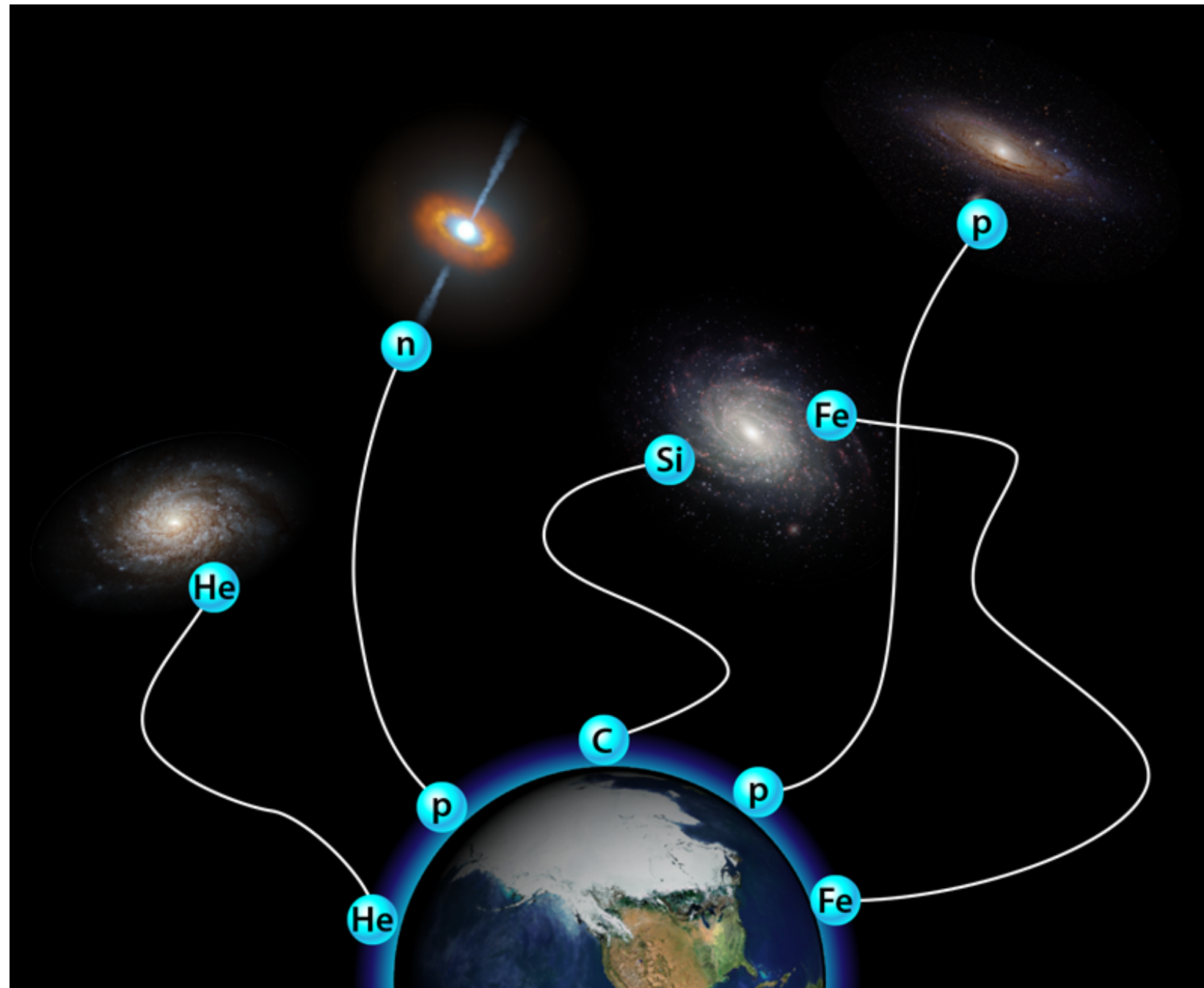
[PUEO Whitepaper](#)

<https://pueo.space/>

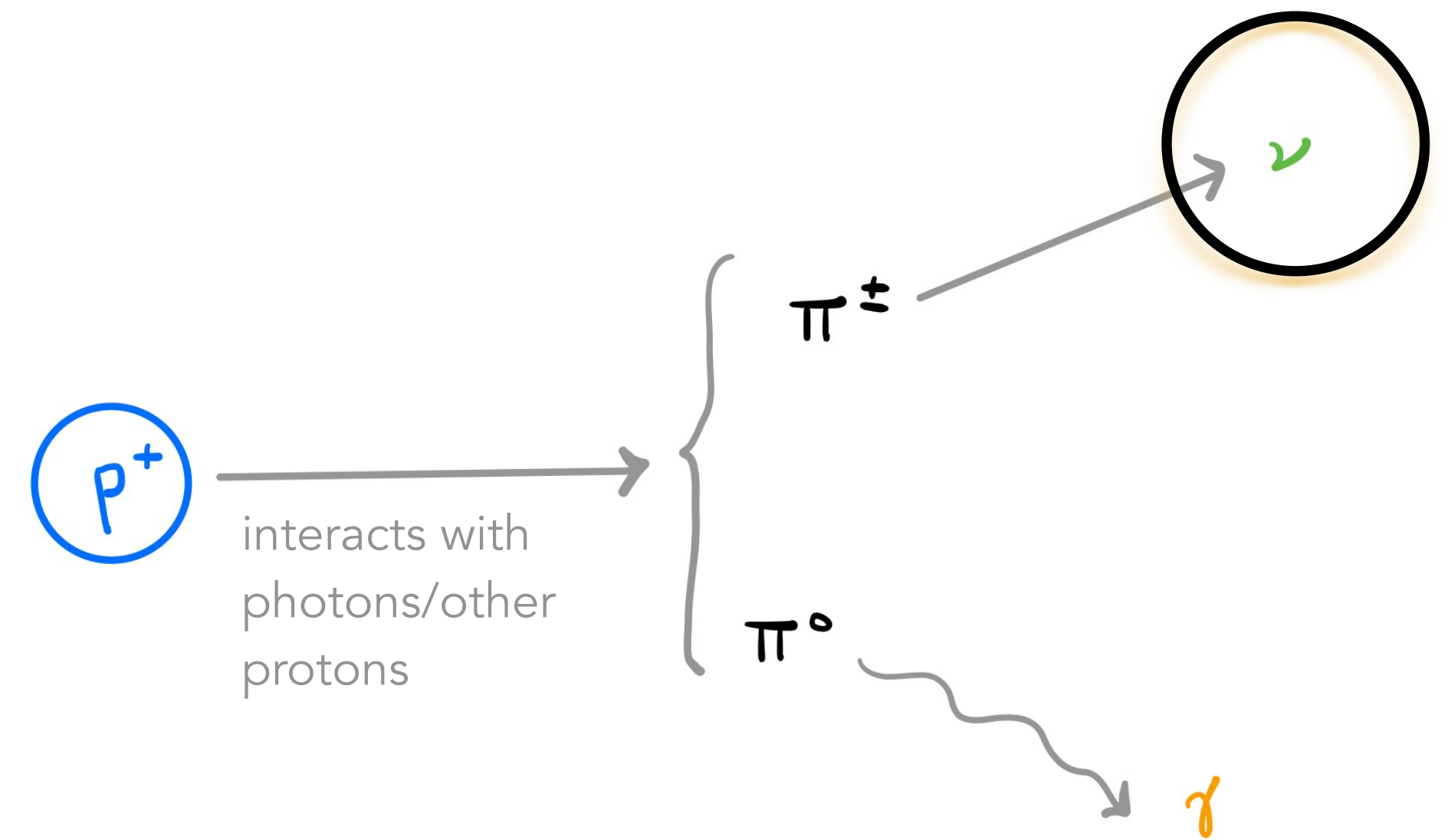


Ultrahigh energy cosmic rays

APS/Alan Stonebraker (galaxy images from NASA)



- UHECRs most energetic particles ever observed, energies can exceed 10^{20} eV
- Sources unknown, composition not well-constrained
- Do not point back to their sources

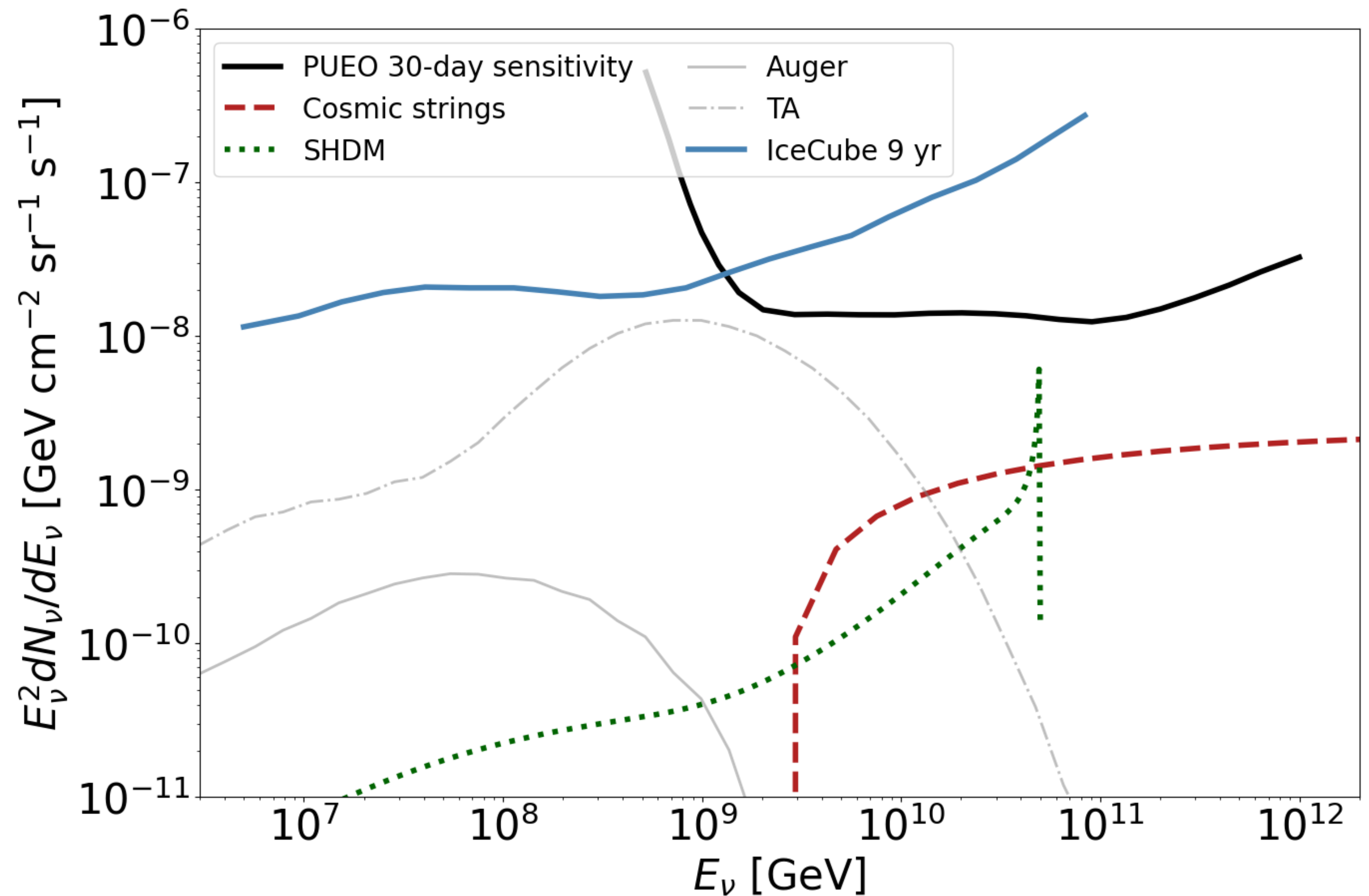


UHE neutrinos are a "golden messenger"

- Produced exclusively* by UHECR interactions
- Do not attenuate in cosmic photon fields
- Do not deflect in magnetic fields

The ultrahigh-energy neutrino landscape

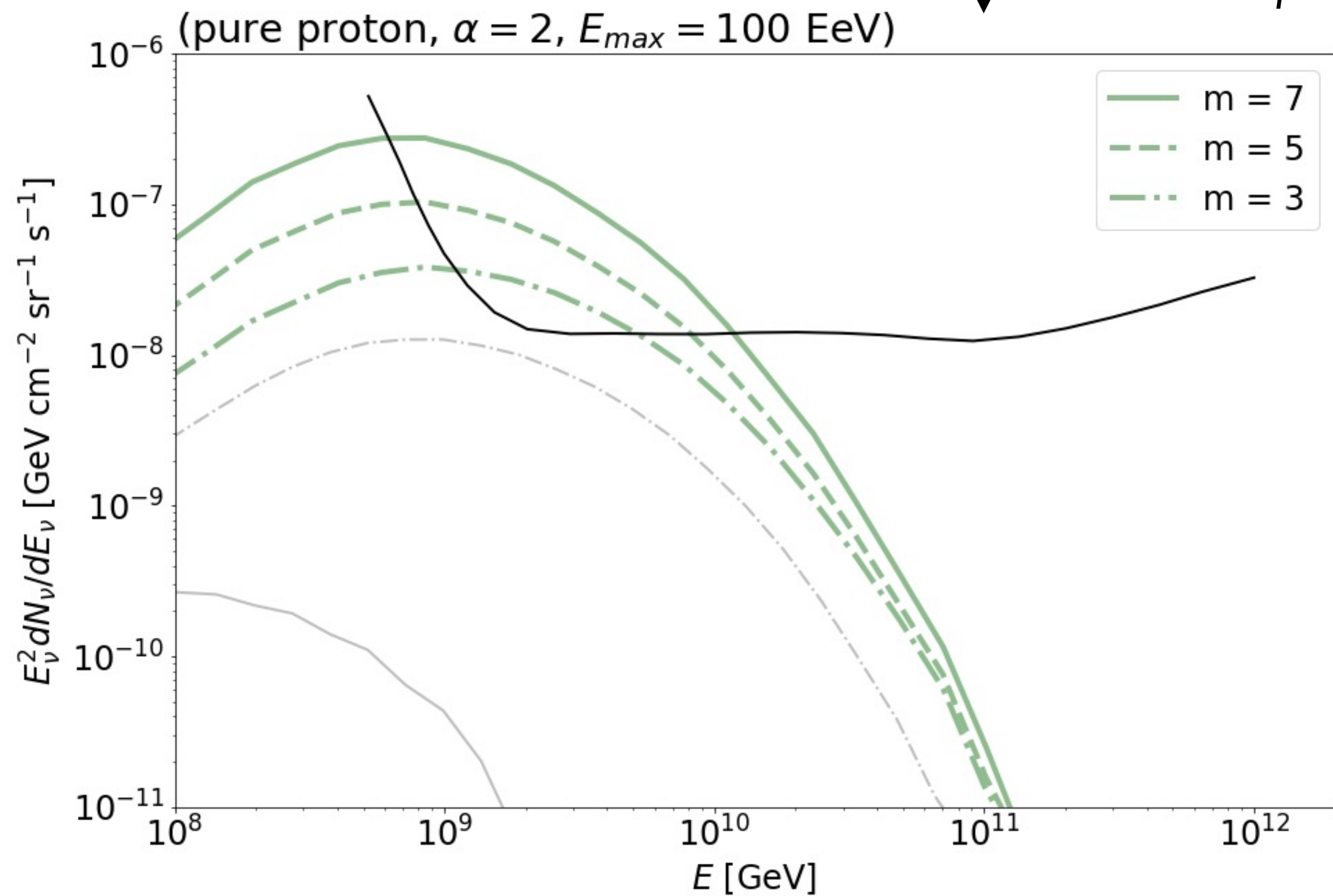
1. Astrophysical neutrinos: made inside a source that accelerates cosmic rays (point sources)
2. **Cosmogenic neutrinos:** made by cosmic ray interactions with the CMB
3. BSM neutrinos: dark matter, cosmic strings, etc.



Cosmogenic neutrinos trace properties of UHECR sources

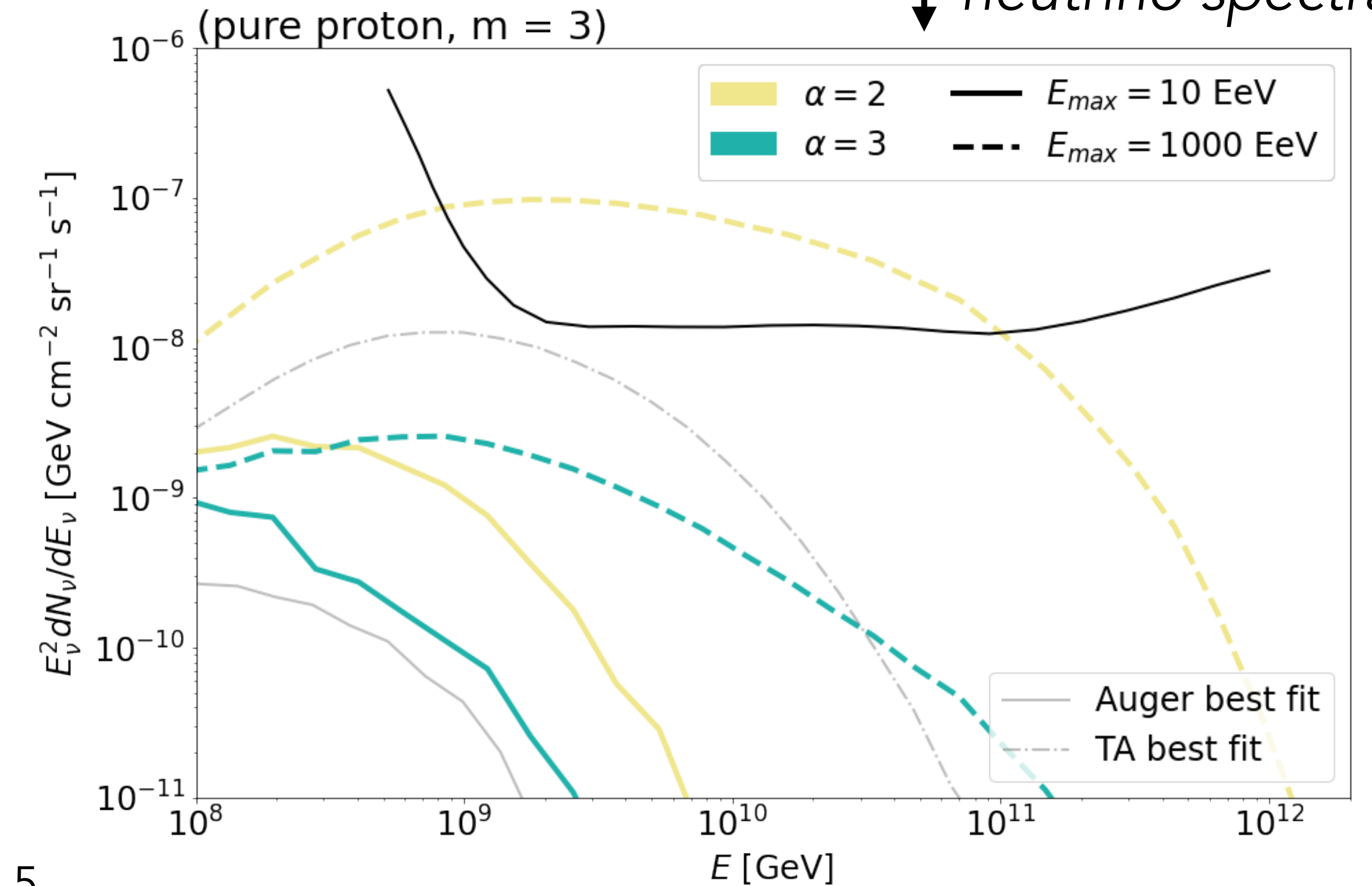
UHECR source evolution $\frac{dN}{dt} \propto (1+z)^m$

↓
neutrino spectra



UHECR source spectrum $\frac{dN}{dE} \propto E^{-\alpha} e^{-E_p/E_{max}}$

↓
neutrino spectra



Nondetection of EeV neutrinos constrains UHECR source properties

Angelina Sherman et al (2026) Phys. Rev. D 113, 083033

***neutrinos are efficiently produced by protons only

proton fraction (f_p)

source evolution

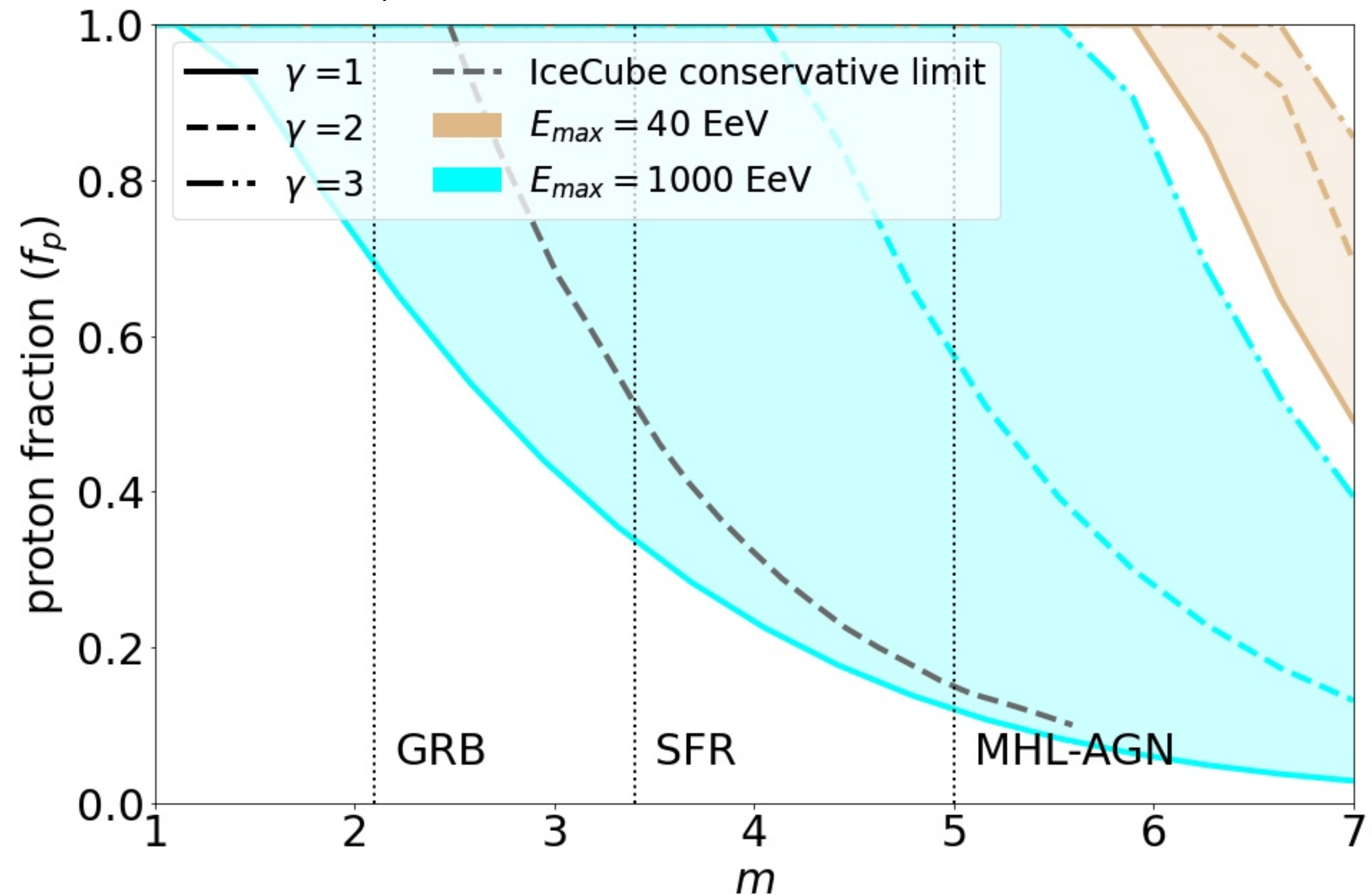
$$\frac{dN}{dt} \propto (1+z)^m$$

pick 2, constrain 1

source spectrum

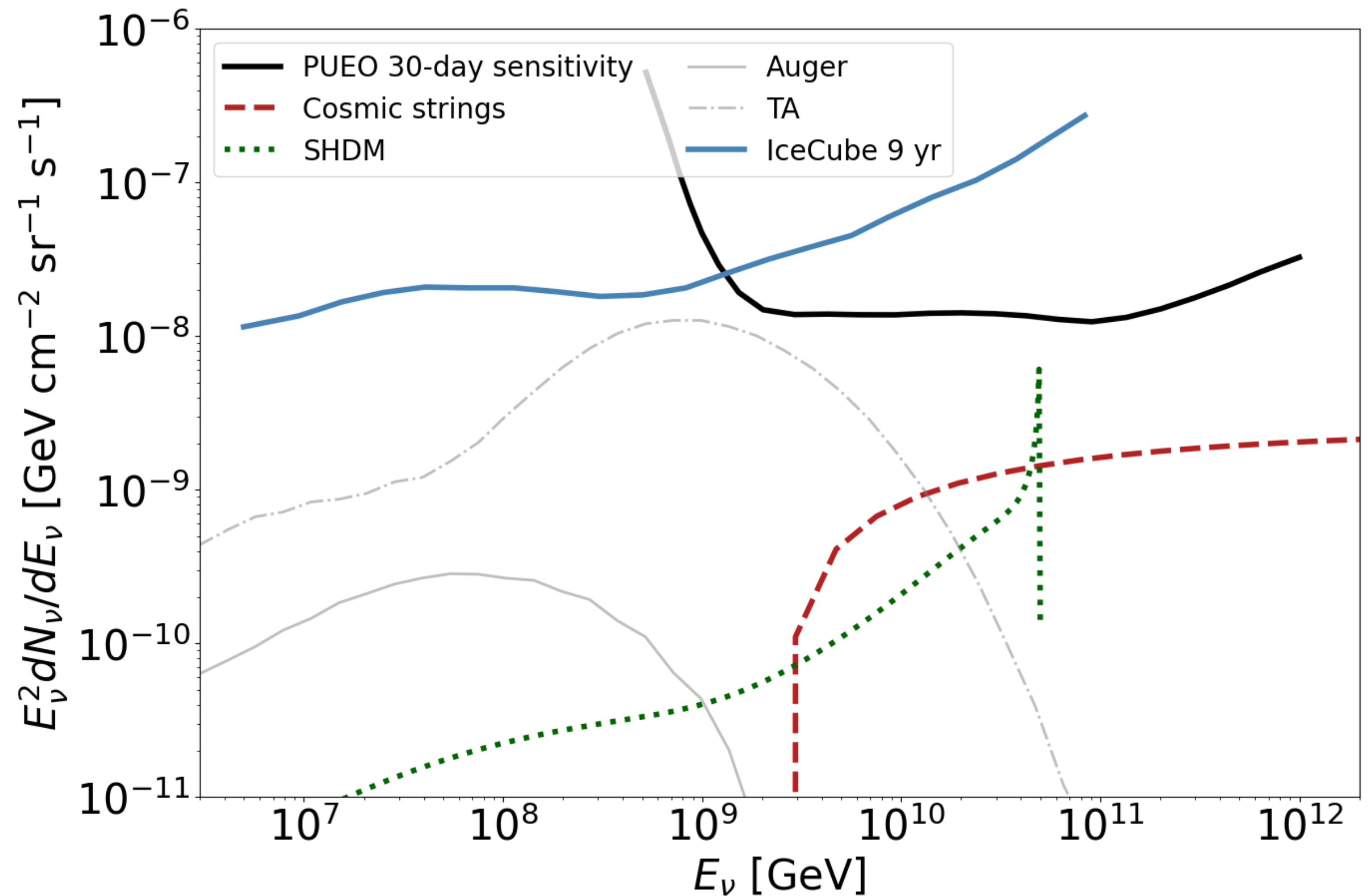
$$\frac{dN}{dE} \propto E^{-\alpha} e^{-E_p/E_{max}}$$

(Parameter space that could be ruled out by PUEO nondetection)



The ultrahigh-energy neutrino landscape

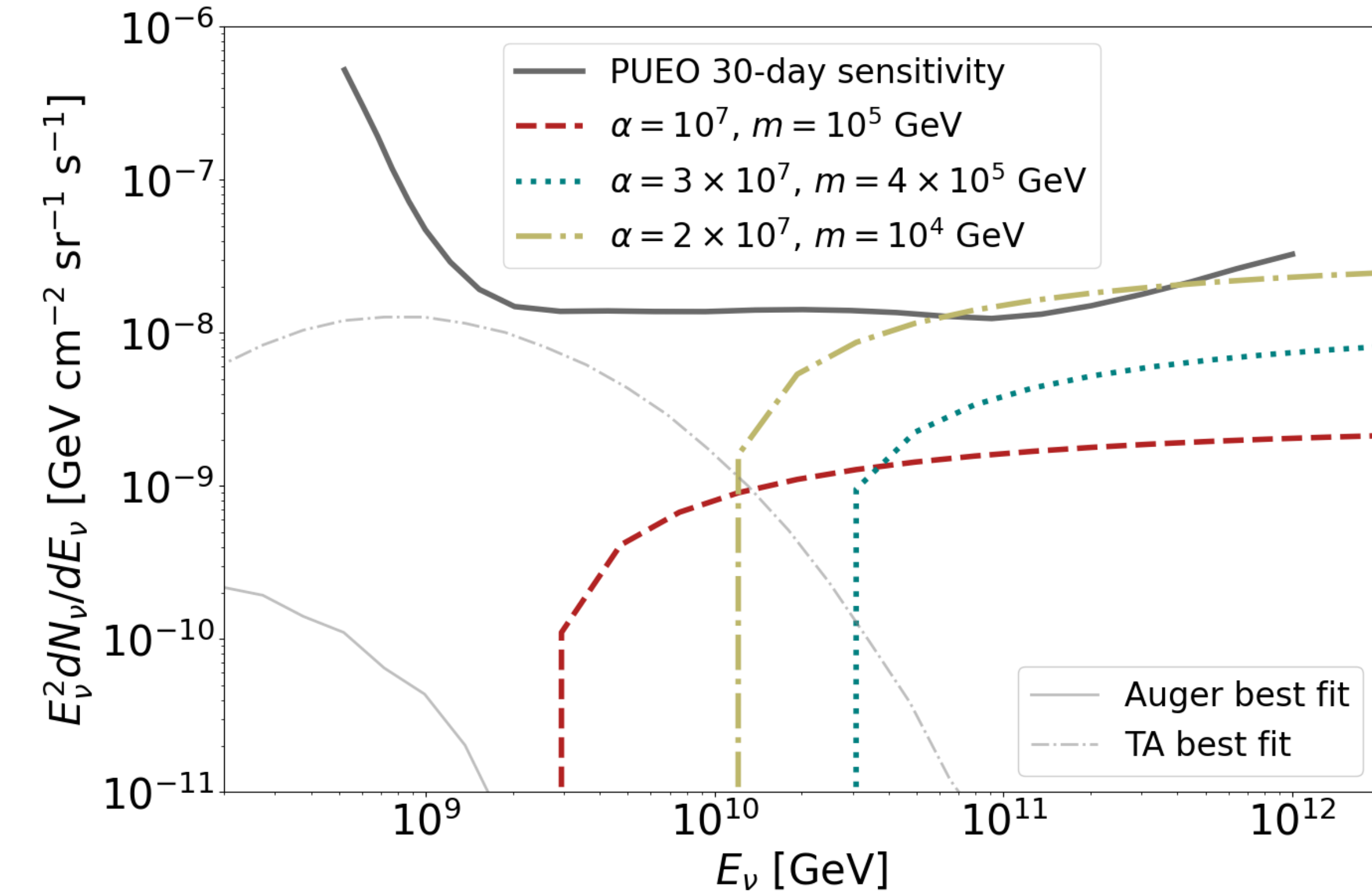
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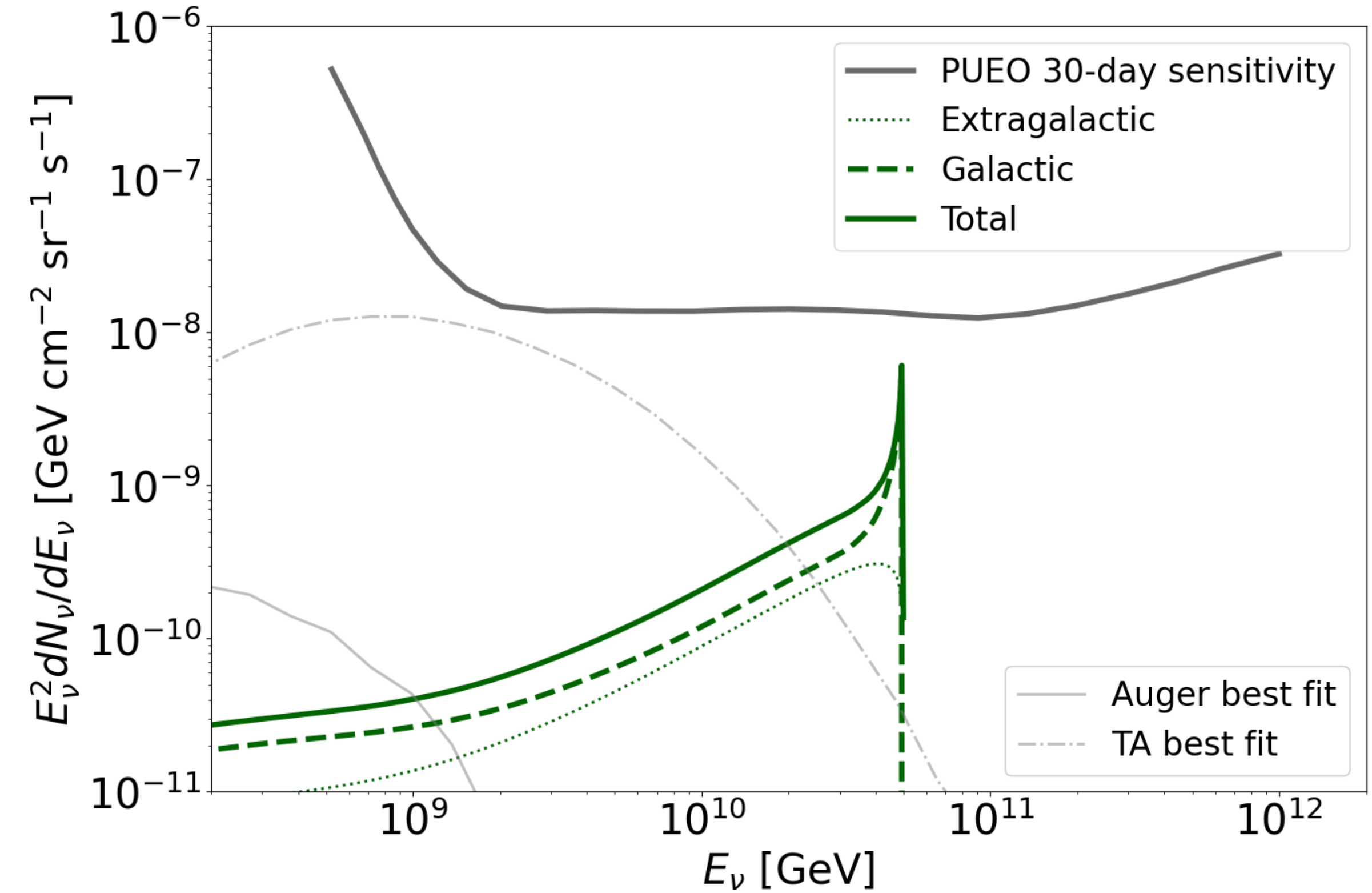
Neutrinos from exotic Physics

Angelina Sherman et al (2026) Phys. Rev. D 113, 083033

Radiation by cosmic string cusps, model from [Berezinsky+ \(2011\)](#)



Radiation from SHDM, model from [Fiorillo+ \(2023\)](#)



Summary

- PUEO currently provides leading sensitivity to neutrinos above an EeV
- The cosmogenic neutrino spectrum is highly sensitive to the proton fraction and source evolution of UHECRs
- A nondetection of UHE neutrinos can be used to constrain UHECR source population and BSM physics
- **The results shown here are not unique to PUEO: many upcoming UHE neutrino detectors can be used to place similar, or better constraints**