



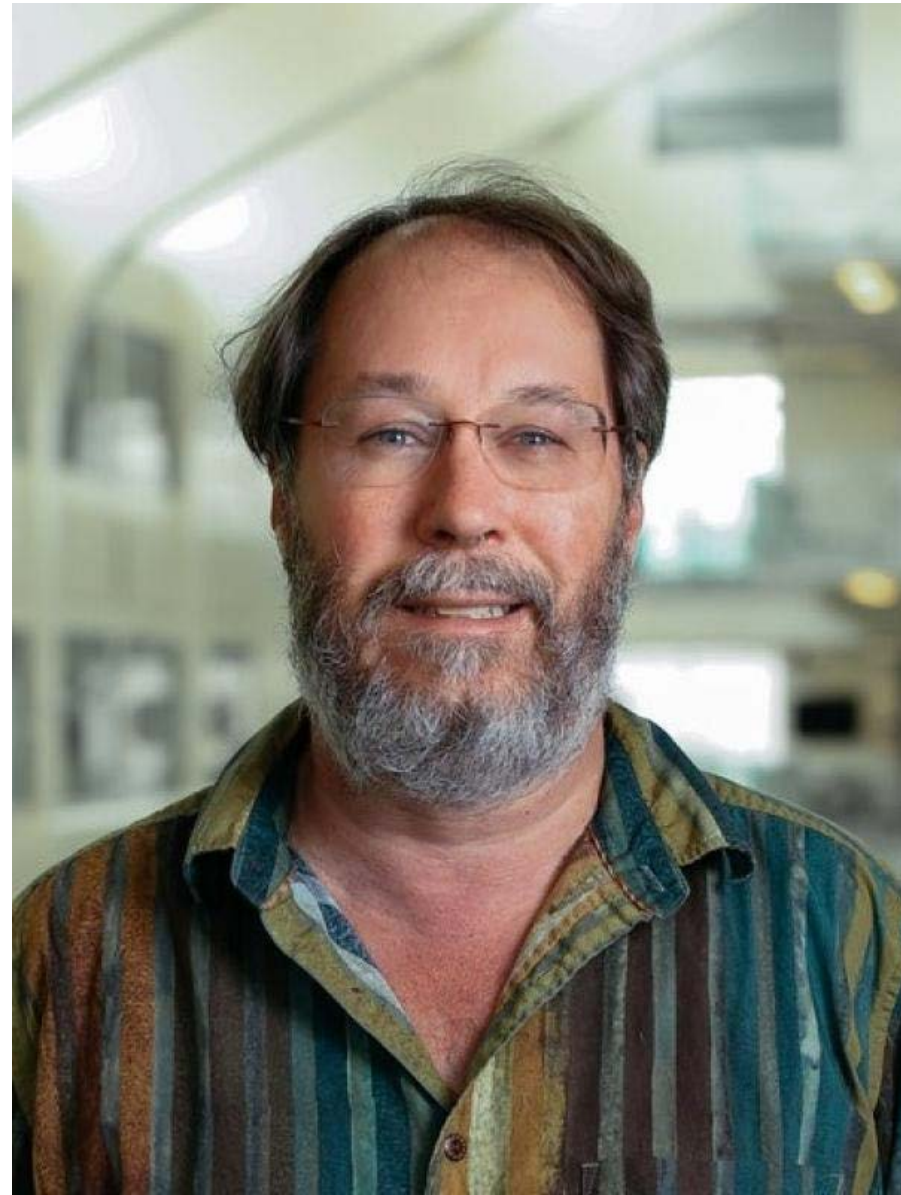
Particle Astrophysics at CCAPP: across the [Energy] Decades

Kaeli Hughes | June 12, 2026

Particle Astrophysics Research Groups



Particle
Astrophysics
(Theory)



Particle
Astrophysics
(Experiment)



Particle
Astrophysics
(Experiment)

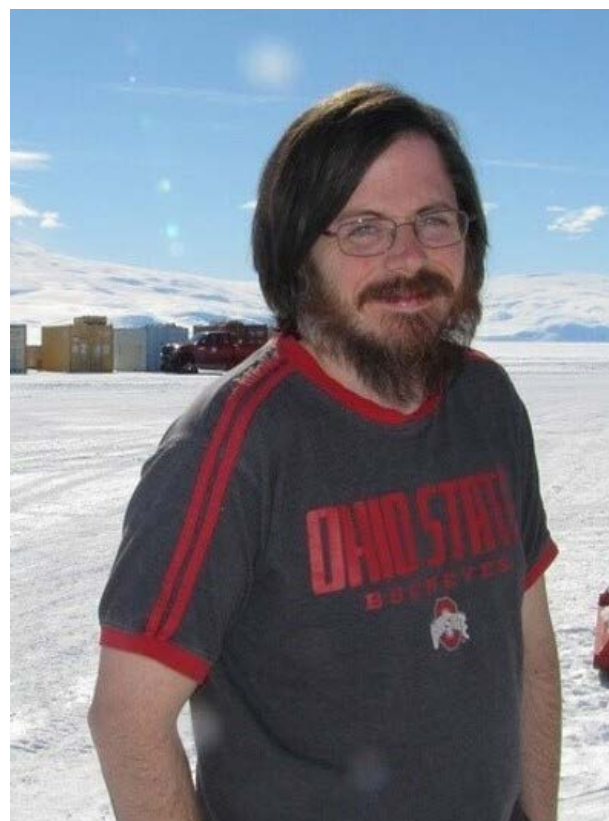
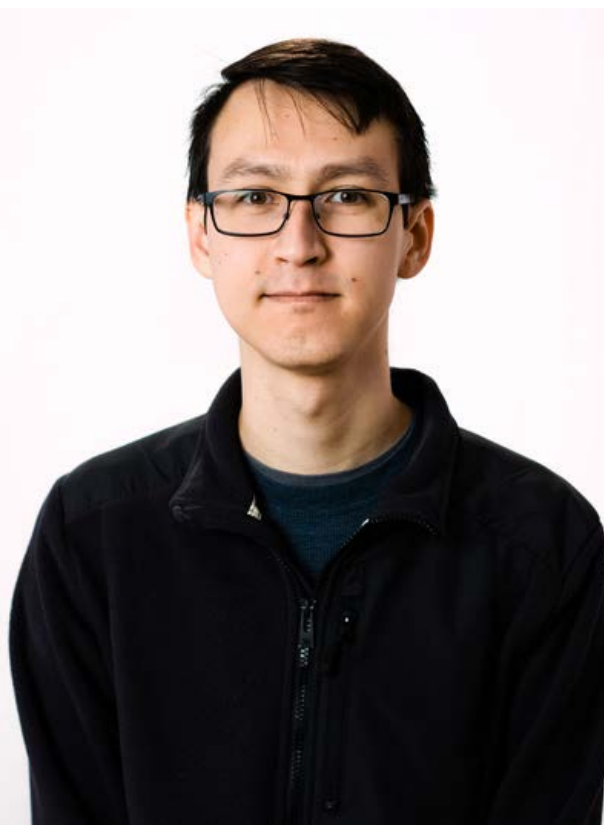


Particle
Astrophysics
(Experiment)

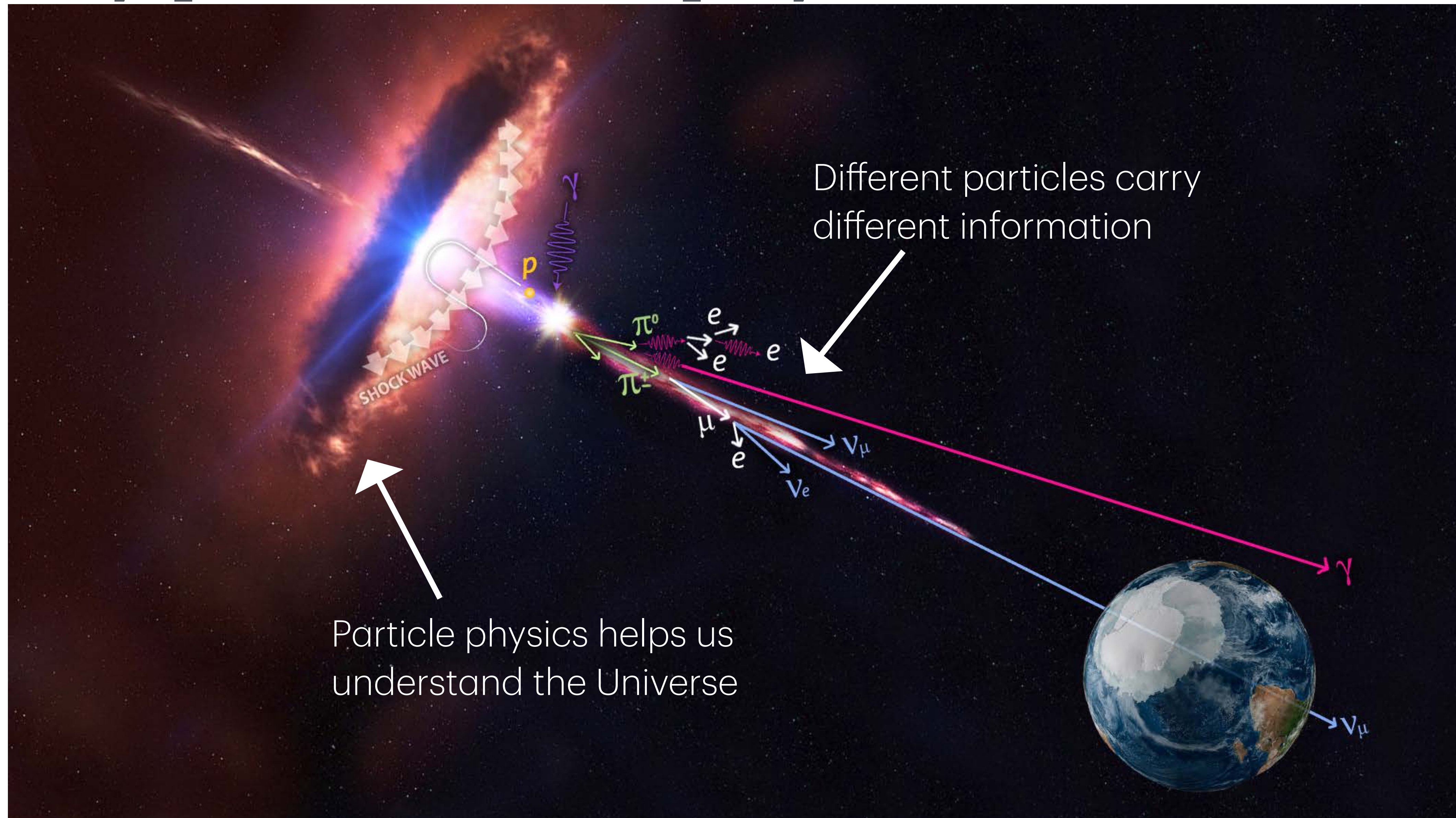


Particle (+astro)
Physics
(Experiment)

Particle Astrophysics Researchers!!

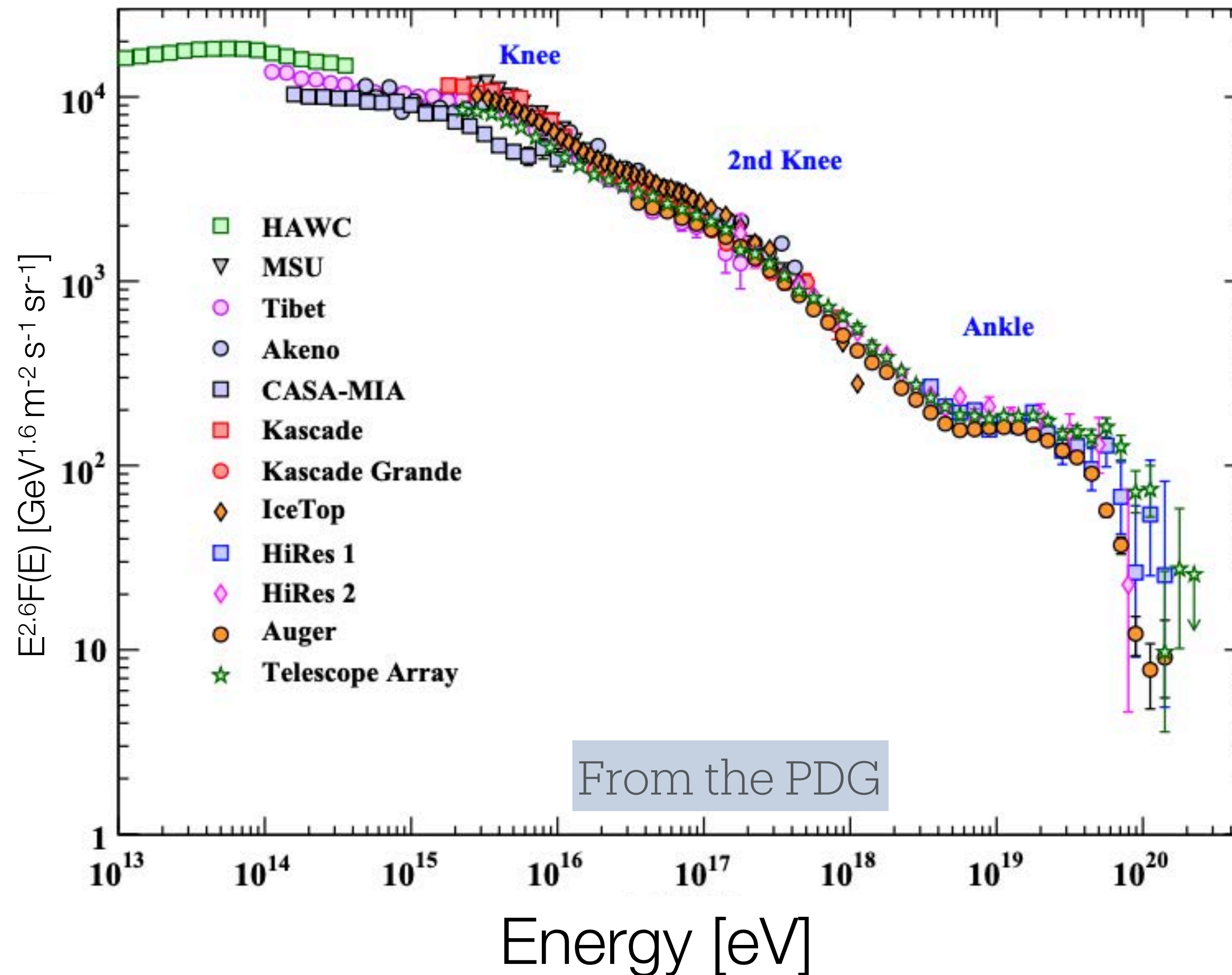


Why particle astrophysics?



Open questions in cosmic ray physics

Cosmic Ray Flux



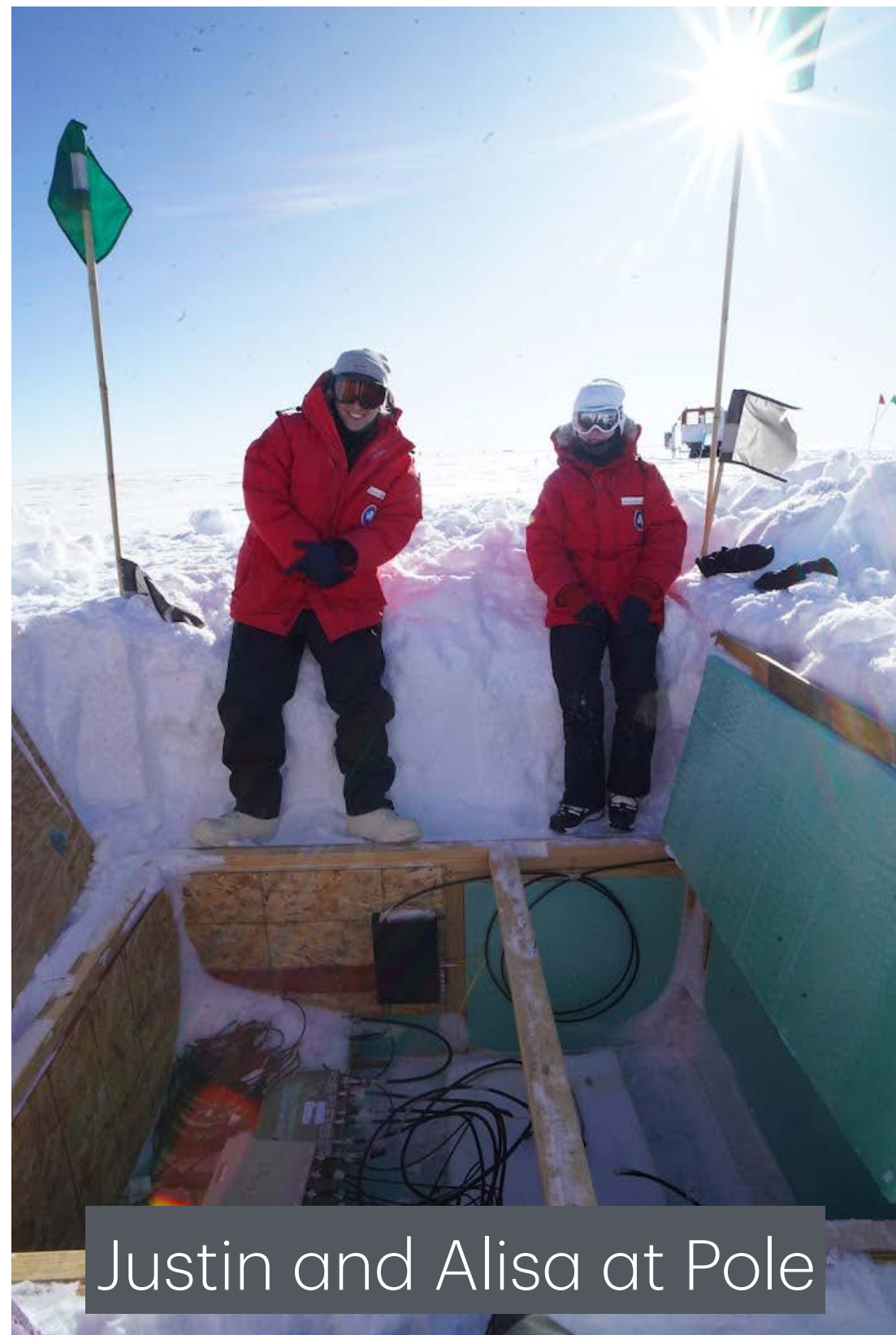
Where are the highest energy cosmic rays coming from?

What information do cosmic rays carry about their journey through the Universe?

How can we use cosmic rays to learn more about particle physics?

What we do at CCAAPP

- We build detectors- often in the most extreme places on Earth!



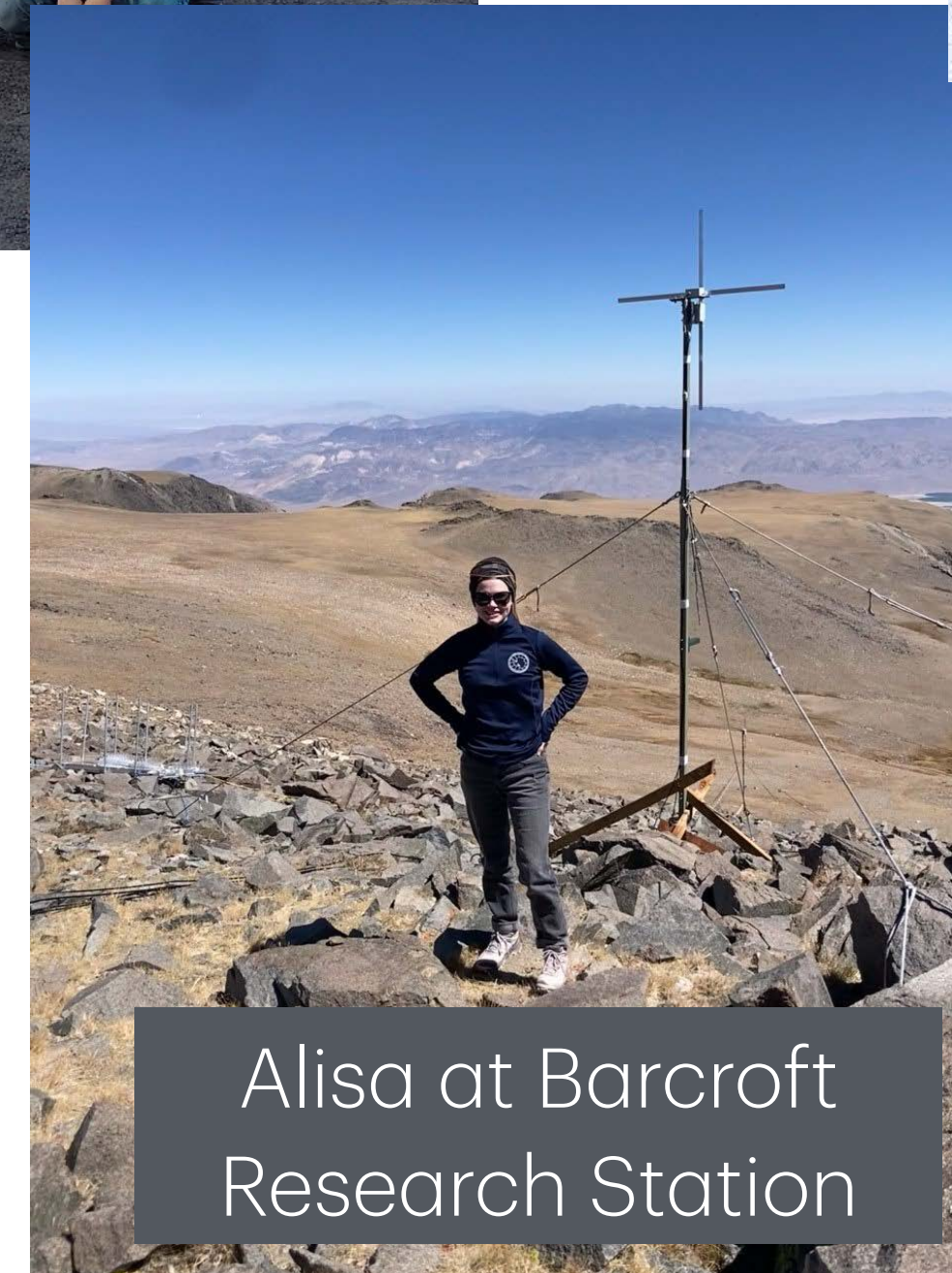
Justin and Alisa at Pole



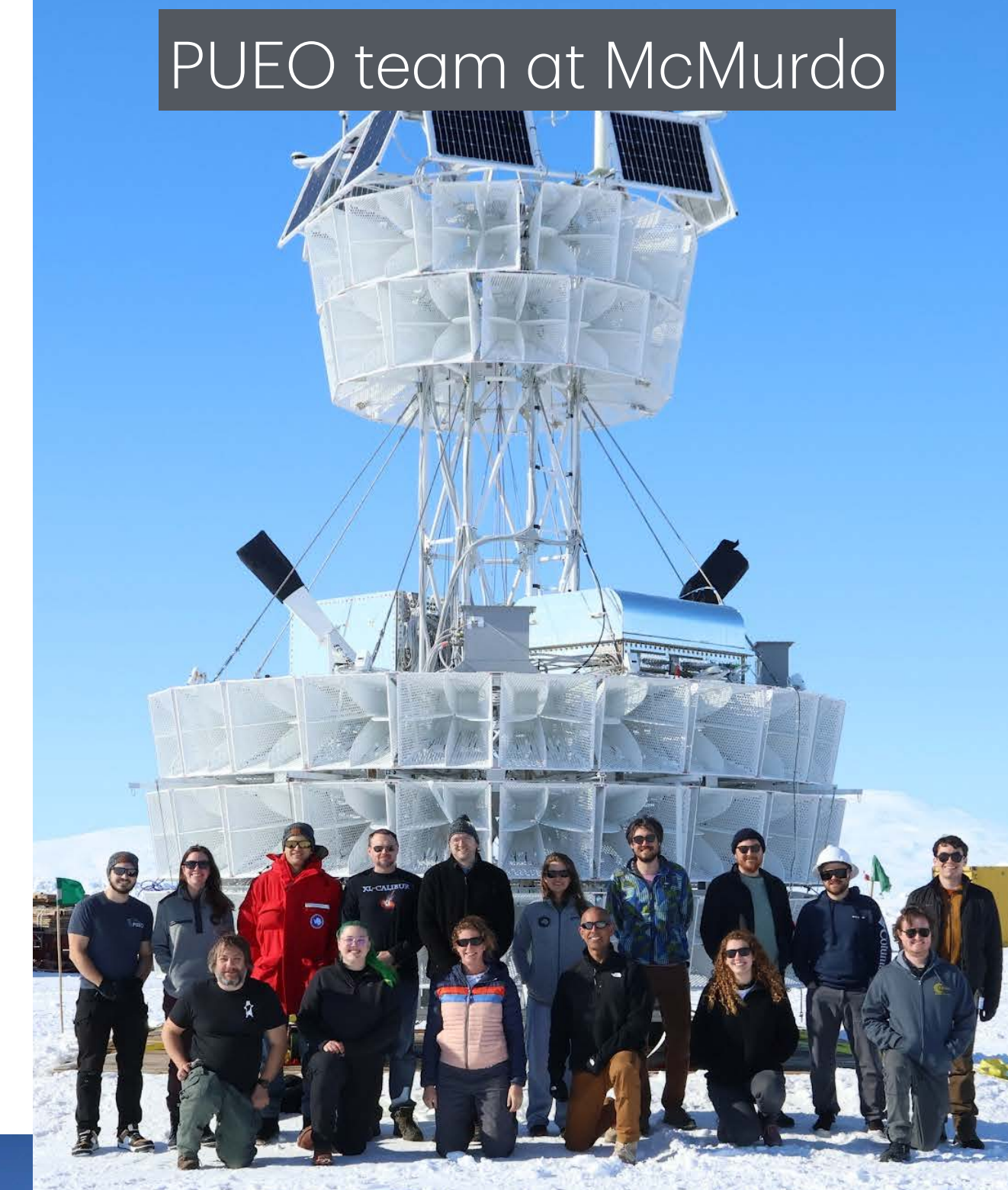
Will et. al. hunting for tornados



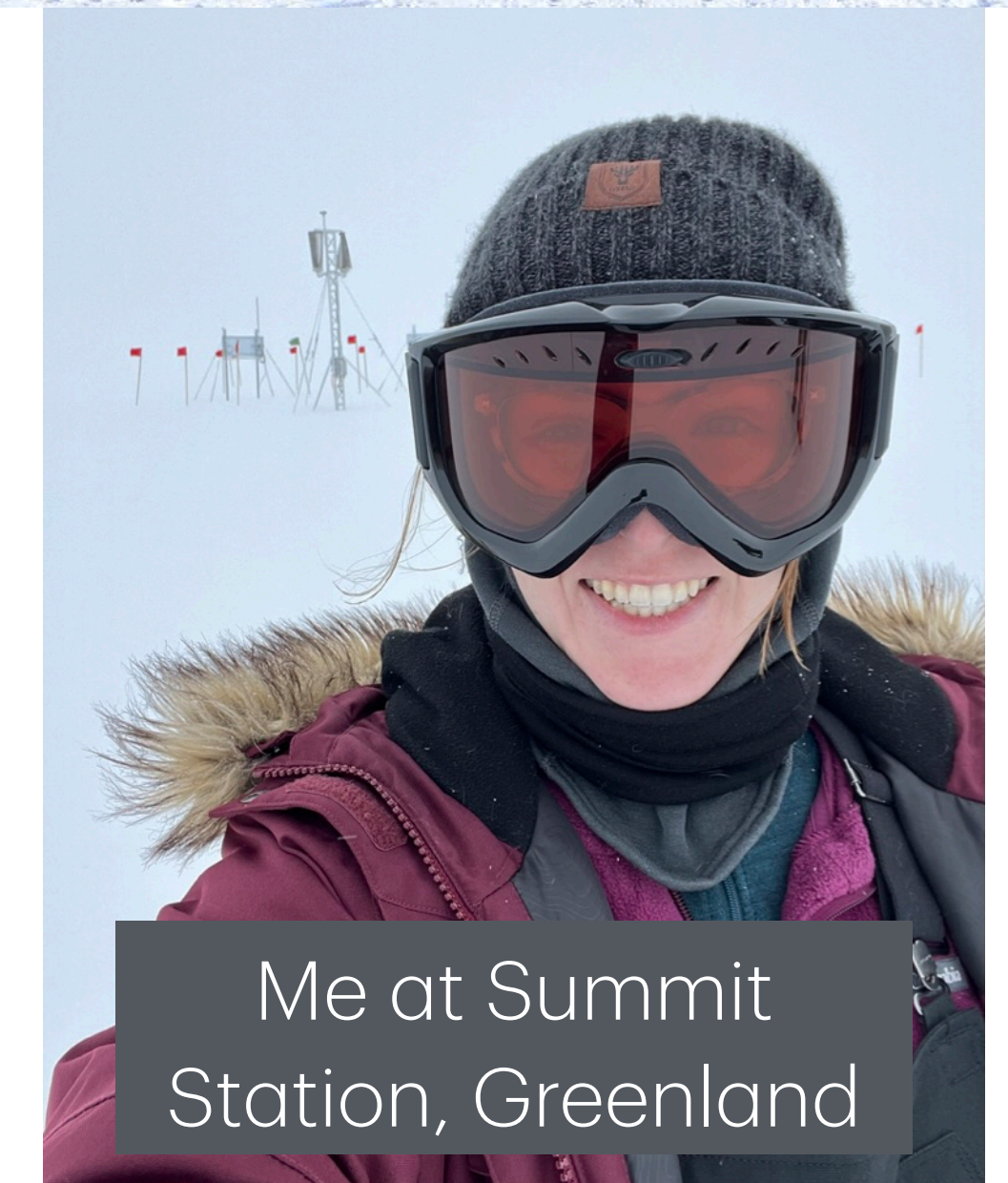
HELIX team pre-flight



Alisa at Barcroft Research Station



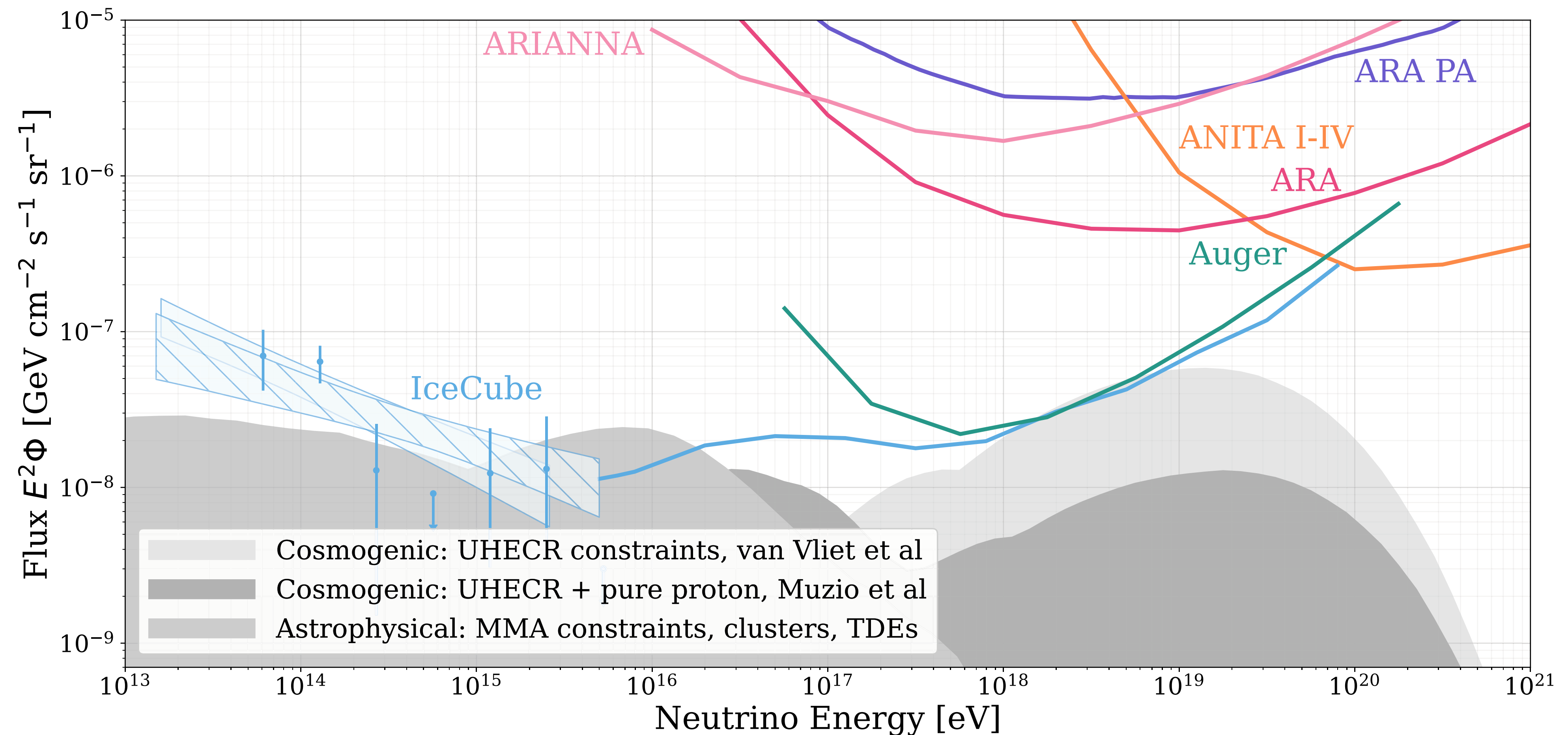
PUEO team at McMurdo



Me at Summit Station, Greenland

What we do at CCAPP

- We analyze data- contributing world-leading measurements or one-of-a-kind discoveries to our respective experiments!



What we do at CCAPP



- We interpret experimental results and motivate the next generation of particle detectors

Towards First Detection of the Solar MSW Transition With JUNO

Obada Nairat , ^{1,2,*} John F. Beacom , ^{1,2,3,†} Kevin J. Kelly , ^{4,‡} and Shirley Weishi Li , ^{5,§}

Minimal Dark Matter: Generalized Framework and Direct-Detection Sensitivity

Spencer Griffith , ^{1,2,*} Juri Smirnov , ^{3,†} Laura Lopez-Honorez , ^{4,5,‡} and John F. Beacom , ^{1,2,6,§}

Probing the conditions of the solar core using ^8B neutrinos

Melanie A. Zaidel , ^{1,2,*} and John F. Beacom , ^{1,2,3,†}

New Probes of Cosmic-Ray Interactions with the Sun

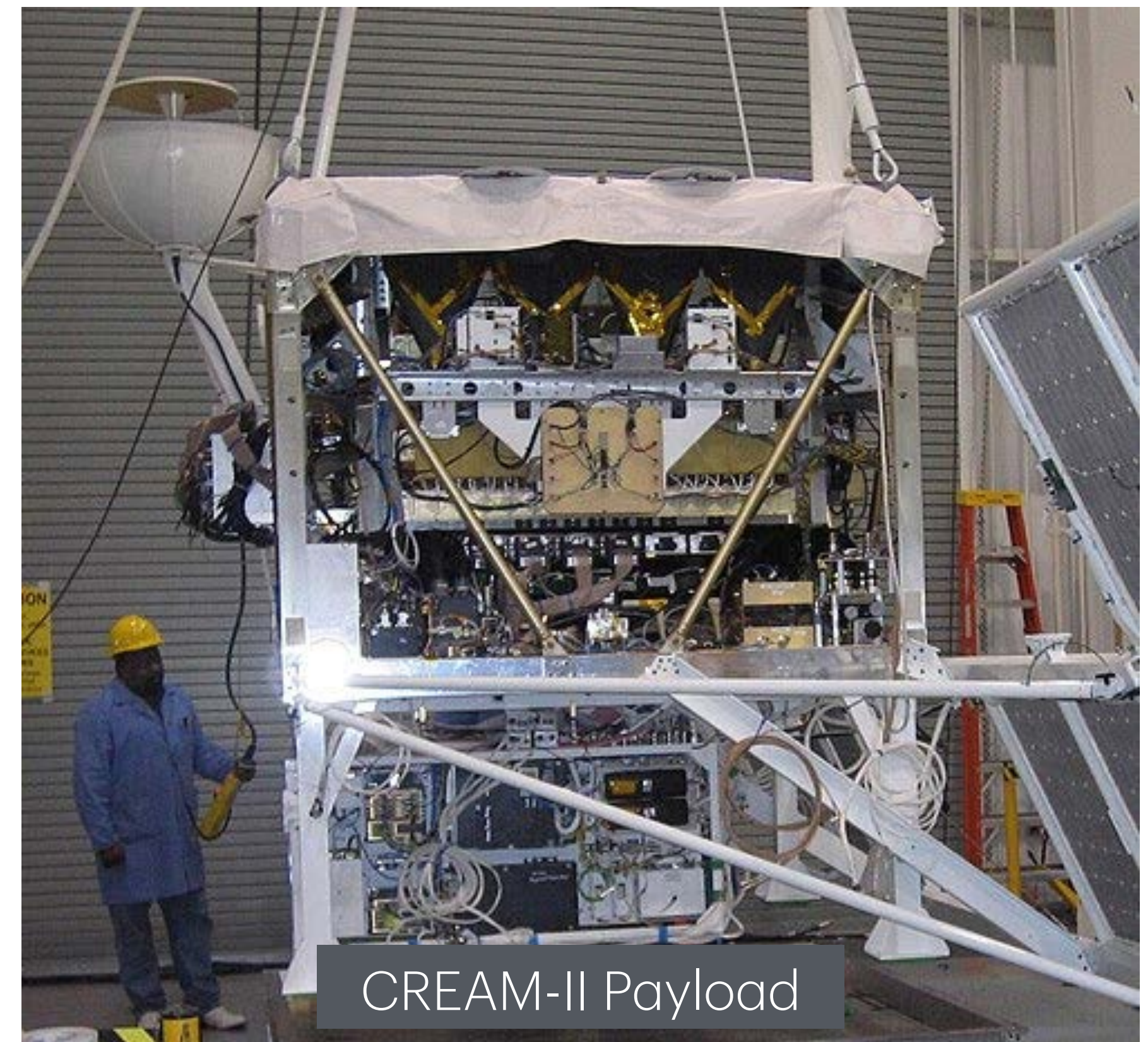
D. Leung, J.-T. Li, A. Peter, J. Beacom

Self-Calibration of the Neutrino-Argon Cross Section with Solar Neutrinos

Rasmi Hajjar, Obada Nairat, and John Beacom

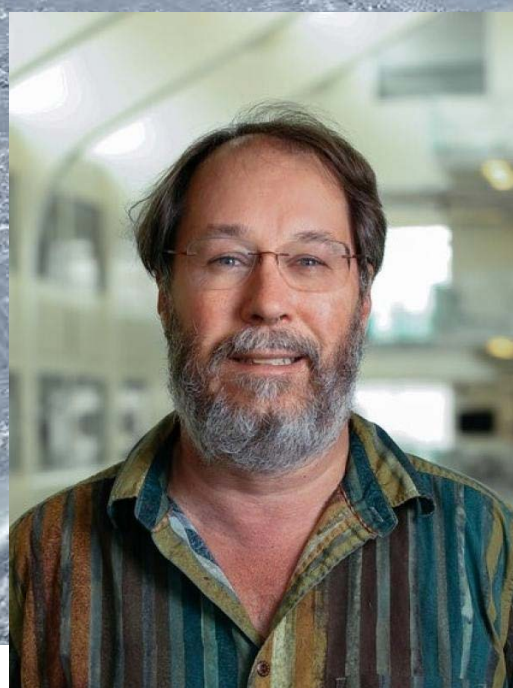
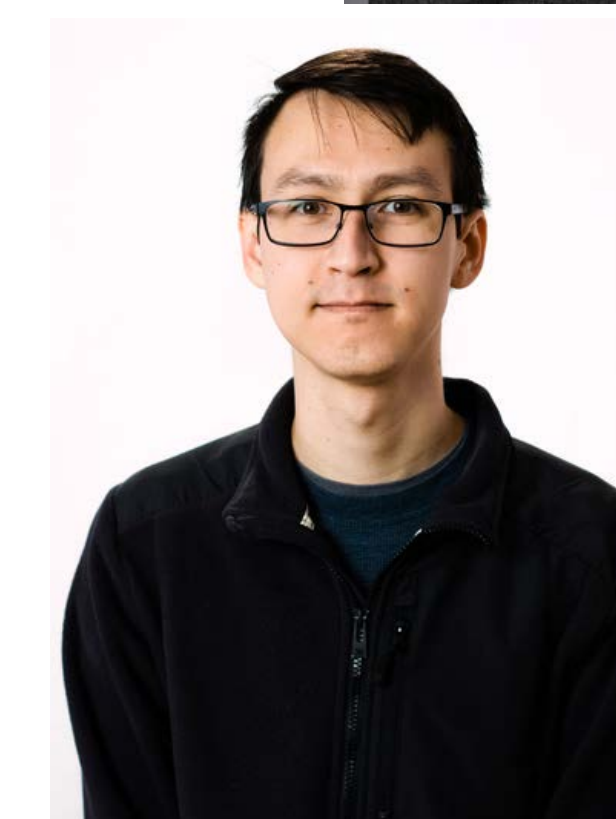
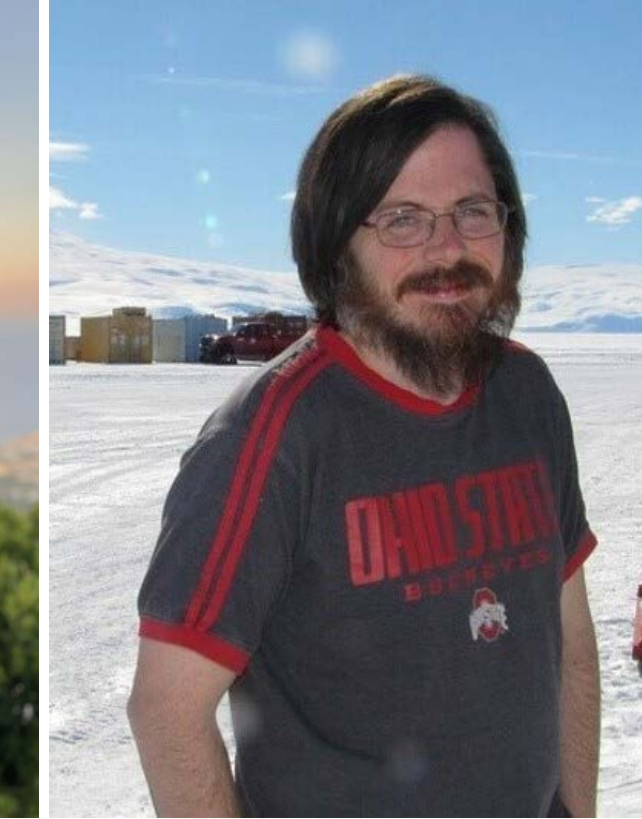
Then and now...

Ballooning in 2006



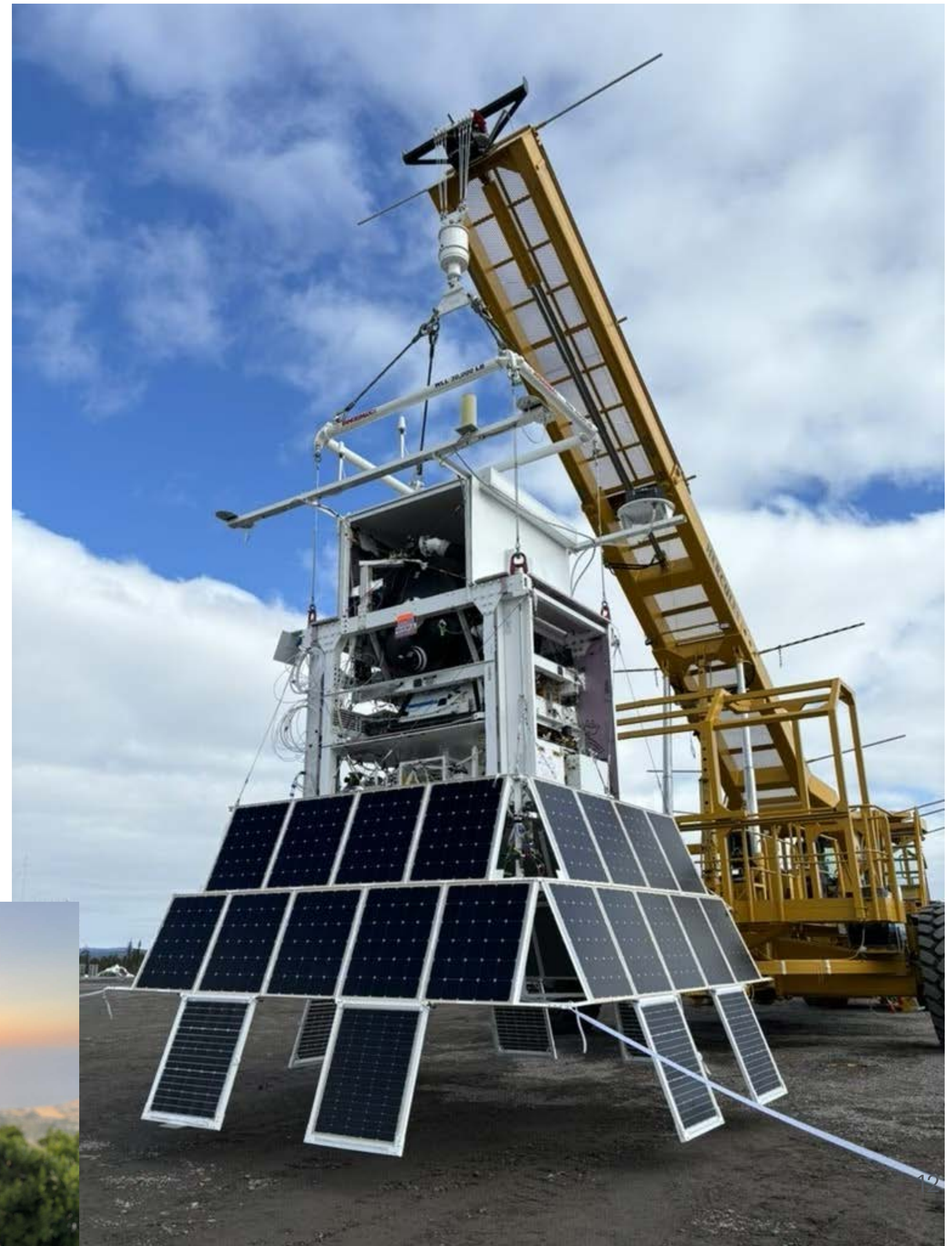
Ballooning Now: PUEO

World leading sensitivity to neutrinos at the highest energies!

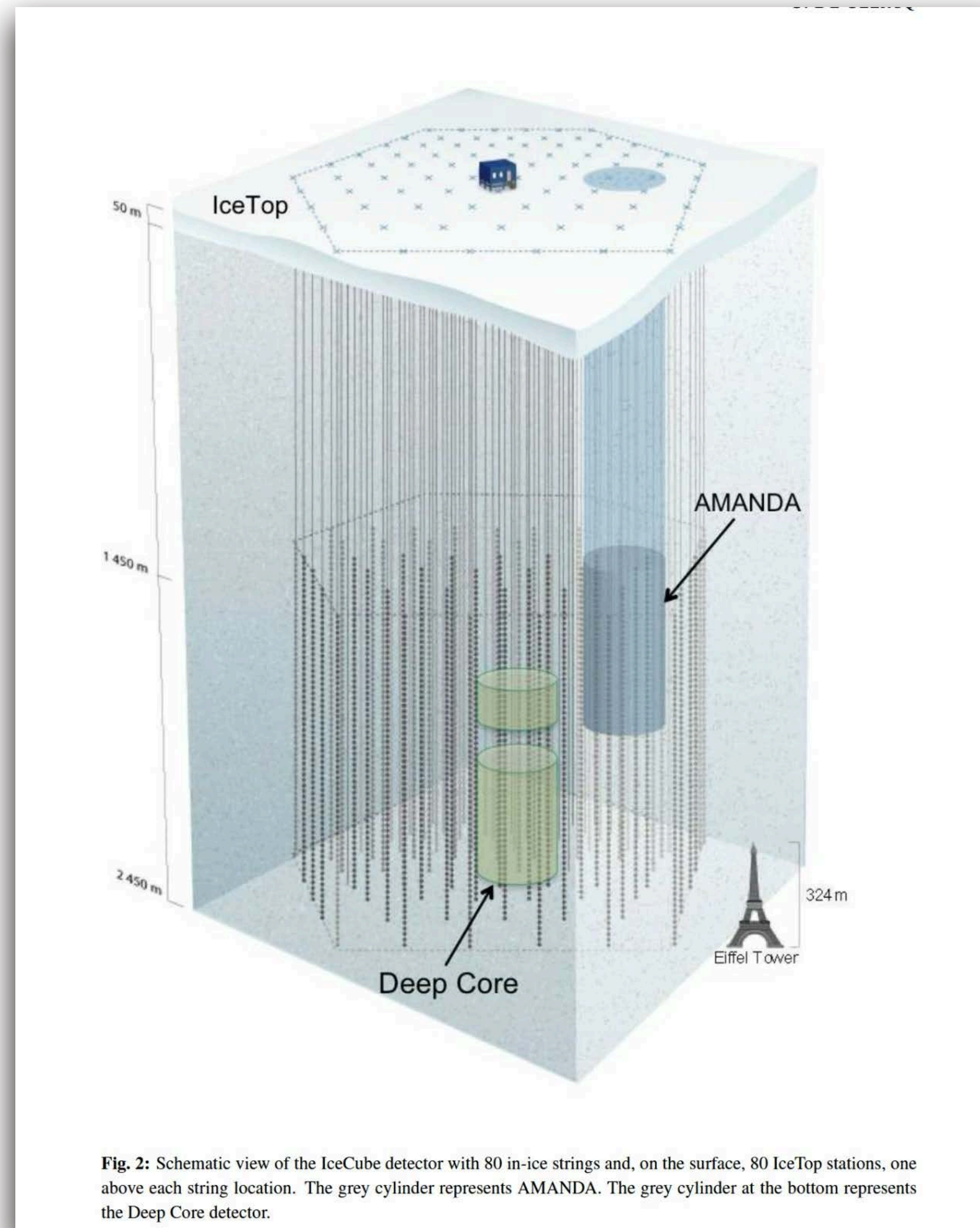


Ballooning Now

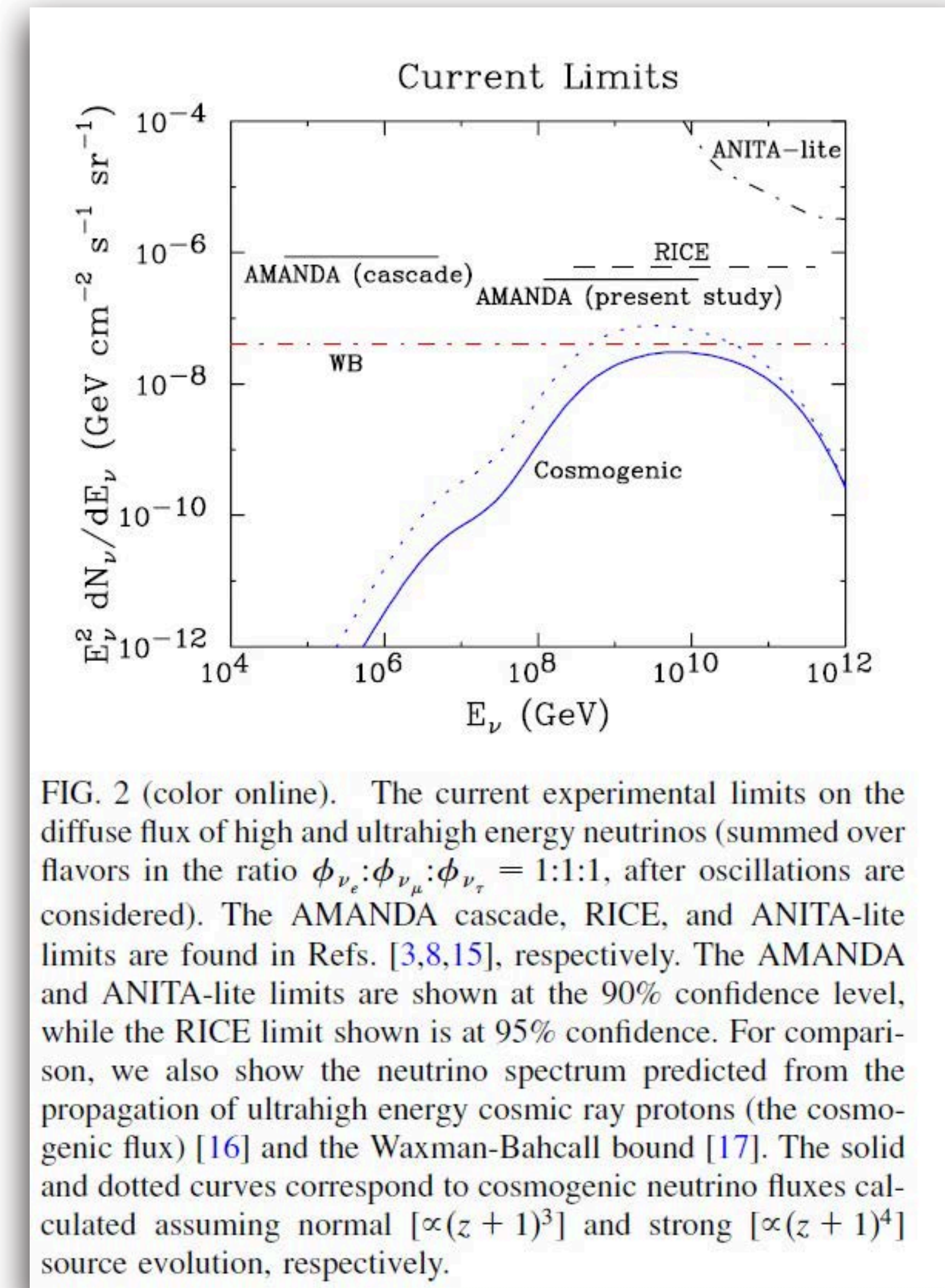
HELIX



Ice-based neutrino detectors in 2006

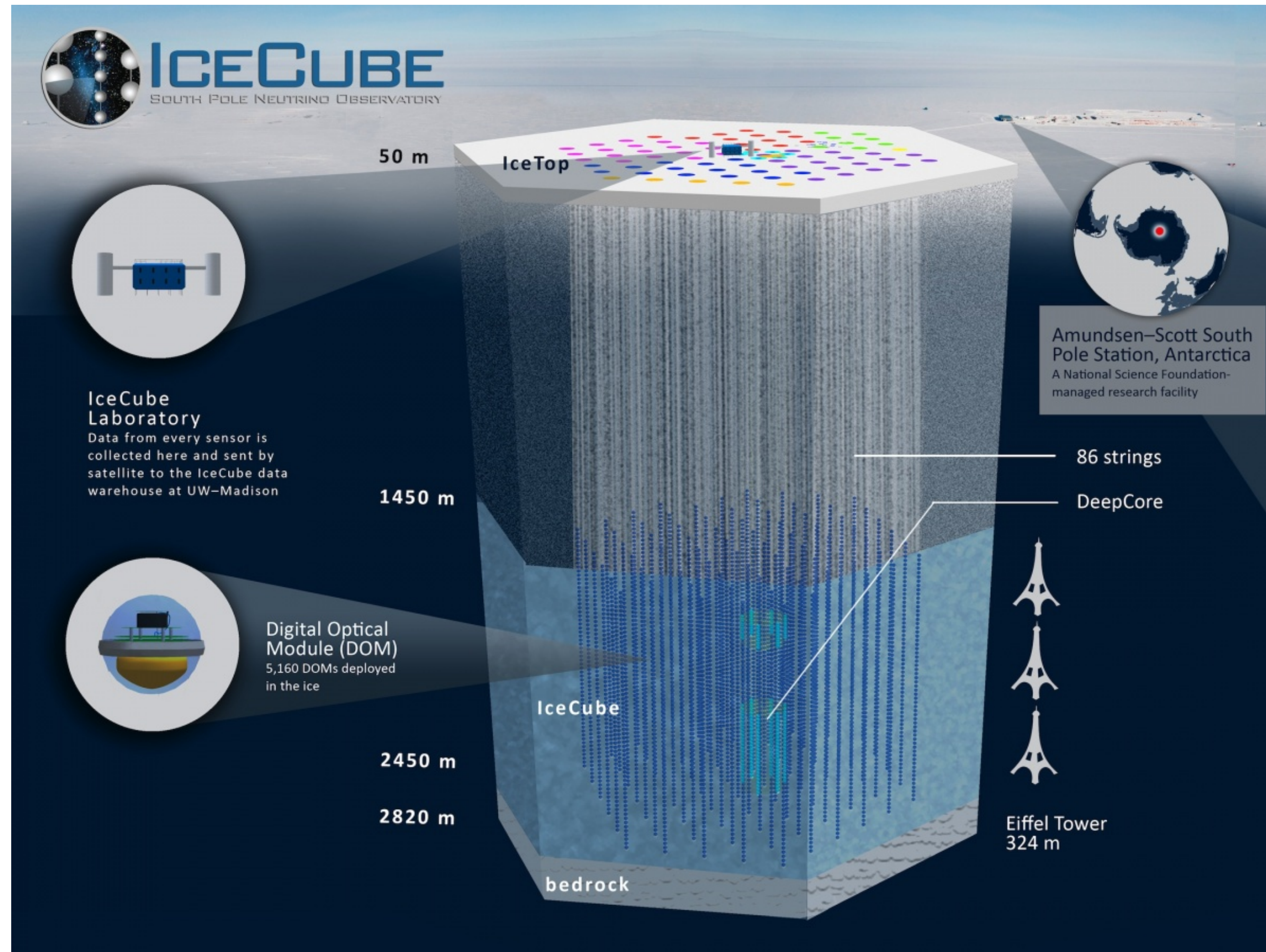
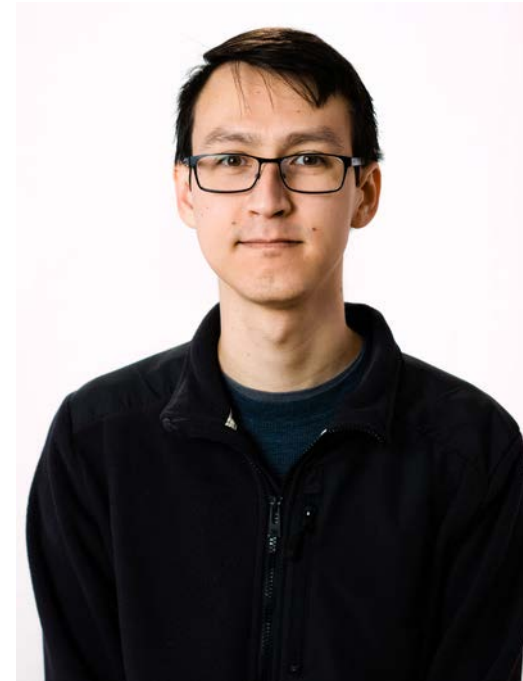


deClercq, 2006

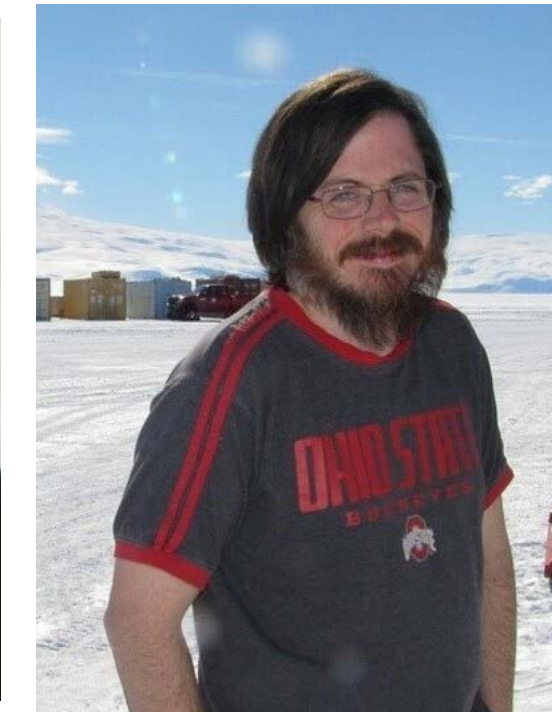
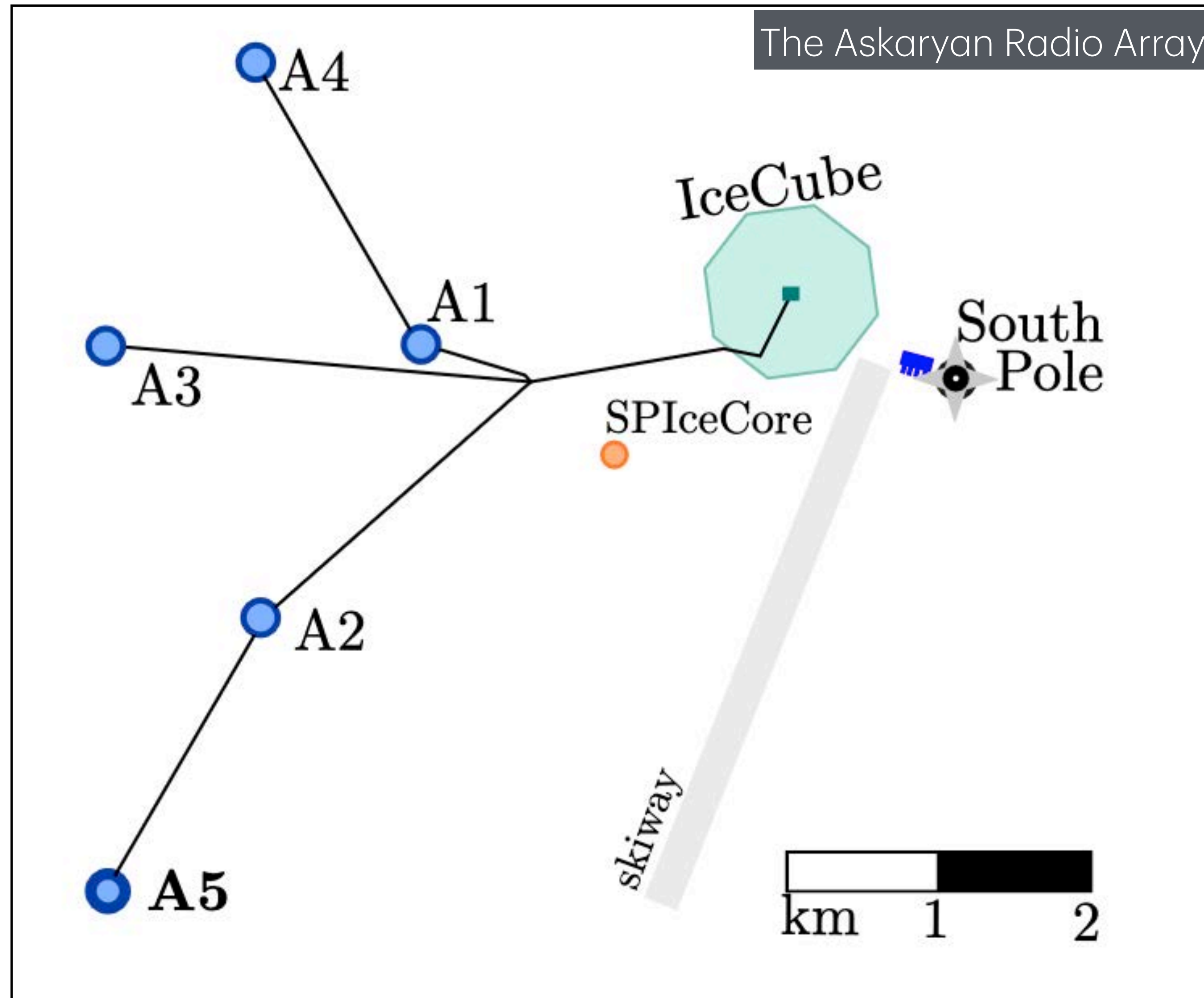


Hooper and Halzen, 2006

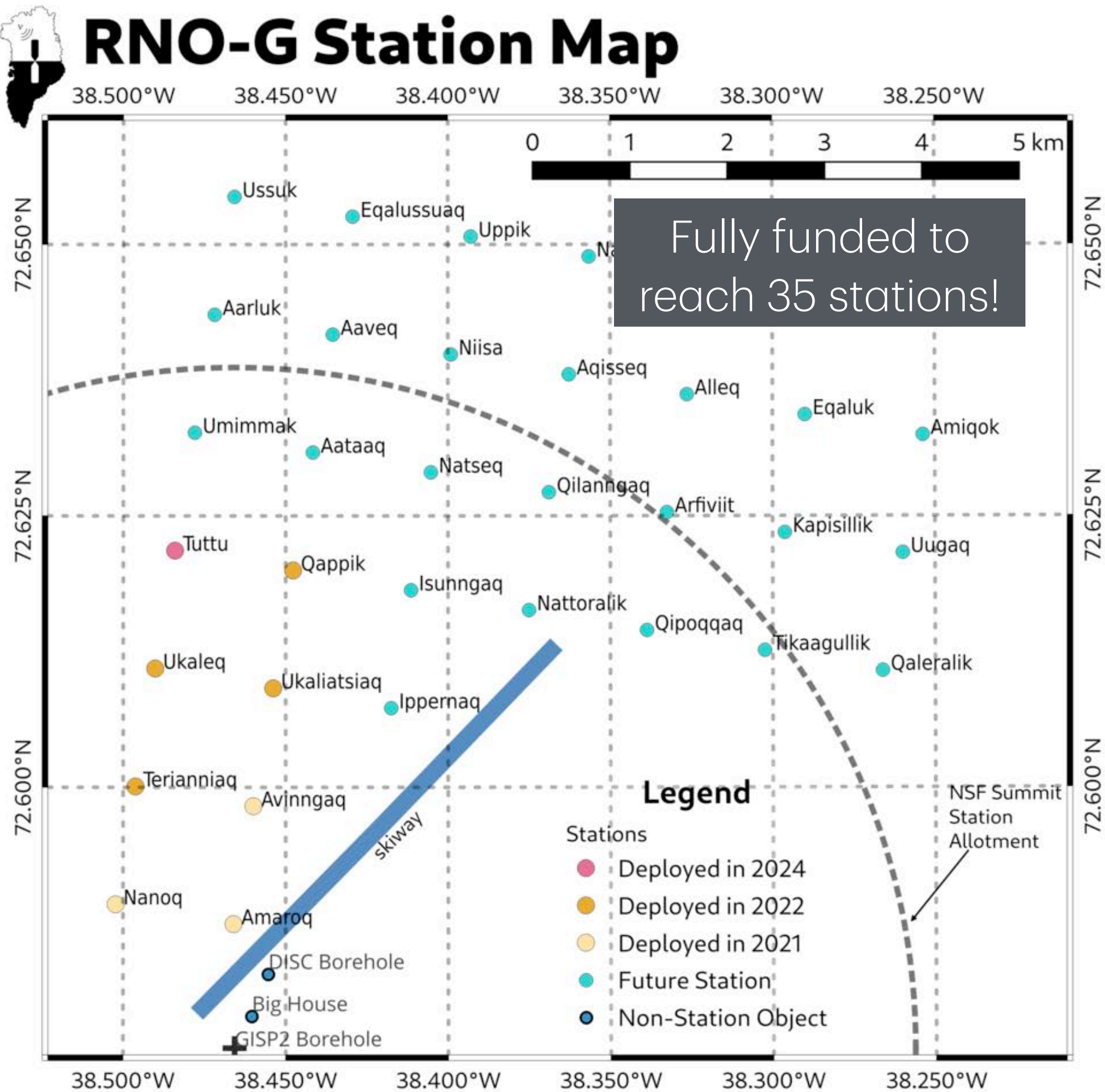
Ice-based neutrino detectors now



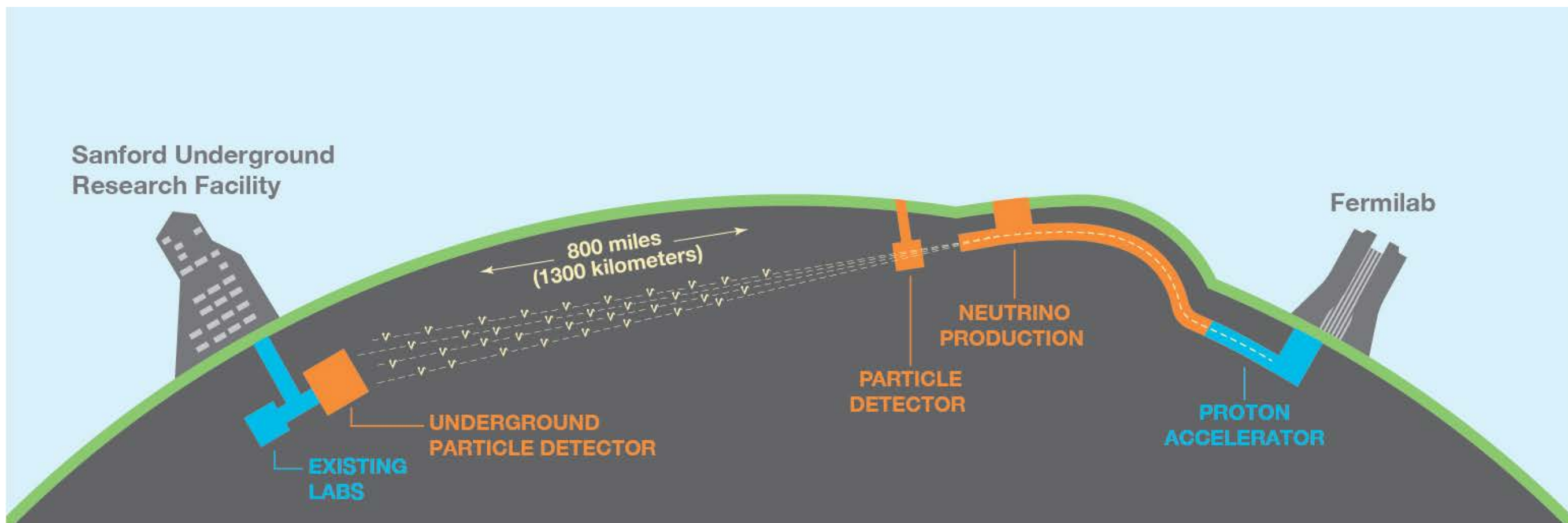
Ice-based neutrino detectors now



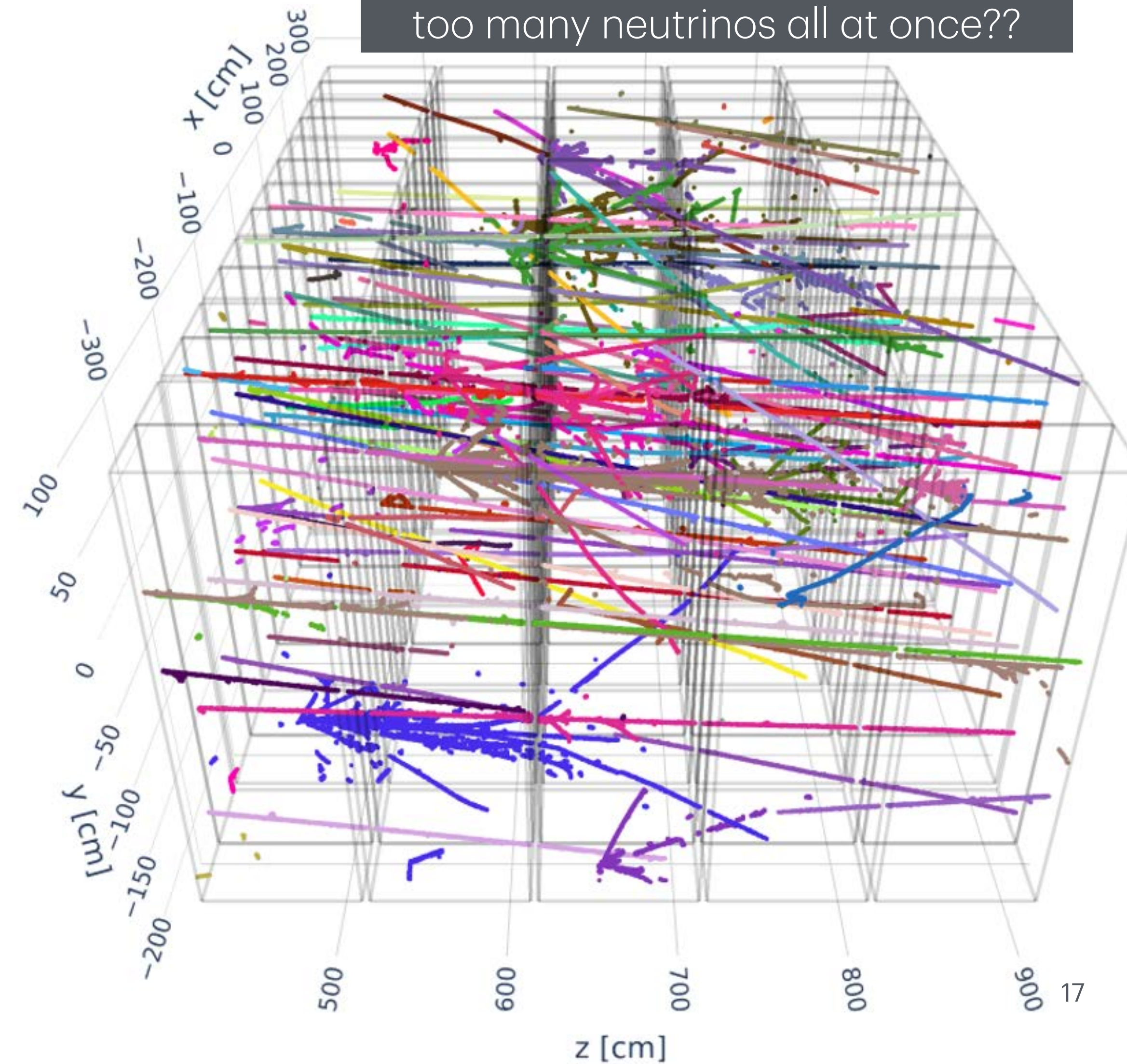
Ice-based neutrino detectors now



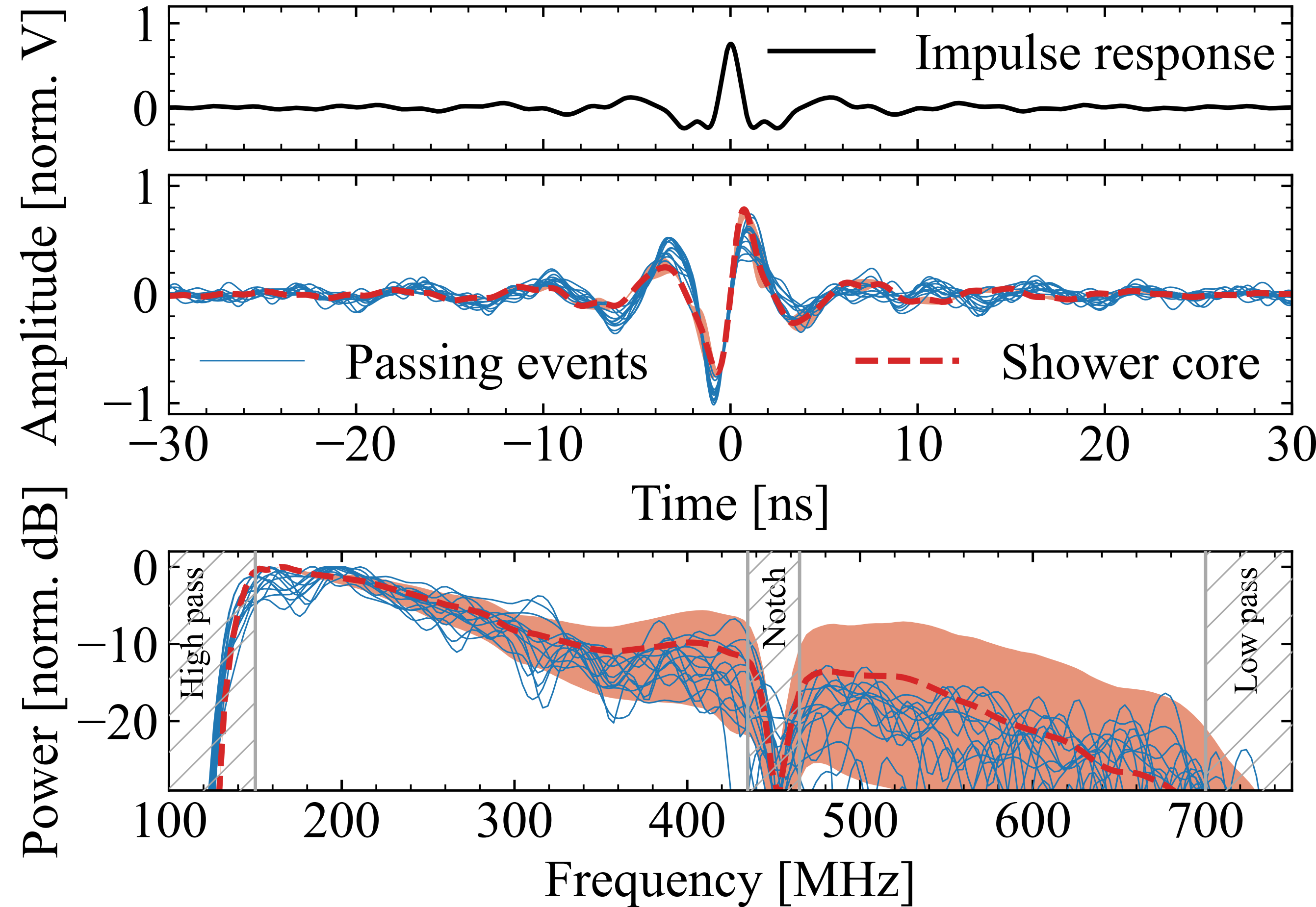
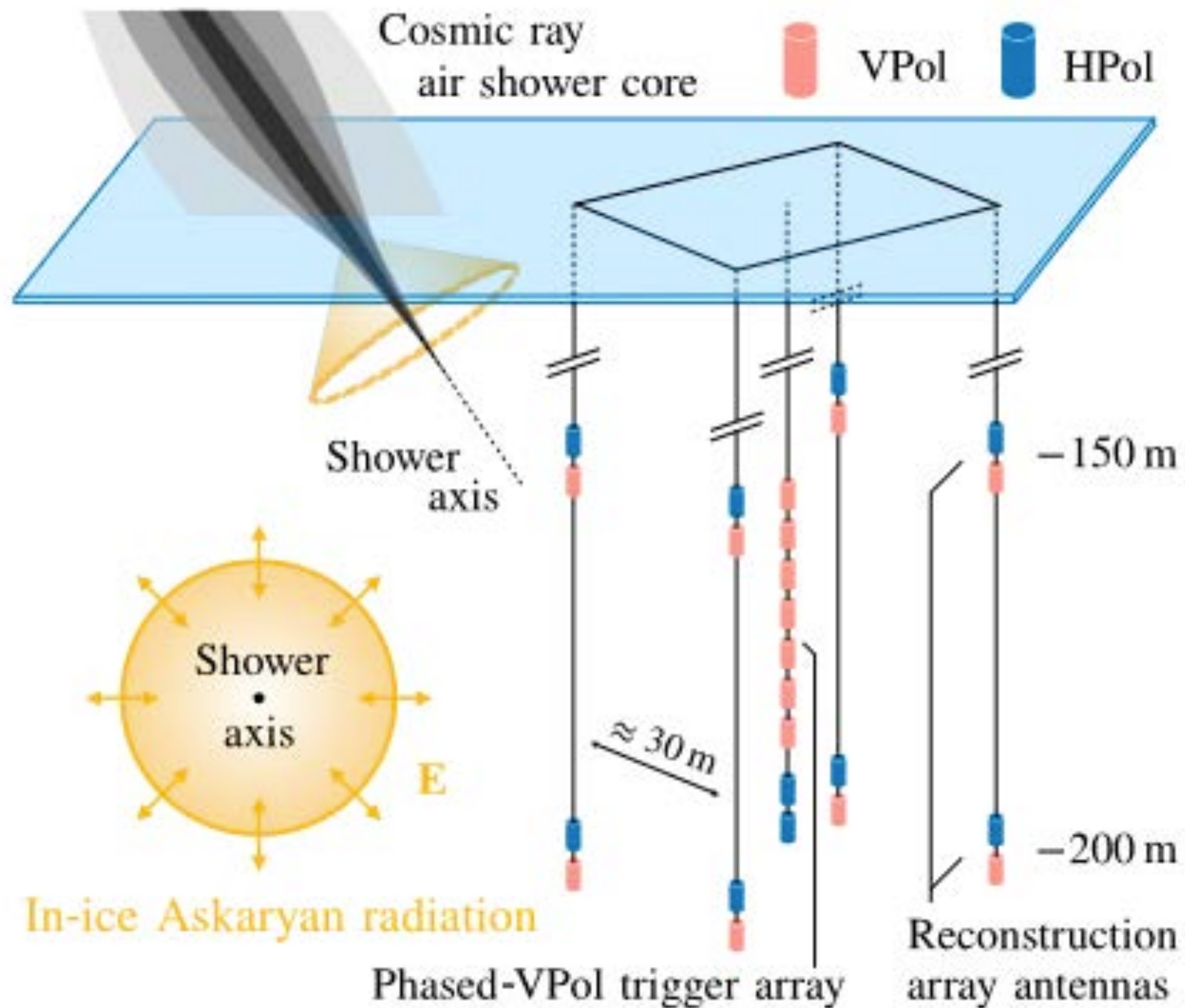
Neutrino Detectors Now



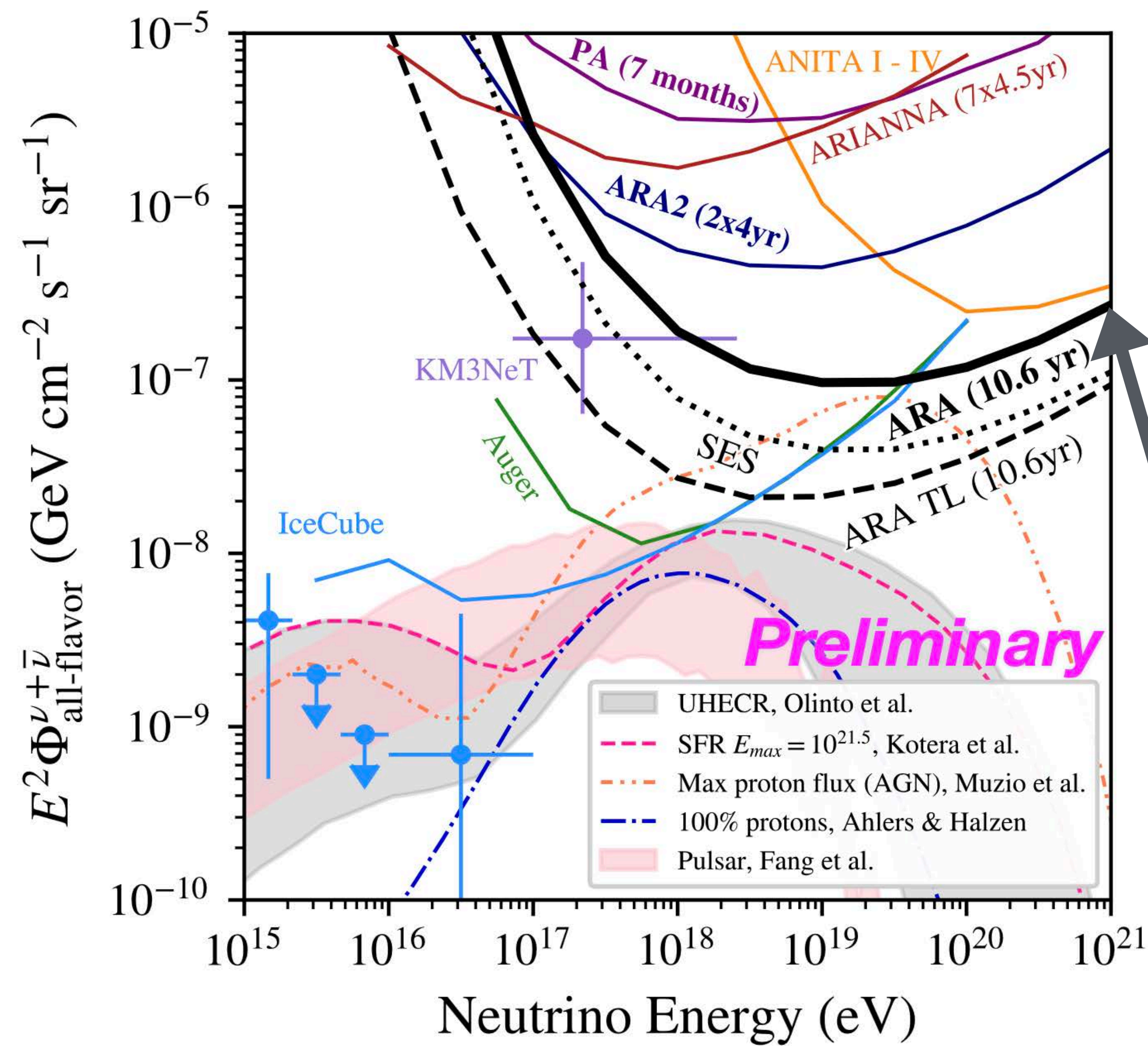
Upcoming DUNE Near Detector-
too many neutrinos all at once??



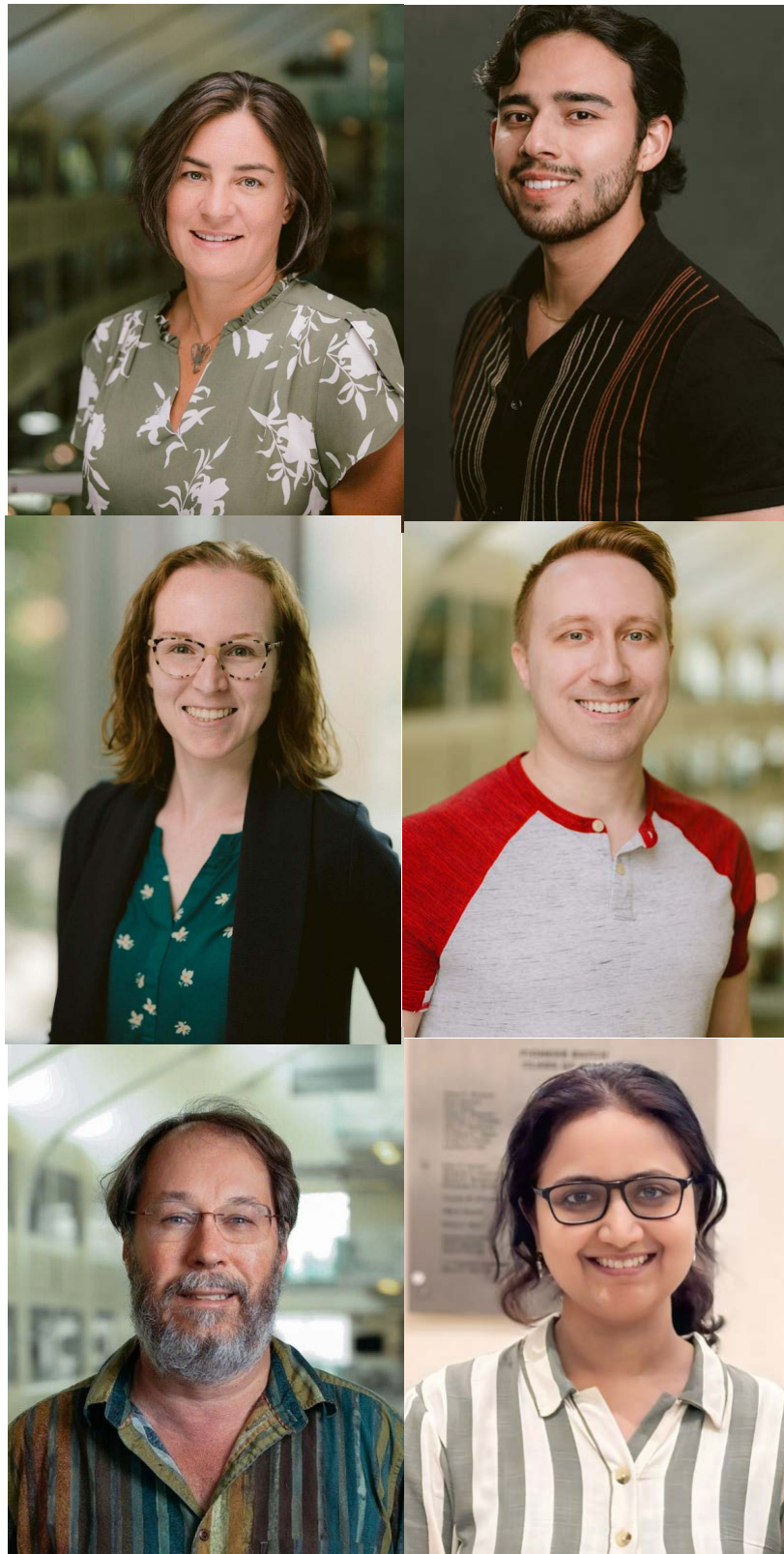
Recent Results: detecting Askaryan emission in natural ice!



Recent Results: new limit from the Askaryan Radio Array!



Projected limit for ongoing neutrino search - stay tuned!



Summary

- Over the last 20 years, CCAPP has more than earned its international reputation for excellent particle astrophysics research
- Lots of groundbreaking and world-leading research continues here today, thanks to a huge team of grad students, postdocs, and researchers
- Special thanks to Jim Beatty, who is retiring this year- we will have big shoes to fill!

