

June 3rd, 2026

Brief Career History

Jacob Daughhete

Radiation, Imaging, and Advanced Diagnostics
Group

Physics Division

Physical Sciences Directorate



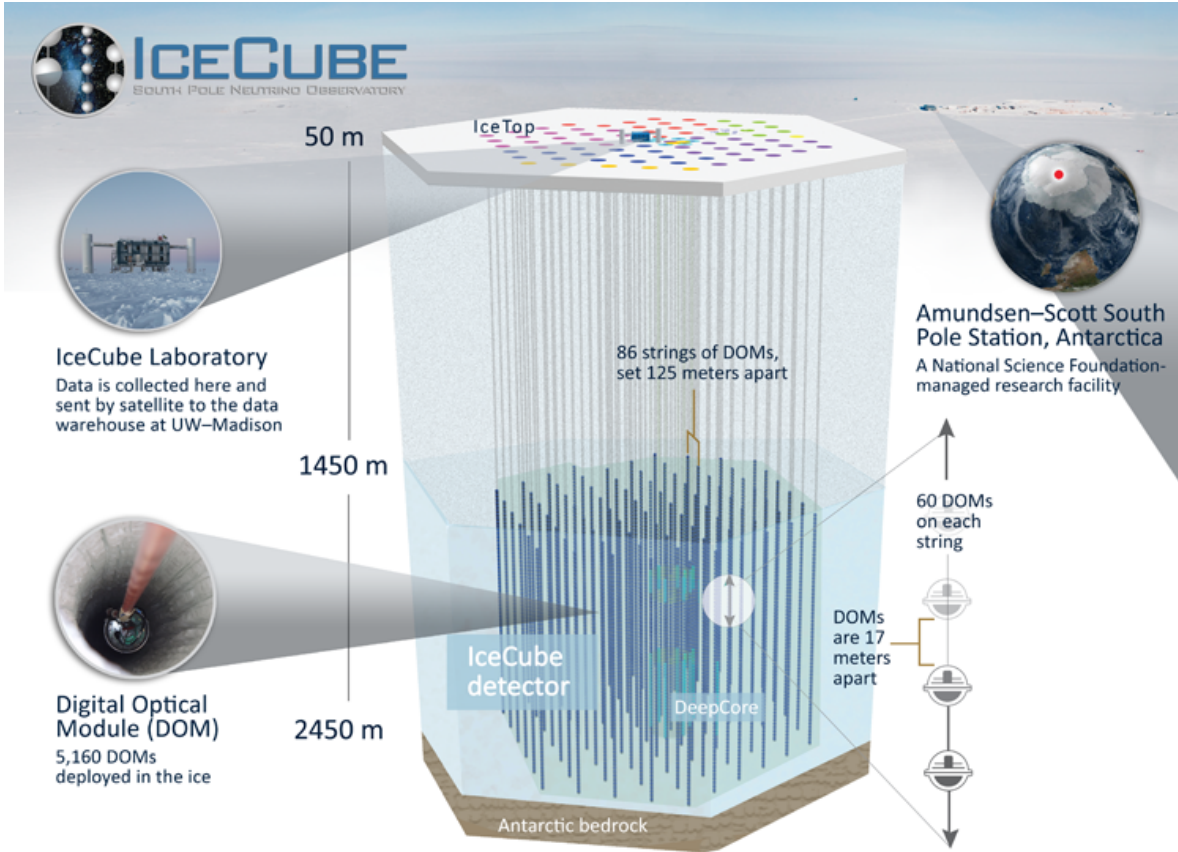
U.S. DEPARTMENT
of **ENERGY**

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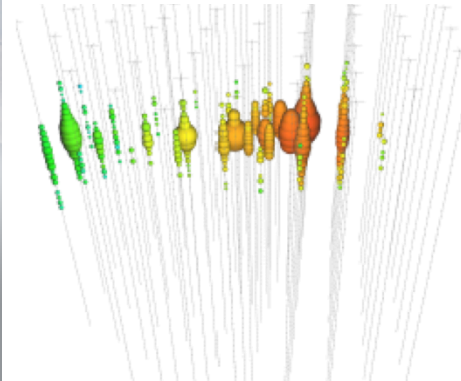


Neutrino Astronomy at Georgia Tech

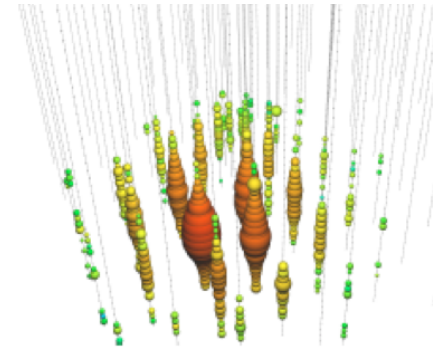
PhD in 2015



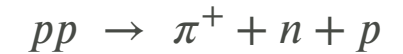
Tracks



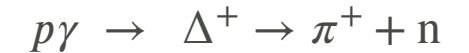
Cascades



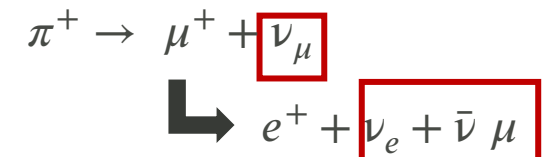
- High energy cosmic rays means hadronic acceleration -> neutrinos:



OR



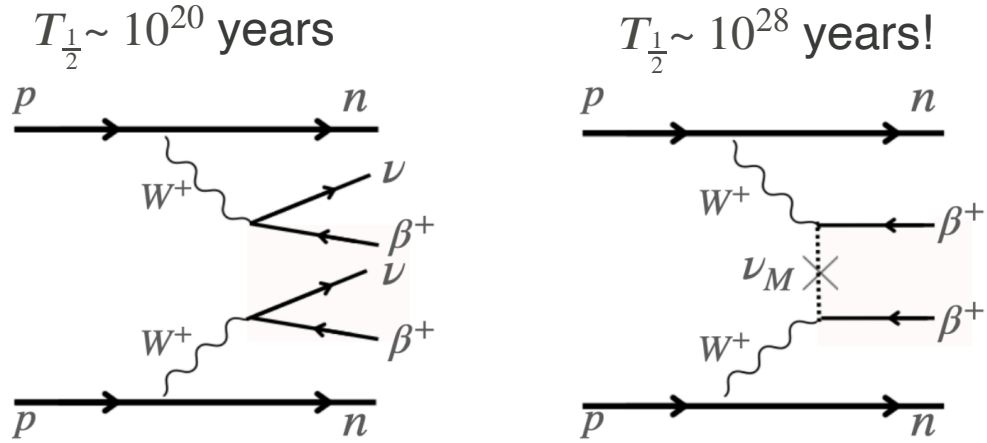
π^- can be produced as well, both will decay yield neutrinos:



- Tracks from muon neutrinos provide excellent spatial resolution – use these to search for neutrino point sources in the sky!
- IceCube science includes source searches, neutrino oscillation measurements, dark matter, real-time alerts, and more.
- LARGE detector with large amounts of data – collaboration utilizes ML tools to good effect.

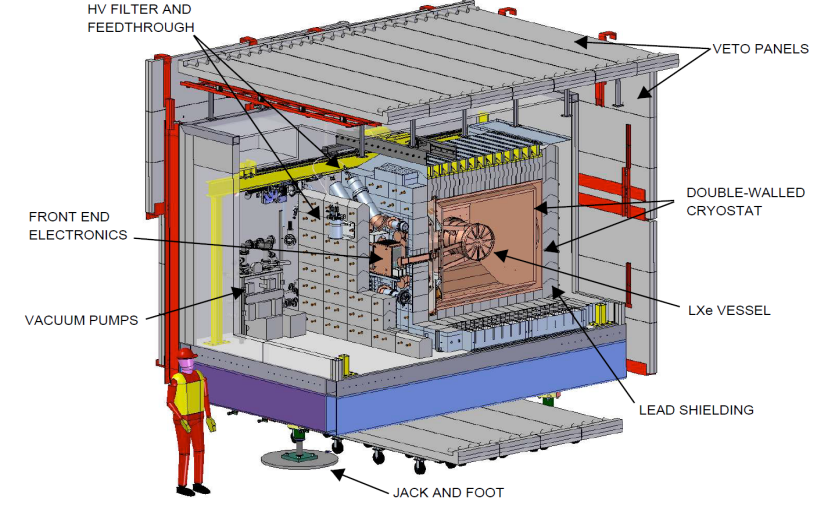
Neutrinoless Double Beta Decay

- How do neutrinos get their mass?
- Why are they so much lighter?
- **Majorana vs Dirac**



Isotope	Nat %
^{48}Ca	0.187
^{76}Ge	7.75
^{96}Zr	2.8
^{130}Te	34.1
^{136}Xe	8.86

University of South Dakota
(2016-2017)



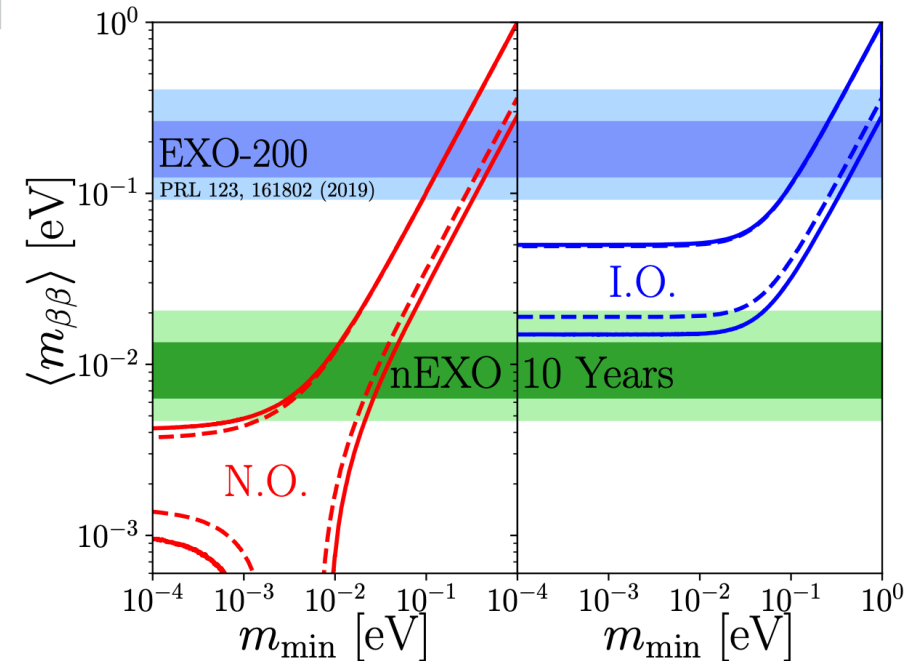
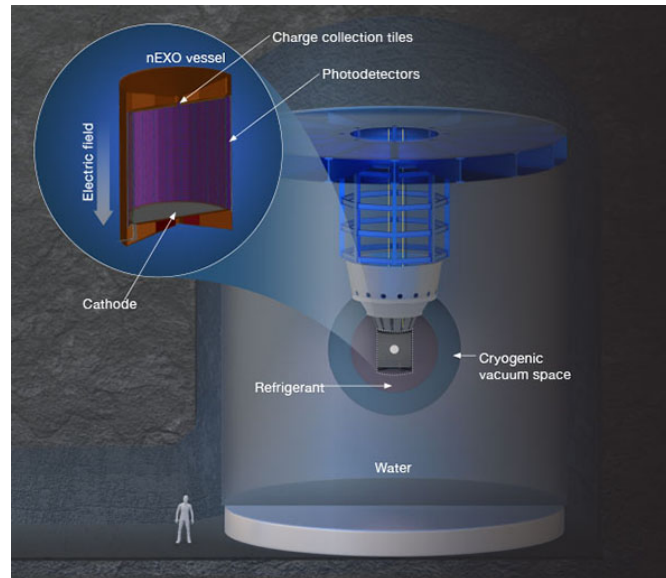
If the neutrino is a Majorana particle...

Heavy right-hand neutrinos

ν and $\bar{\nu}$ are the same!



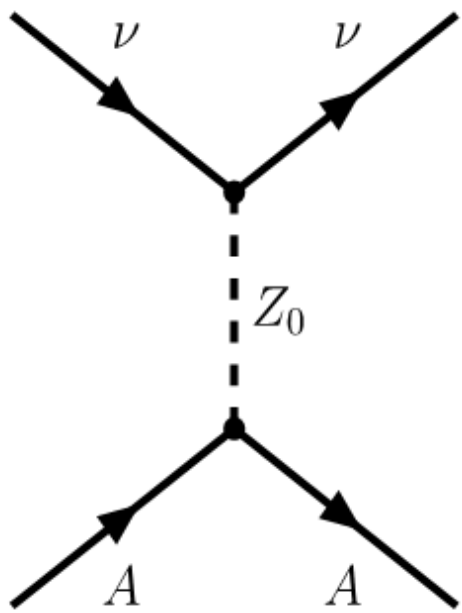
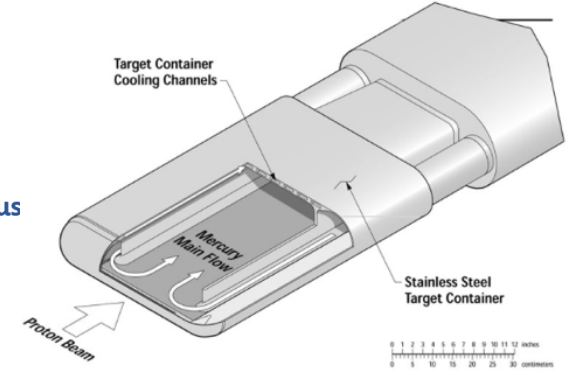
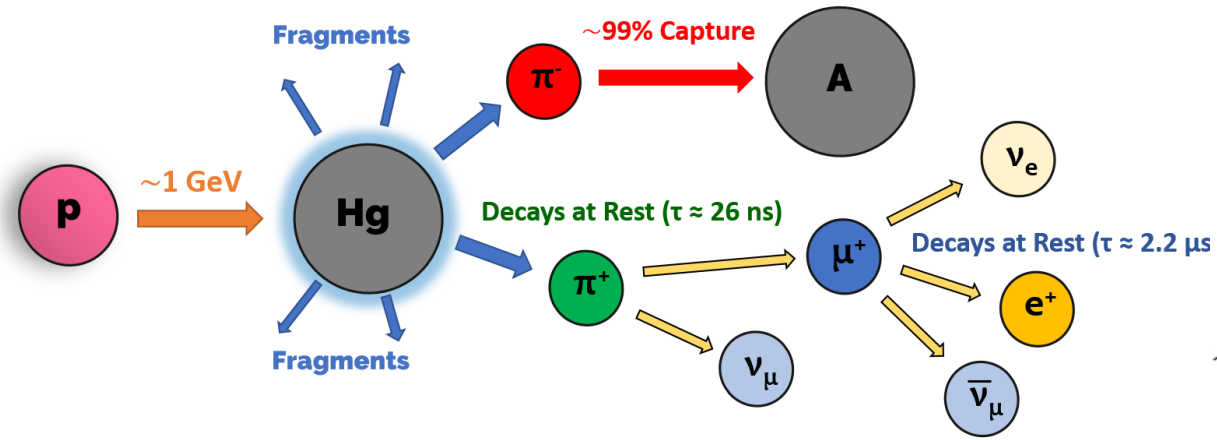
Leptogenesis



Coherent Elastic Neutrino-Nucleus Scattering

University of Tennessee

(2017-2021)



- CEVNS cross-section is high (for neutrinos...) but the signal is a very small nuclear recoil!
- First detection of coherent elastic neutrino-nucleus scattering (**CEVNS**) in 2017 using 14.6 kg CsI[Na] crystal.
- Additional results using Ge and Ar detectors; D₂O detector installed to more accurately measure flux.
- First foray into using neural networks as tool for electronic vs nuclear recoil event identification in LAr.



Rad Imaging - Oak Ridge National Laboratory

Developing novel radiation imaging technologies for **treaty verification**, **criticality safety**, **material accountability**.

Neutrons

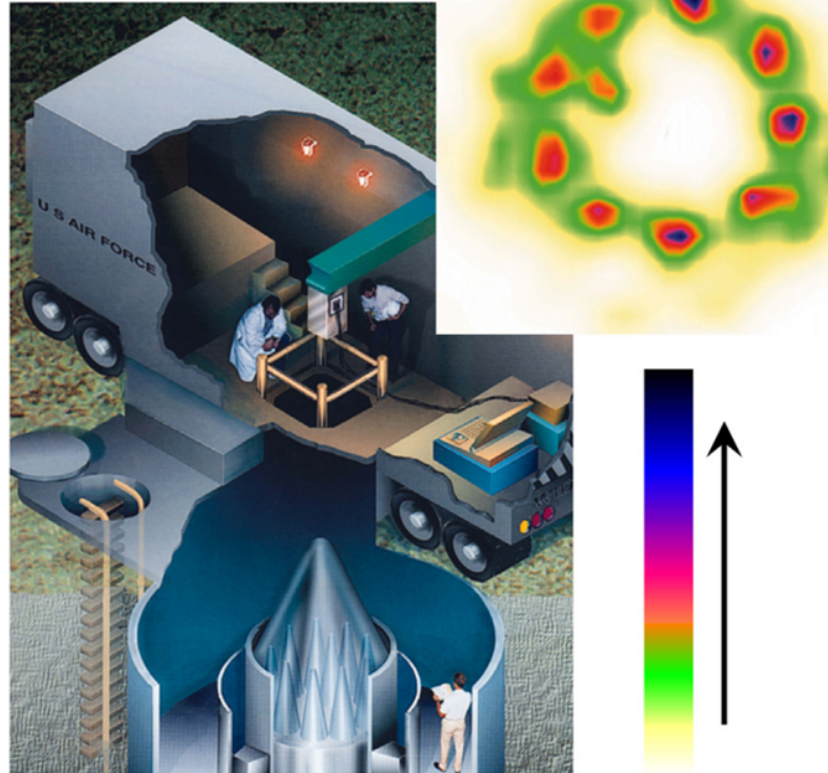
Associated Particle Imaging

Gamma Rays

- Spectroscopy
- Compton Imaging
- **Coded Aperture**



Special Nuclear Material
(^{235}U , ^{239}Pu , ^{241}Am , etc.)
emits radiation!



Top-down gamma ray image of a peacekeeper missile with individual warheads visible.

<https://str.llnl.gov/sites/str/files/2024-04/1995.10.pdf>

Images of 25 x 50 cm cards coated with enriched uranium oxide dust.
(Top) Coded Aperture cross-correlation
(Bot) Elastic Net linear regression
Article in preparation for NIM A