Radio Detections of Neutrinos and UHECRs

Abby Bishop
IceCube Bootcamp 2022
17 June 2022

UHE = 10^{17} eV + above

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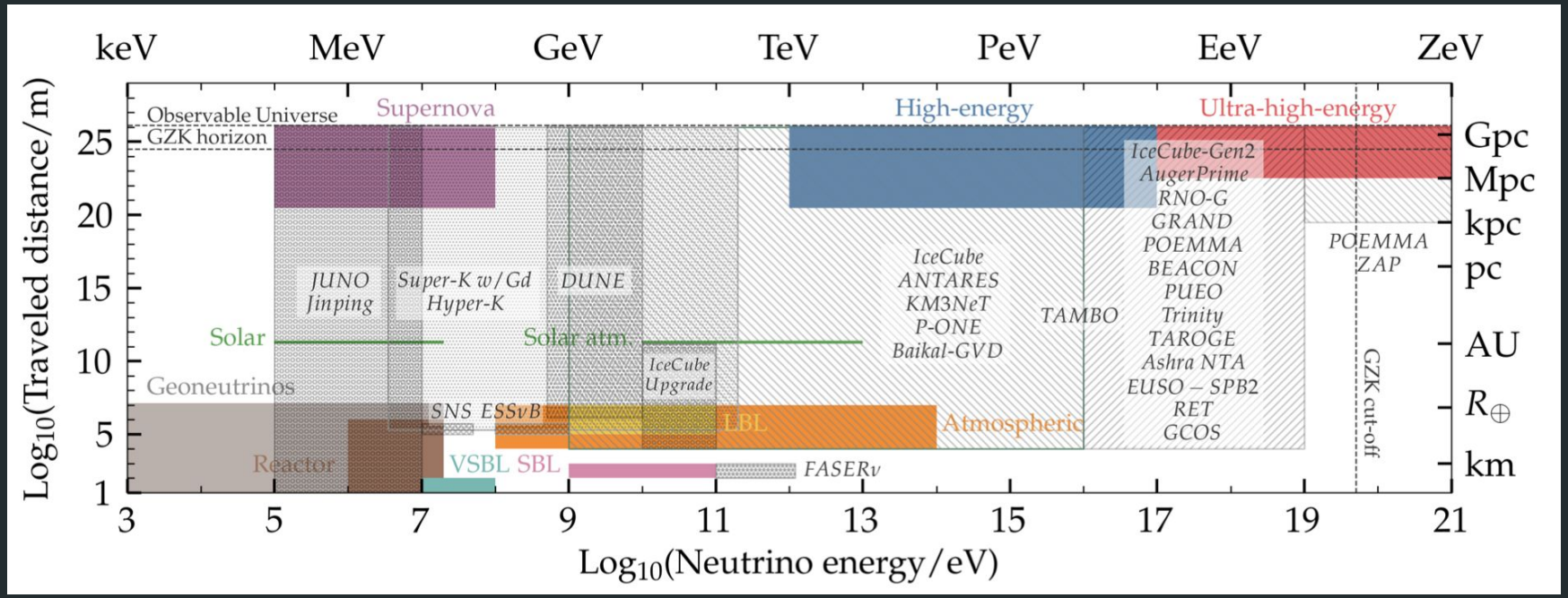
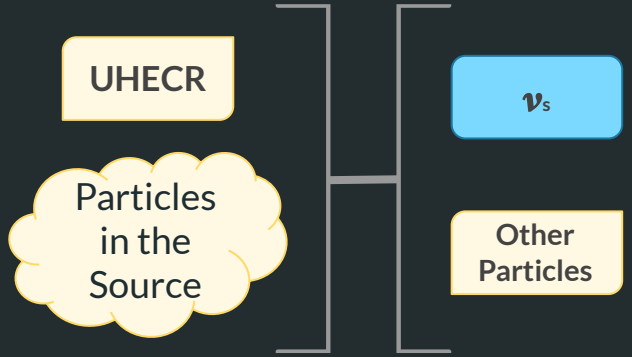


https://arxiv.org/abs/2203.08096

Producer of UHE Neutrinos = Ultra High Energy Cosmic Ray Interactions

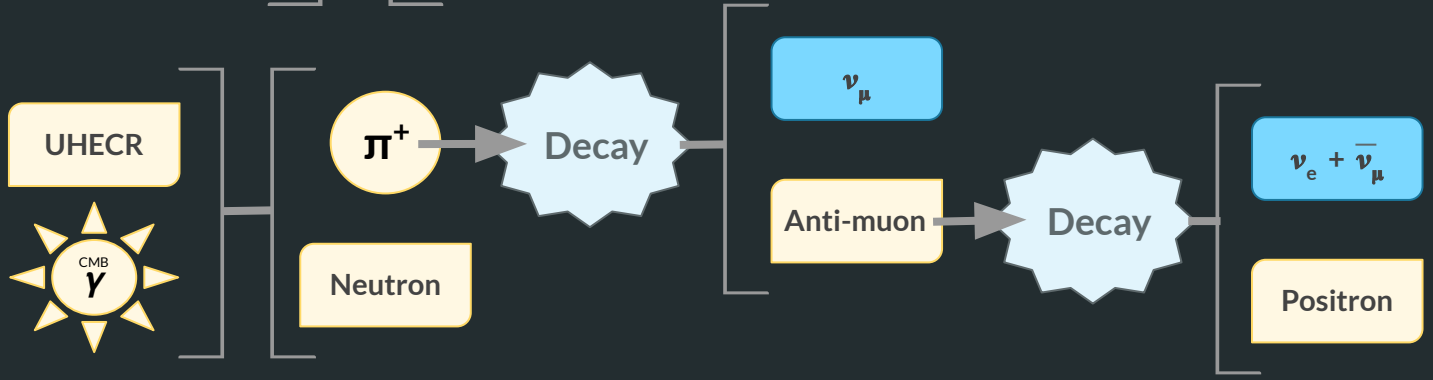
Astrophysical

(point sources)

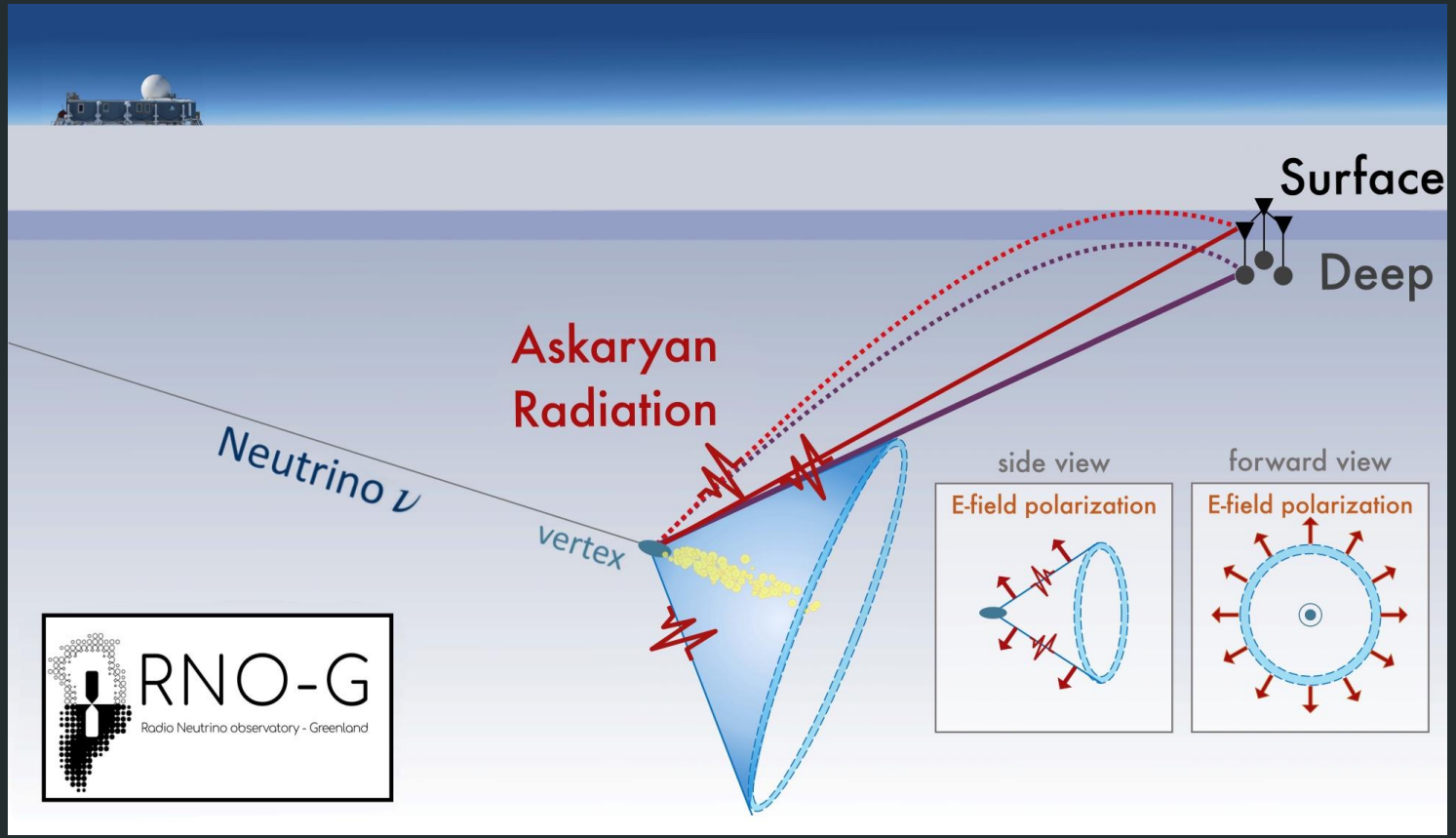


Cosmogenic

(diffuse sources, via GZK effect)



Askaryan Radiation Reveals UHE Neutrino Interactions

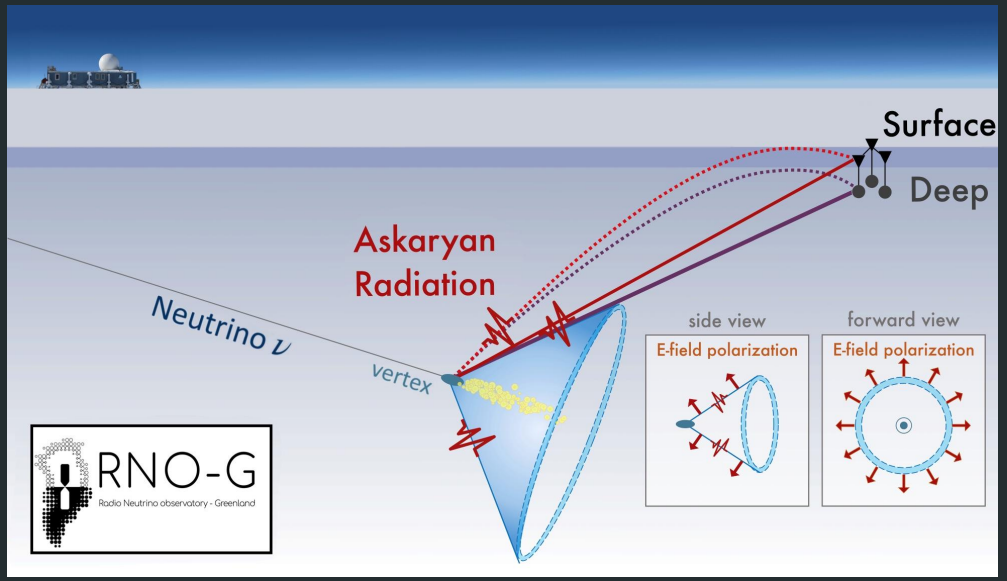


https://arxiv.org/abs/2010.12279

Finding UHE Neutrinos 101

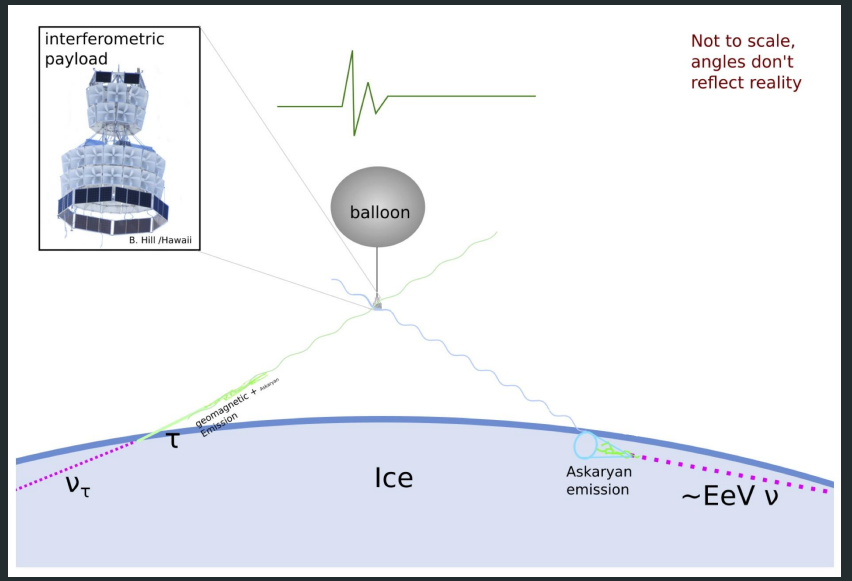
Look for neutrinos of all flavors interacting in ice, coming from sky and horizon

From Ice



https://arxiv.org/abs/2010.12279

From Air

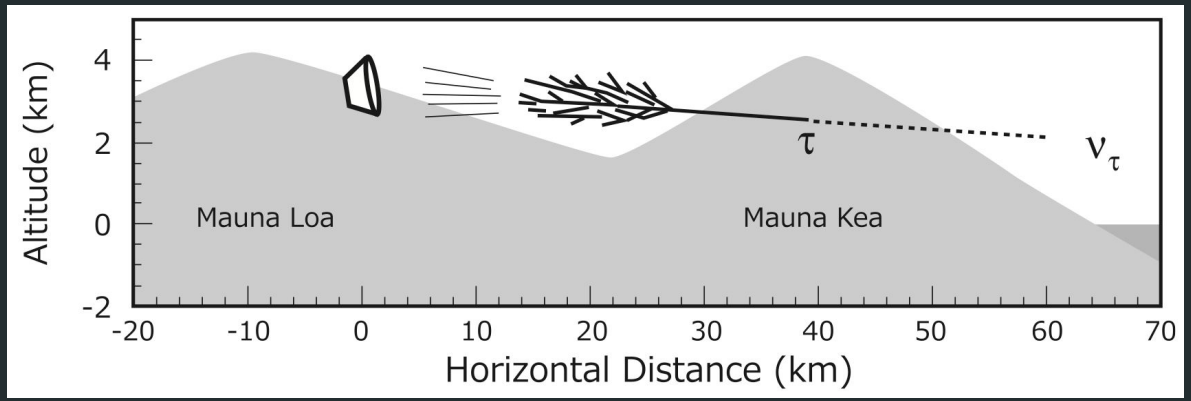


https://www.hep.ucl.ac.uk/uhen/anita/

Finding UHE Neutrinos 101

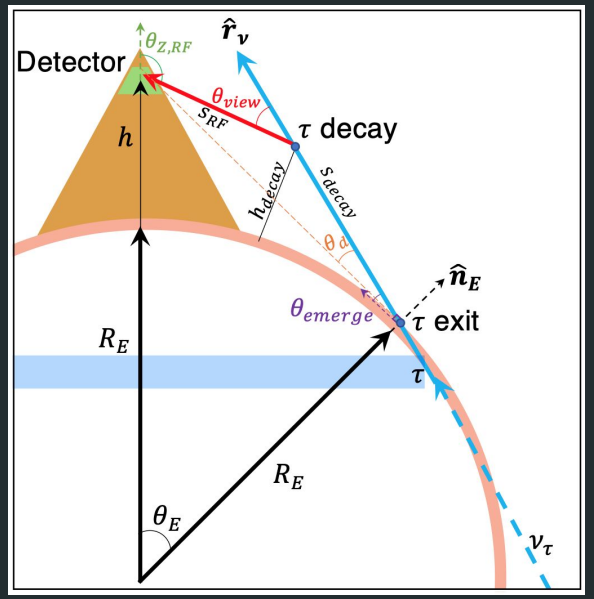
Look for tau neutrino charged current interactions in dense media

Like Mountains



https://arxiv.org/abs/1202.5656

Or Earth's Crust

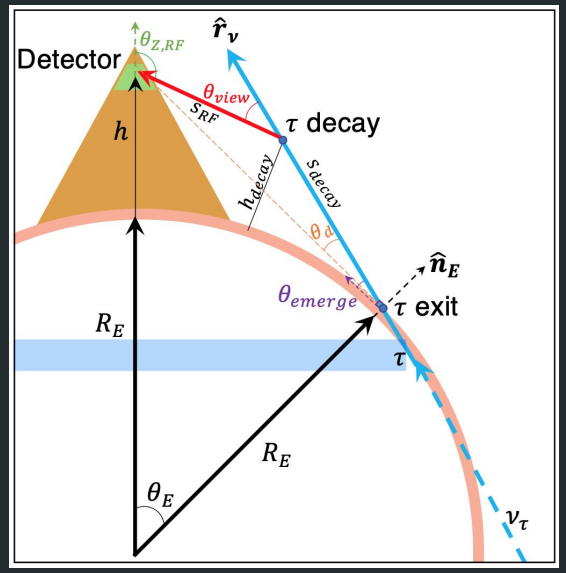


https://arxiv.org/abs/2004.12718

Observing UHE Neutrinos with the 3 Elements

	Earth	Ice	The Moon
Experiments			
Methods			

https://arxiv.org/abs/2203.08096



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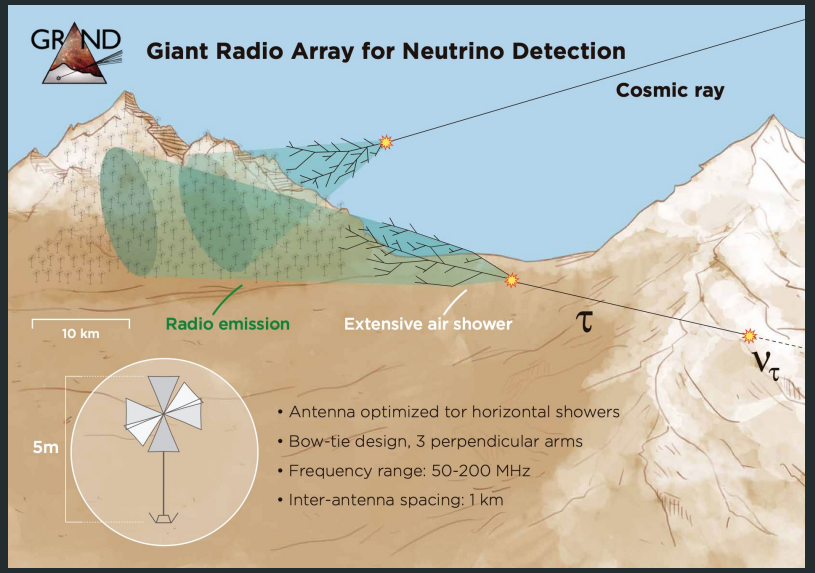


https://arxiv.org/abs/1810.09994

BEACON

TAROGE

ARIANNA

GRAND

Observing UHE Neutrinos with the 3 Elements

	Earth	Ice	The Moon
Experiments	BEACON, TAROGE, GRAND, ARIANNA		
Methods	Looking for Earth-skimming UHE Tau Neutrinos in mountains or Earth's crust		

https://arxiv.org/abs/2203.08096

Balloon Detectors

https://www.hep.ucl.ac.uk/uhen/anita/

https://www.science.org/content/article/oddball-particles-tunneling-through-earth-could-point-new-physics NASA

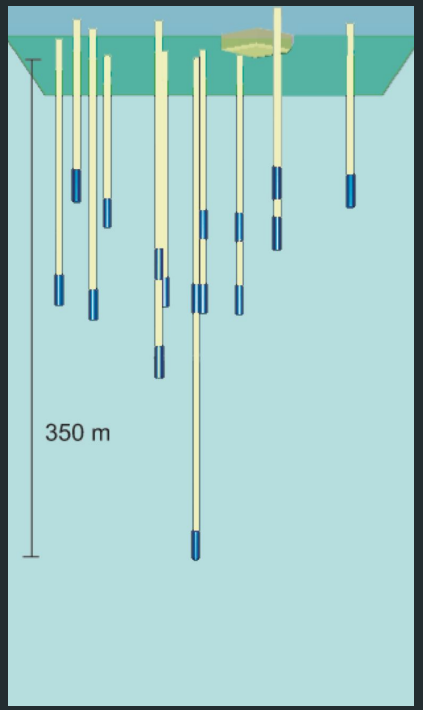
https://news.uchicago.edu/story/find-energetic-particles-space-new-detector-will-soar-over-antarctic-ice Christian Miki, University of Hawaii

ANITA

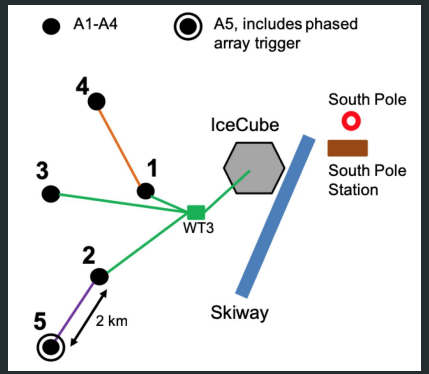
PUEO

In-Ice Detectors

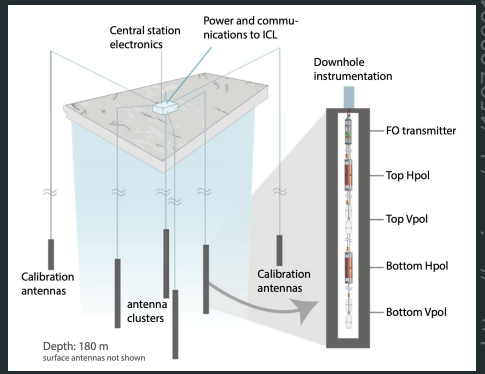
RICE



https://arxiv.org/abs/1106.1164

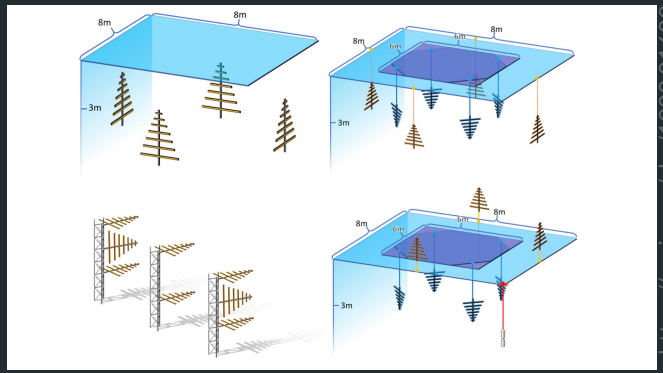


https://arxiv.org/abs/1907.11125



https://arxiv.org/abs/1507.08991

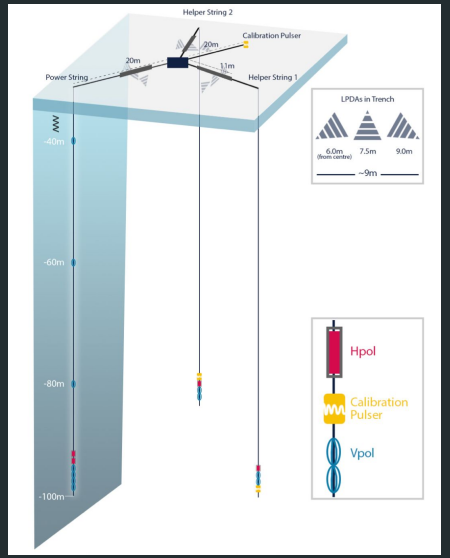
ARIANNA

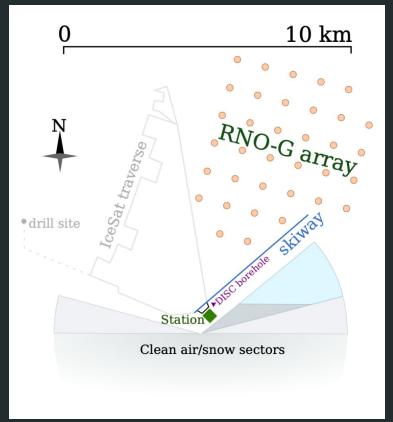


https://arxiv.org/abs/1903.01609

In-Ice Detectors

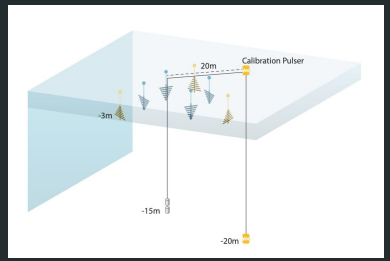
RNO-G





https://arxiv.org/abs/2010.12279

https://arxiv.org/abs/2107.08910



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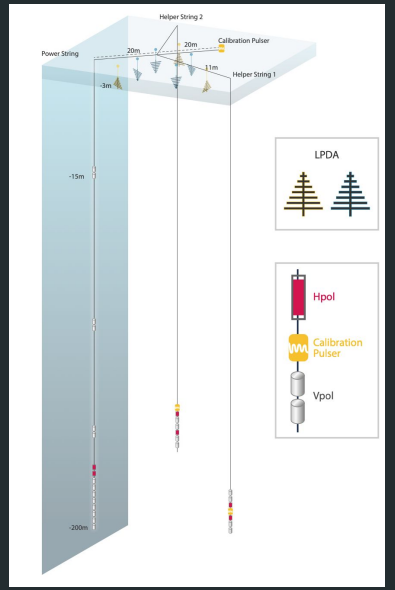
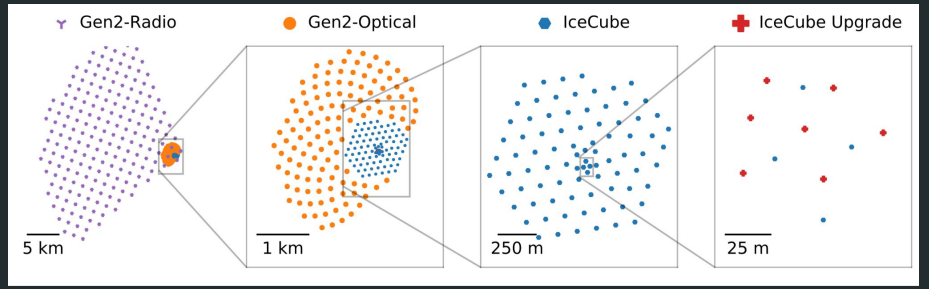


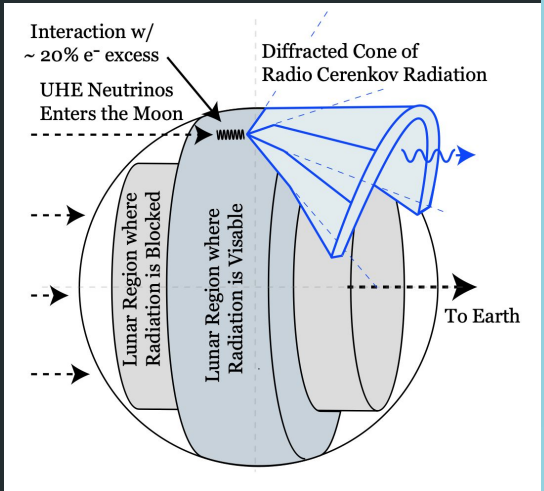


https://arxiv.org/abs/2008.04323

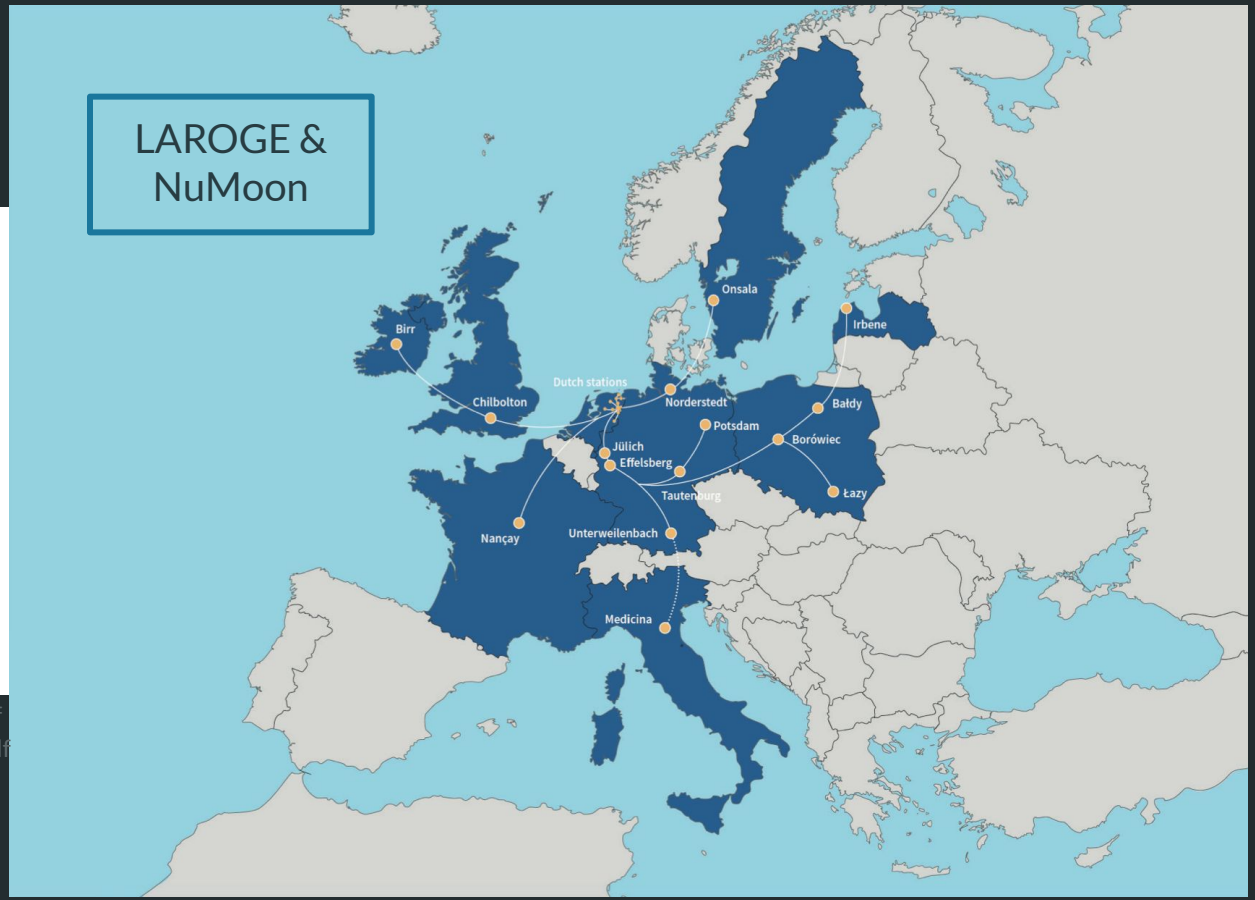
Observing UHE Neutrinos with the 3 Elements

	Earth	Ice	The Moon
Experiments	BEACON, TAROGE, GRAND, ARIANNA	ANITA, PUEO, RICE, ARIANNA, ARA, RNOG, IceCube-Gen2-Radio	
Methods	Looking for Earth-skimming UHE Tau Neutrinos in mountains or Earth's crust	Look for UHE neutrino interactions in Ice	

https://arxiv.org/abs/2203.08096



https://arxiv.org/pdf/0910.5949.pdf
https://pos.sissa.it/395/1148/pdf



https://www.astron.nl/telescopes/lofar/

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Methods	Looking for Earth-skimming UHE Tau Neutrinos in mountains or Earth's crust	Look for UHE neutrino interactions in Ice	Look for UHE neutrino interactions in the Moon

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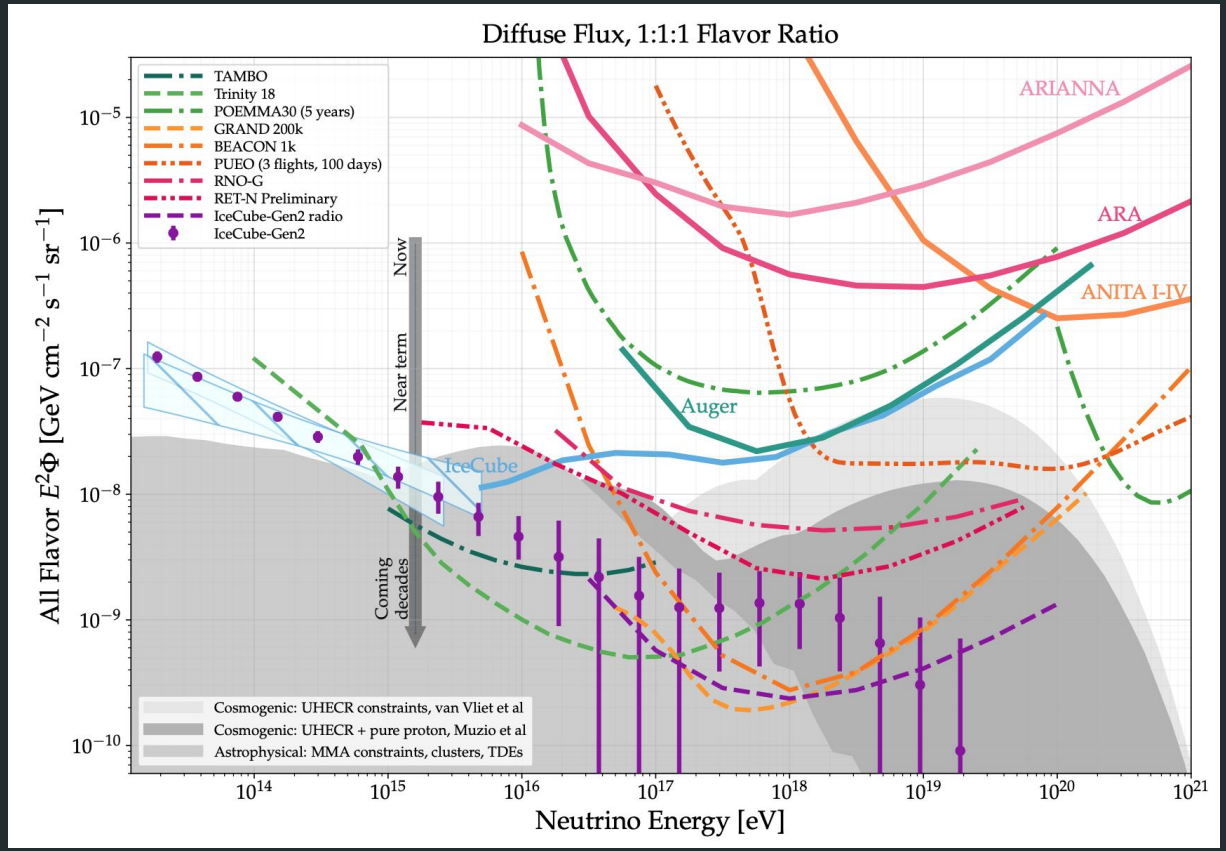
Coming Soon...



https://arxiv.org/abs/2203.08096

Questions?

A lot of this information came from the HE/UHE Snowmass Paper
Check it out here: https://arxiv.org/abs/2203.08096