

Radio Detections of Neutrinos

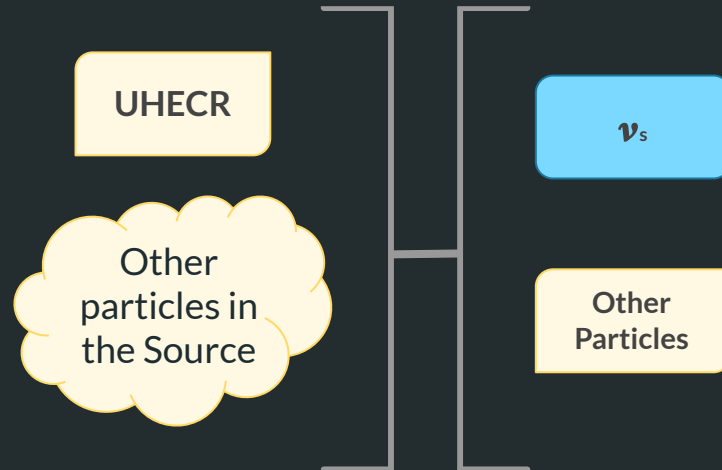
Abby Bishop
IceCube Summer School 2026
5 June 2026

Quick science behind UHE Neutrinos

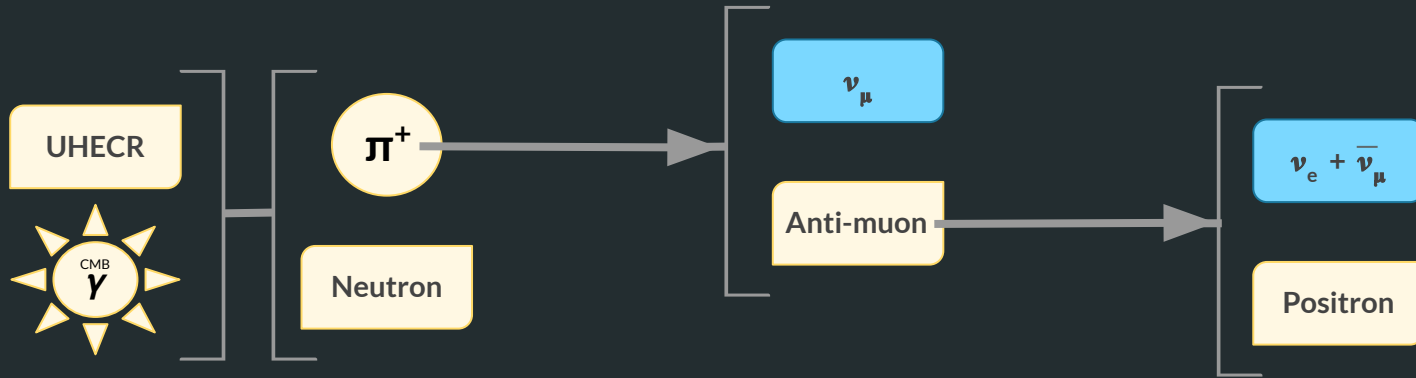
UHE (Ultra-High Energy) = Energy $> 10^{17}$ eV

**We think UHE Neutrinos come from
two potential sources:**

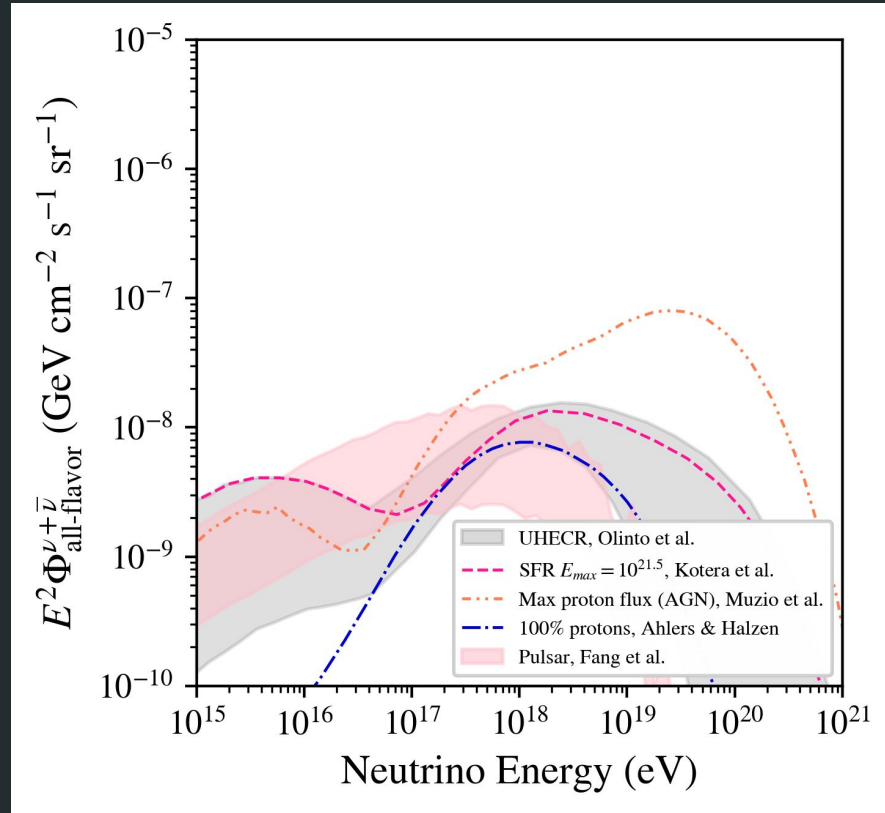
Astrophysical Sources



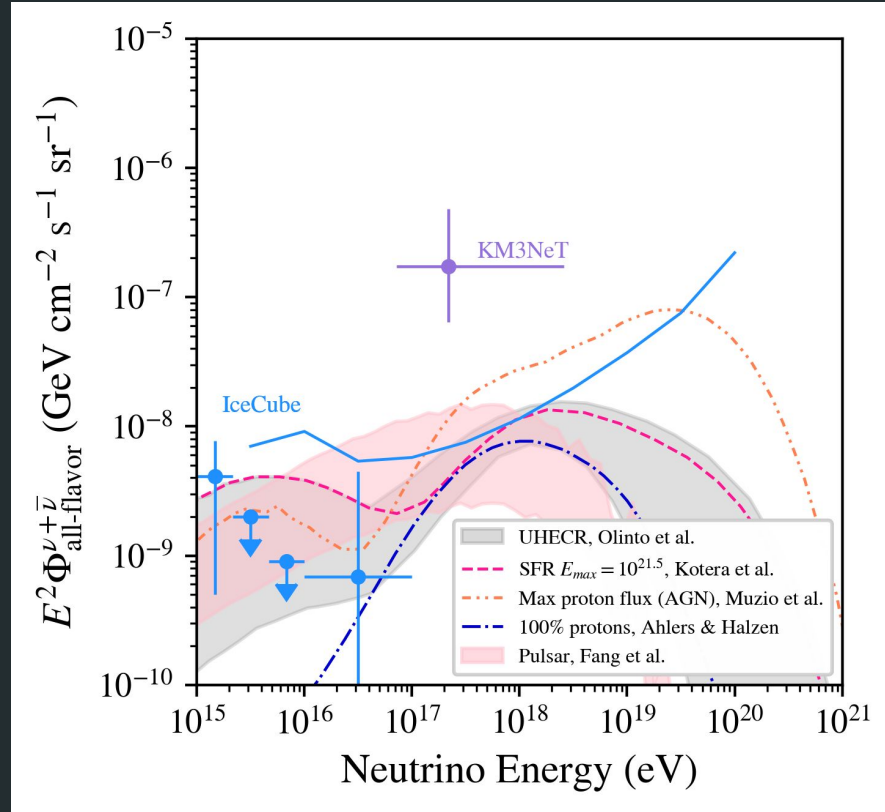
Cosmogenic Sources



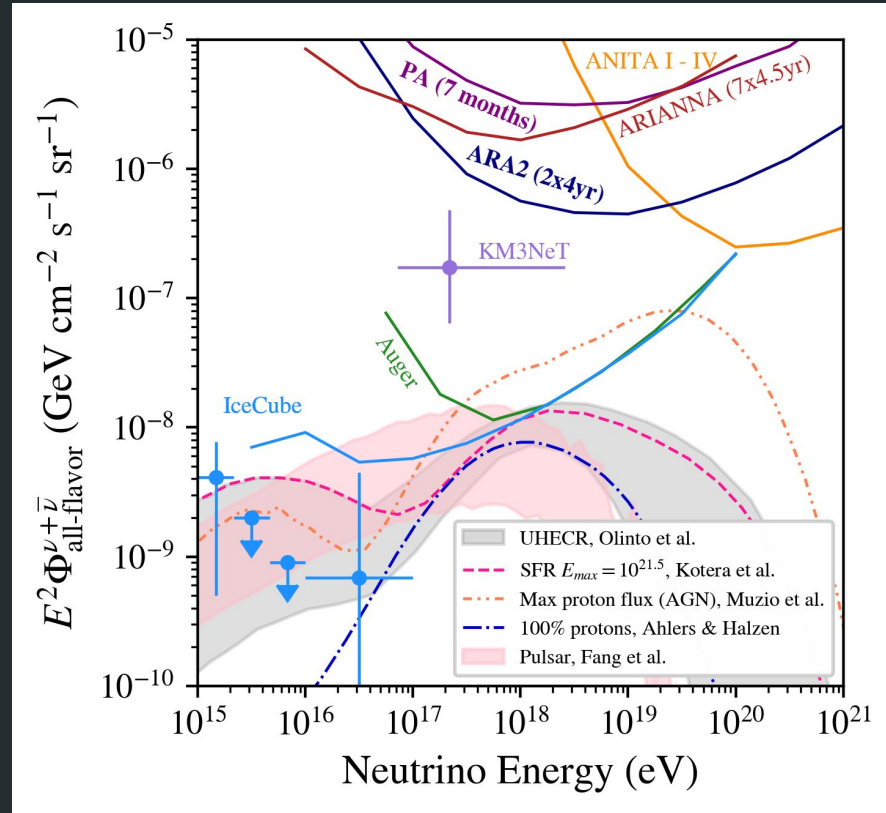
We have models for what neutrino flux we expect



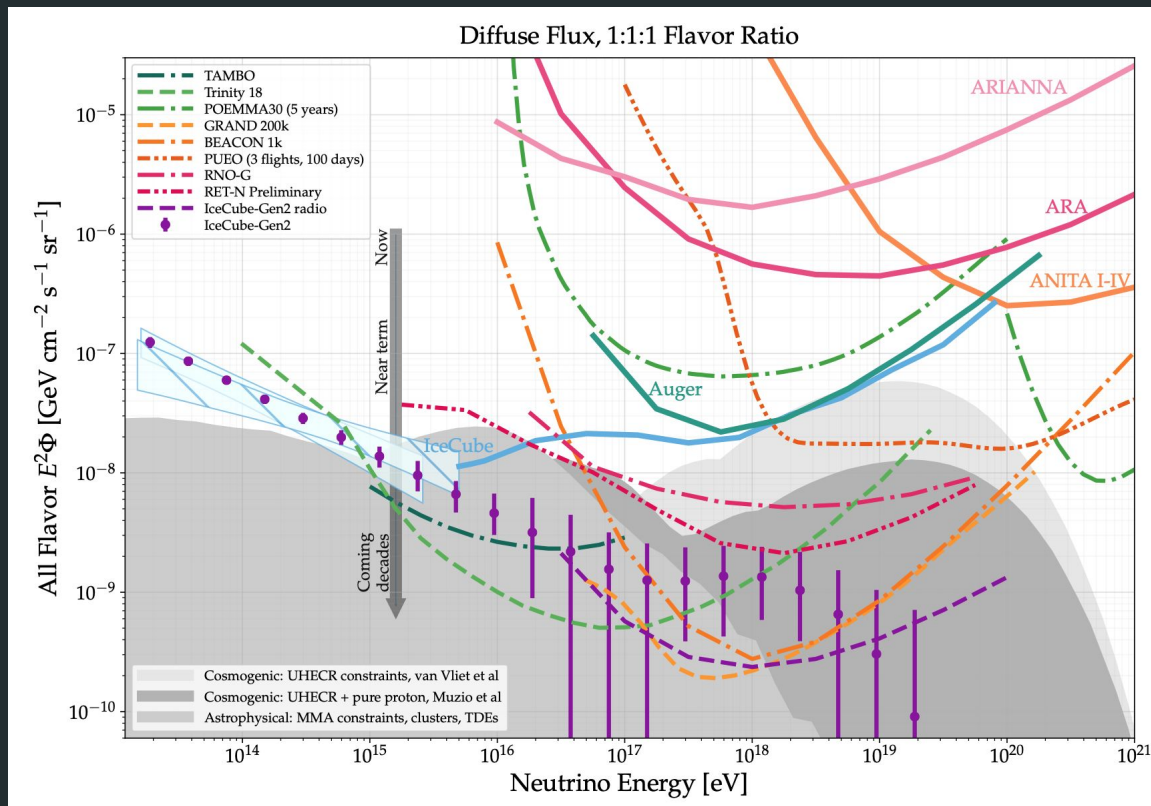
Neutrinos observed up to 220 PeV



At higher energies we just set upper limits



Future detectors are going to probe flux models



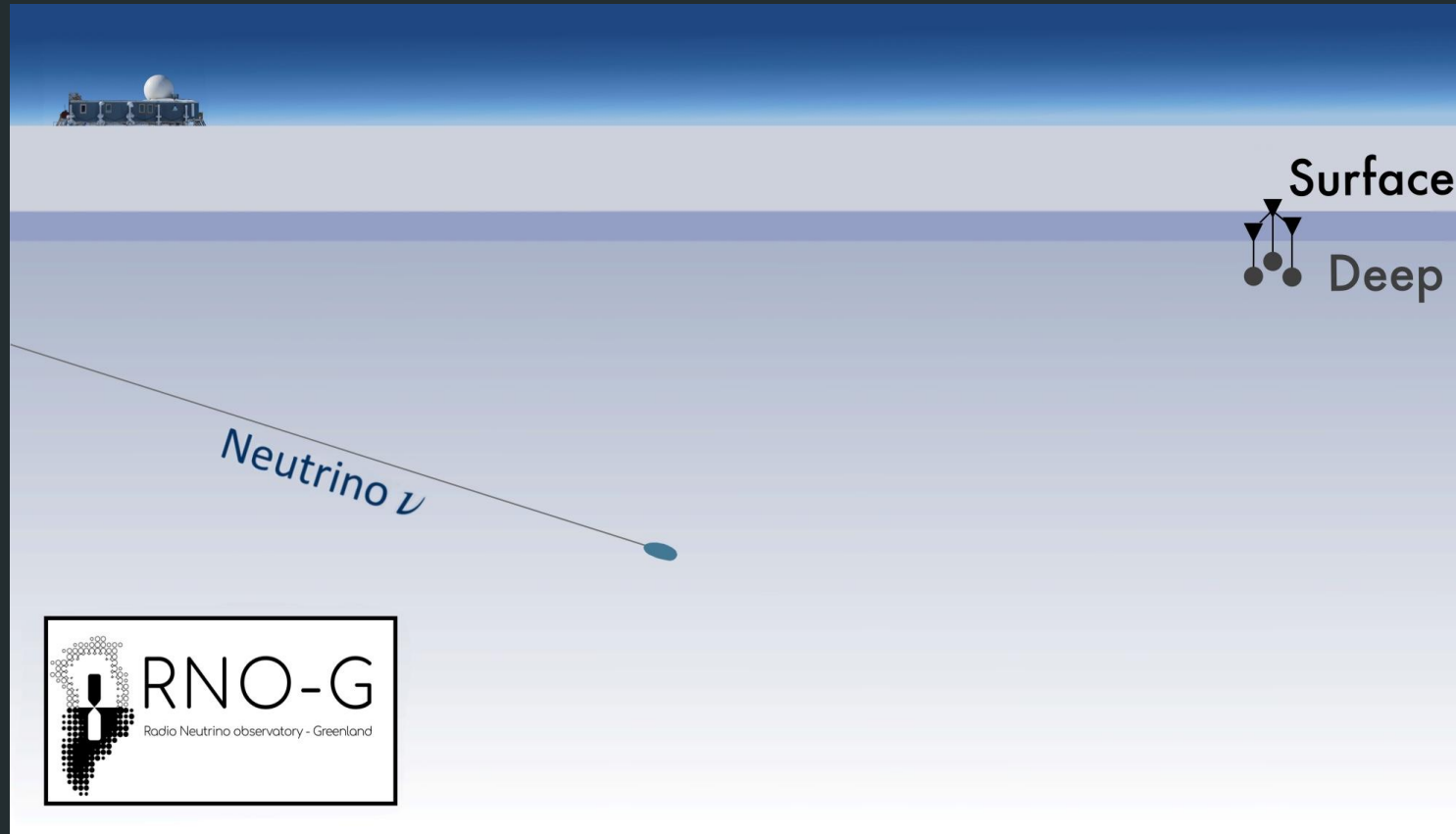
How do we observe
UHE Neutrinos?

Askaryan Radiation Reveals UHE Neutrino Interactions



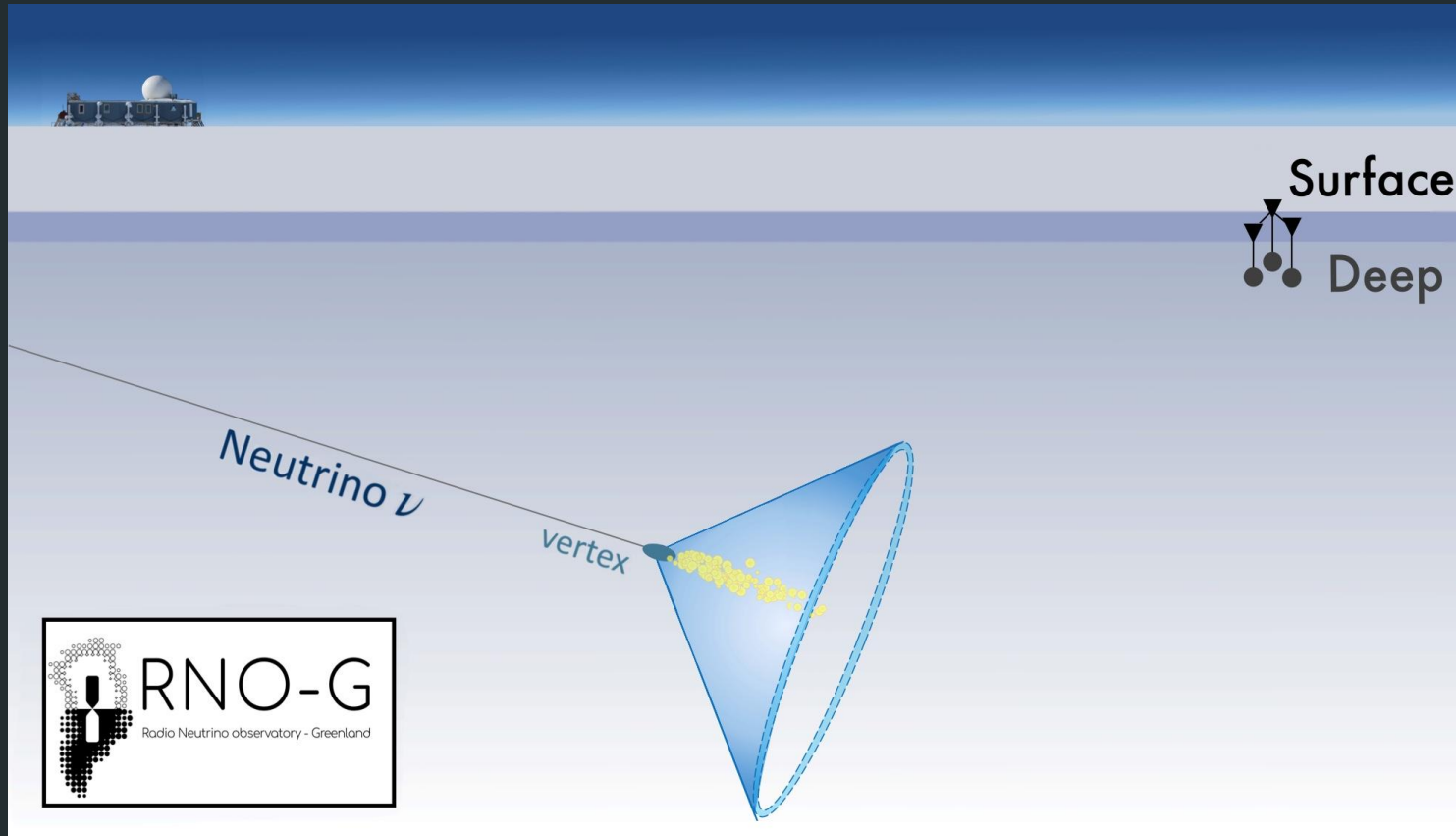
<https://arxiv.org/abs/2010.12279>

Askaryan Radiation Reveals UHE Neutrino Interactions



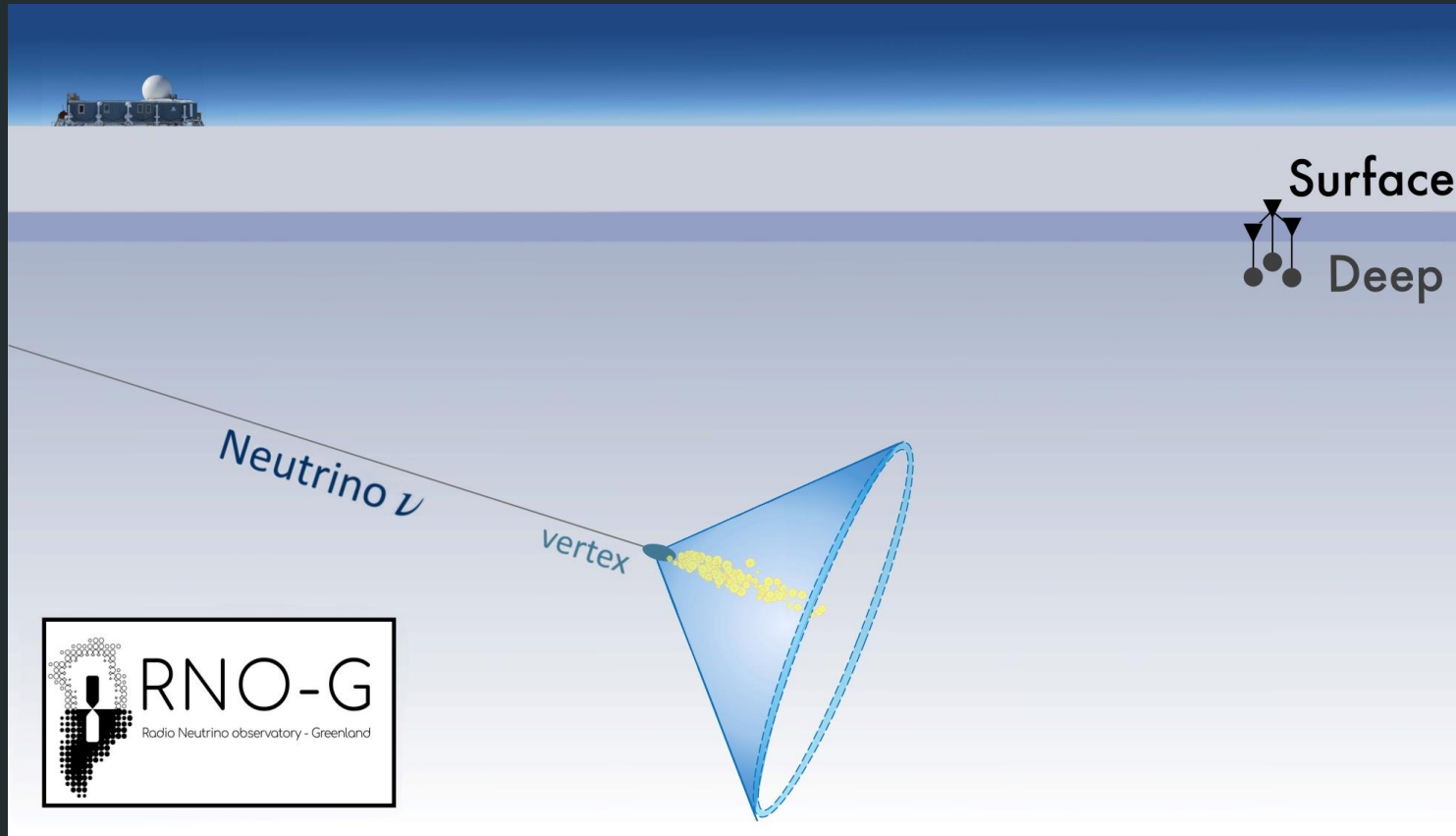
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Askaryan Radiation Reveals UHE Neutrino Interactions



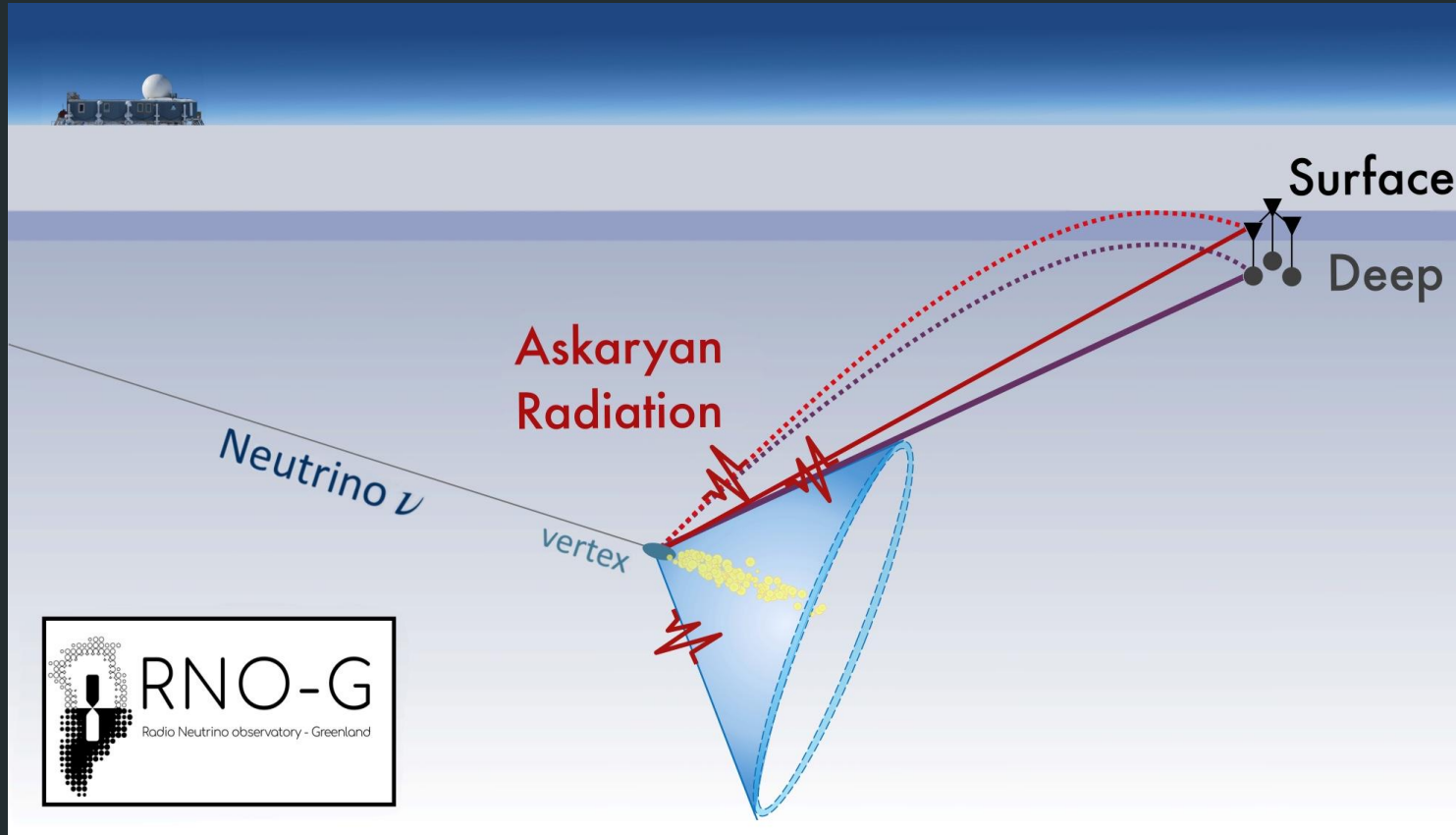
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Askaryan Radiation Reveals UHE Neutrino Interactions



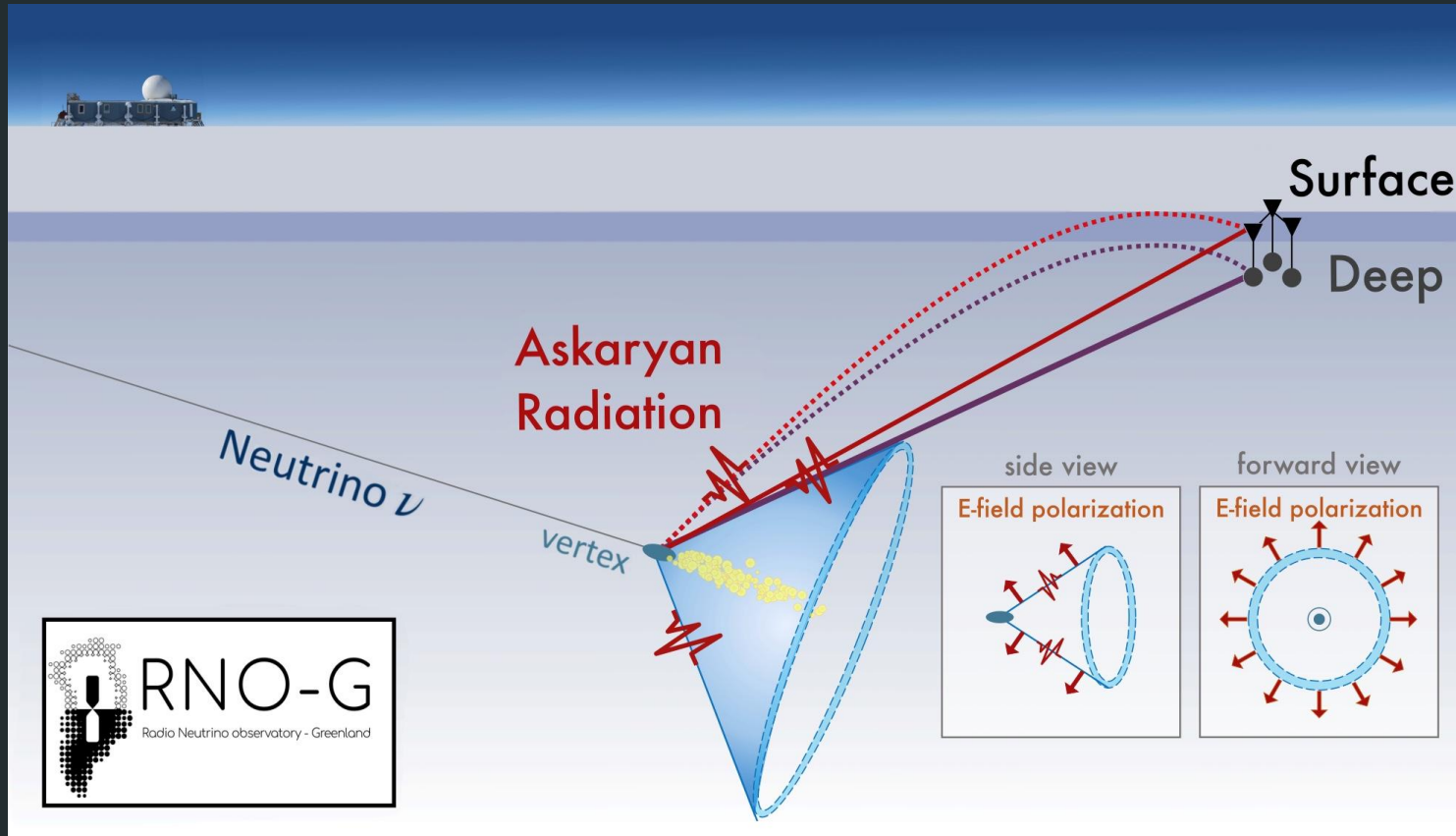
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Askaryan Radiation Reveals UHE Neutrino Interactions



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What's the landscape
of UHE neutrino
observatories?

Observing UHE Neutrinos with the 3 Elements

<https://arxiv.org/abs/2203.08096>

Observing UHE Neutrinos with the 3 Elements

	Earth	Ice	The Moon

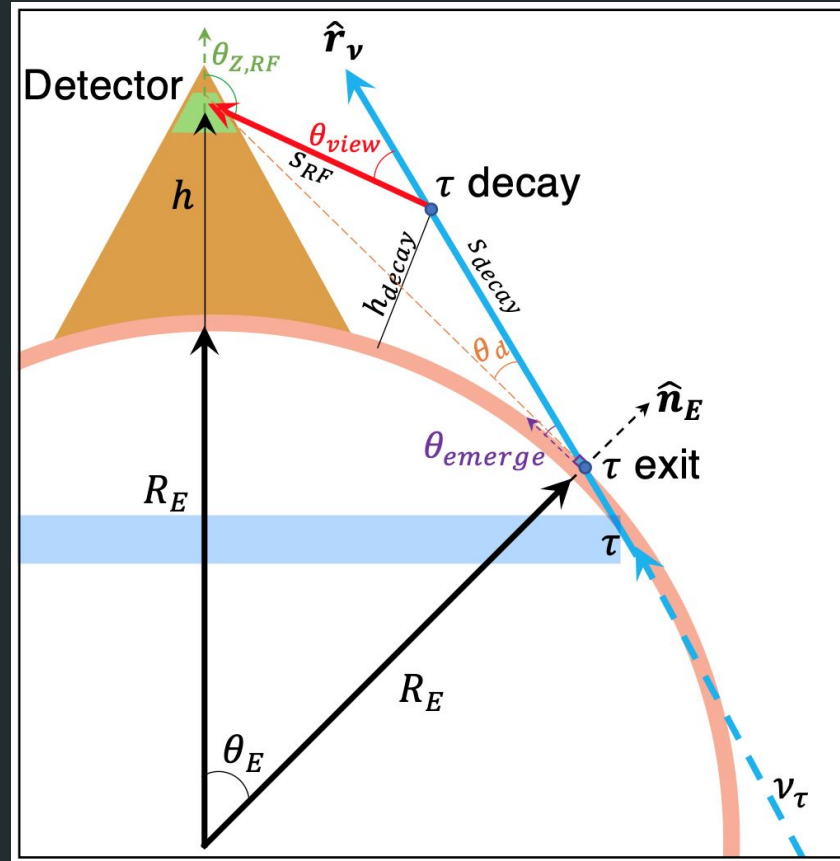
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Observing UHE Neutrinos with the 3 Elements

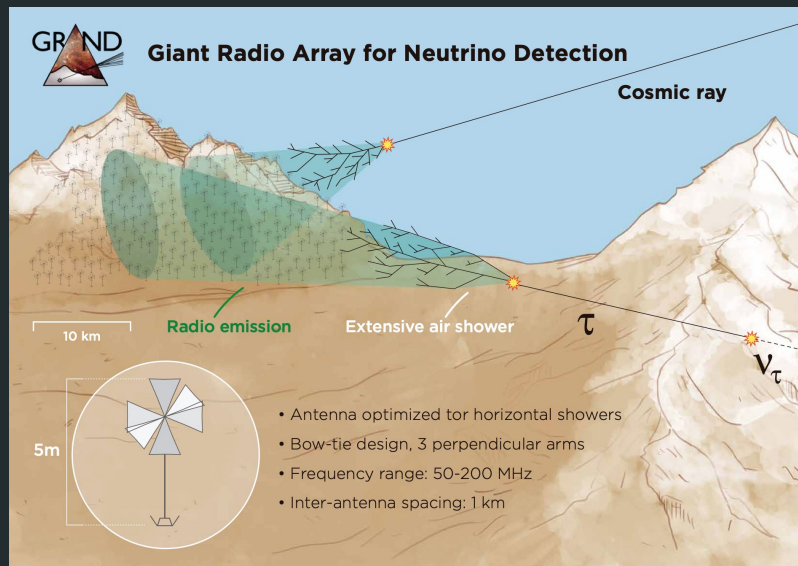
	Earth	Ice	The Moon
Experiments			
Methods			

<https://arxiv.org/abs/2203.08096>

Neutrino Interactions with Earth



<https://arxiv.org/abs/2004.12718>



<https://arxiv.org/abs/1810.09994>



ARIANNA

TAMBO

TAROGÉ



Observing UHE Neutrinos with the 3 Elements

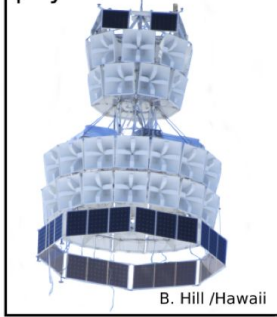
	Earth	Ice	The Moon
Experiments	ARIANNA, BEACON, TAMBO, TAROGE, GRAND		
Methods	Looking for Earth-skimming UHE Tau Neutrinos in mountains or Earth's crust		

<https://arxiv.org/abs/2203.08096>

Balloon Detectors

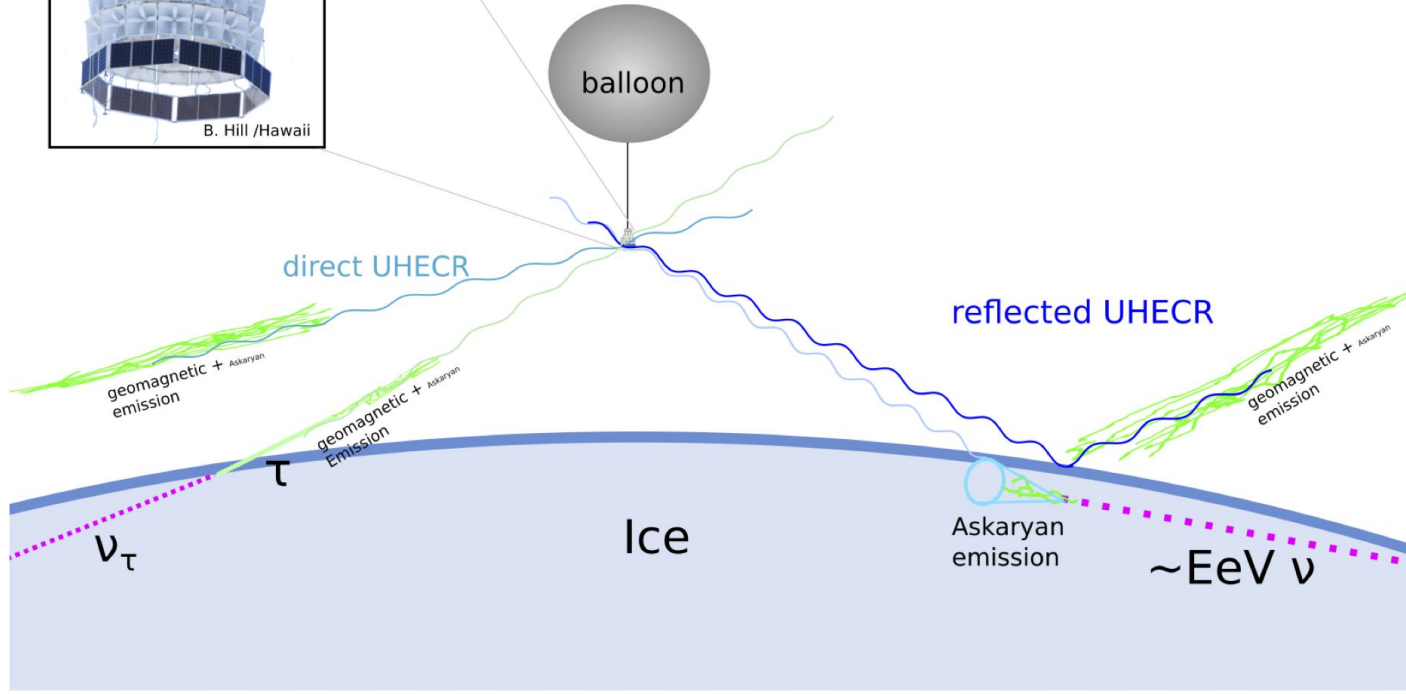
<https://www.hep.ucl.ac.uk/uhen/anita/>

interferometric payload



balloon

Not to scale,
angles don't
reflect reality



Balloon Detectors



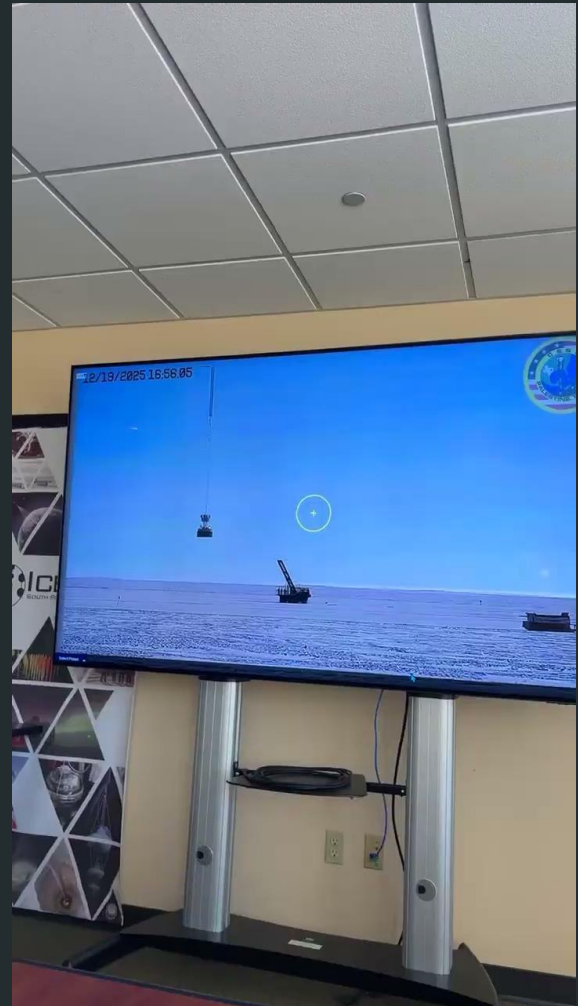
<https://www.science.org/content/article/oddball-particles-tunneling-through-earth-could-point-new-physics>
ics NASA

ANITA



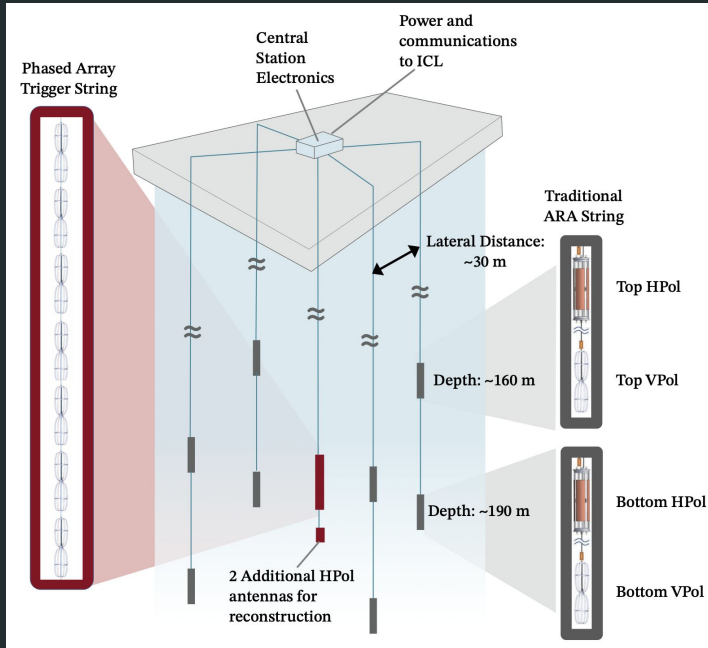
<https://news.uchicago.edu/story/fmd-energetic-particles-space-new-detector-will-soar-over-antarctic-ice>
Christian Miki, University of Hawaii

PUEO

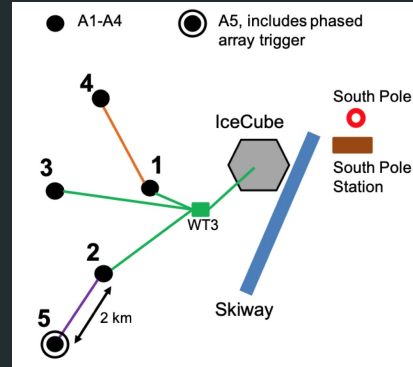




ASKARYAN RADIO ARRAY

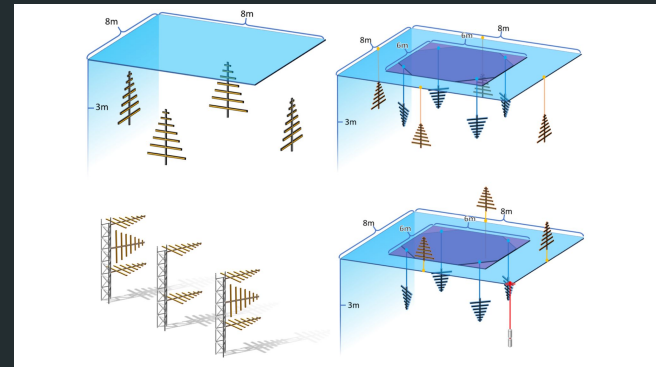


<https://arxiv.org/abs/2605.04268>



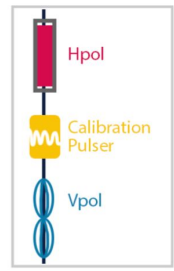
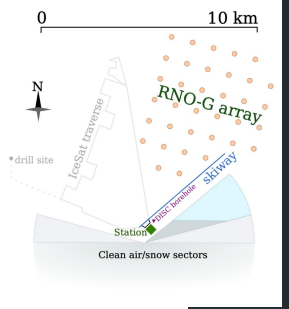
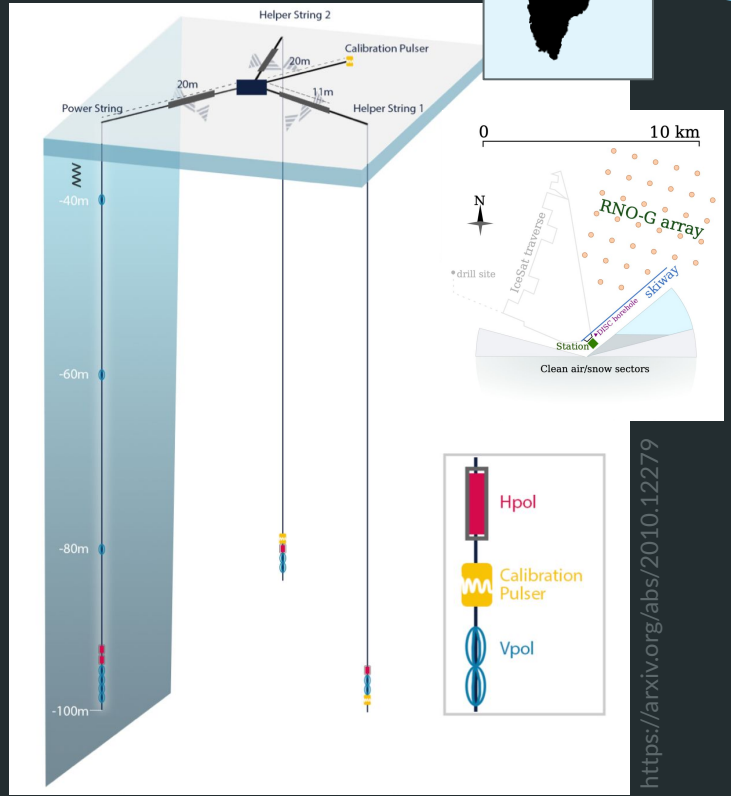
<https://arxiv.org/abs/1907.11125>

ARIANNA

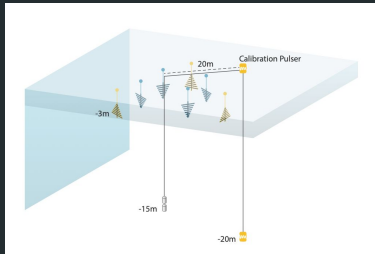


<https://arxiv.org/abs/1903.01609>

RNO-G

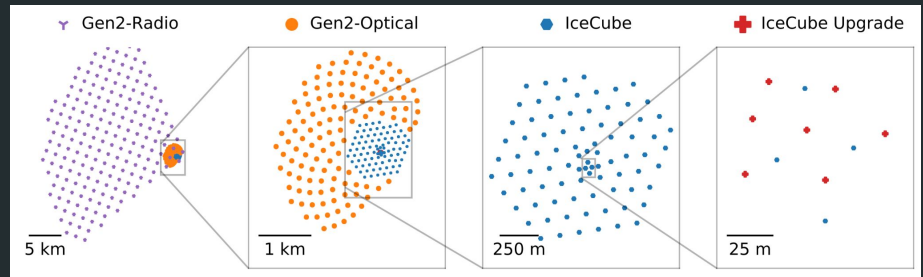
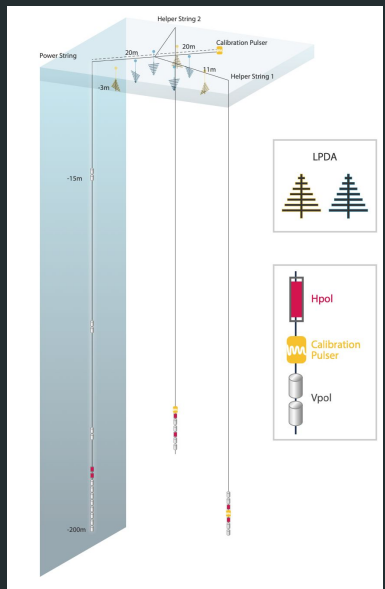


<https://arxiv.org/abs/2010.12279>



<https://arxiv.org/abs/2107.08910>

<https://arxiv.org/abs/2107.08910>



<https://arxiv.org/abs/2008.04323>

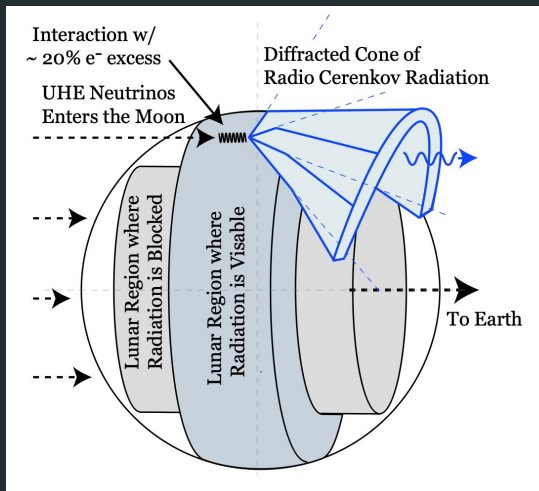




Observing UHE Neutrinos with the 3 Elements

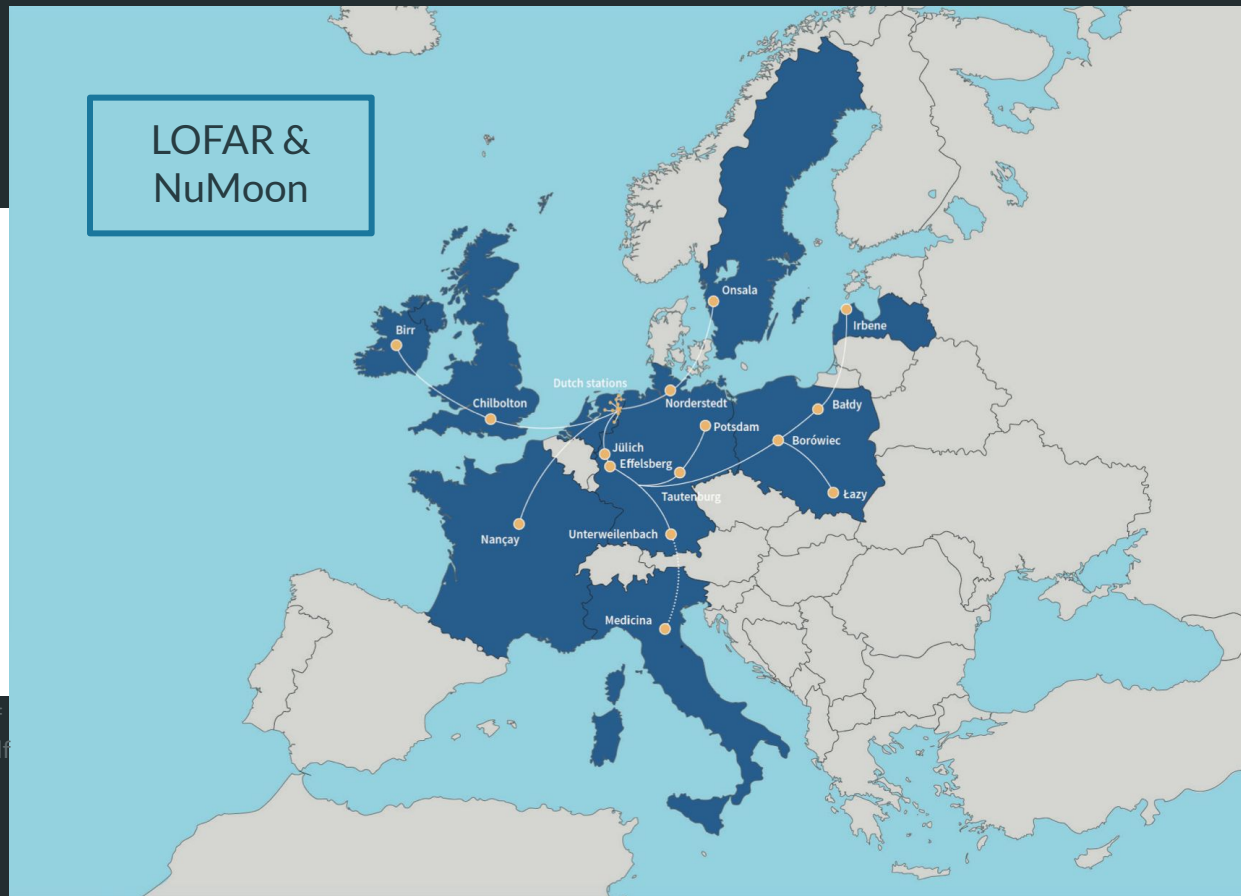
	Earth	Ice	The Moon
Experiments	ARIANNA, BEACON, TAMBO, TAROGE, GRAND	ANITA, PUEO, RICE, ARIANNA, ARA, RNOG, IceCube-Gen2-Radio	
Methods	Looking for Earth-skimming UHE Tau Neutrinos in mountains or Earth's crust	Look for UHE neutrino interactions in Ice	

<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/>

Observing UHE Neutrinos with the 3 Elements

	Earth	Ice	The Moon
Experiments	ARIANNA, BEACON, TAMBO, TAROGE, GRAND	ANITA, PUEO, RICE, ARIANNA, ARA, RNOG, IceCube-Gen2-Radio	NuMoon, LOFAR
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

<https://arxiv.org/abs/2203.08096>

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