

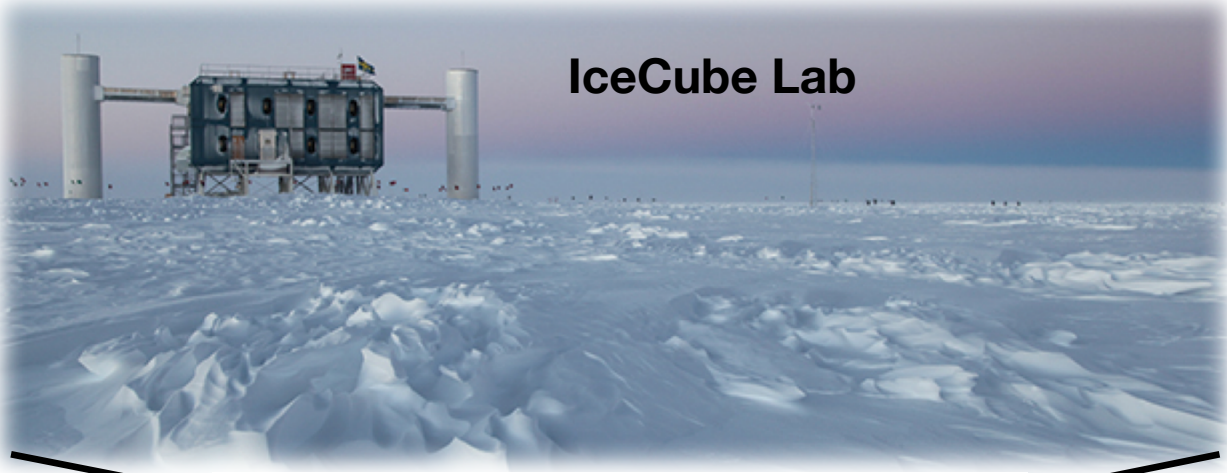
Exploring the Universe with Neutrinos: IceCube, the Upgrade and Gen2

Erin O'Sullivan, for IceCube Sweden

Partikeldagarna 2020

November 24, 2020

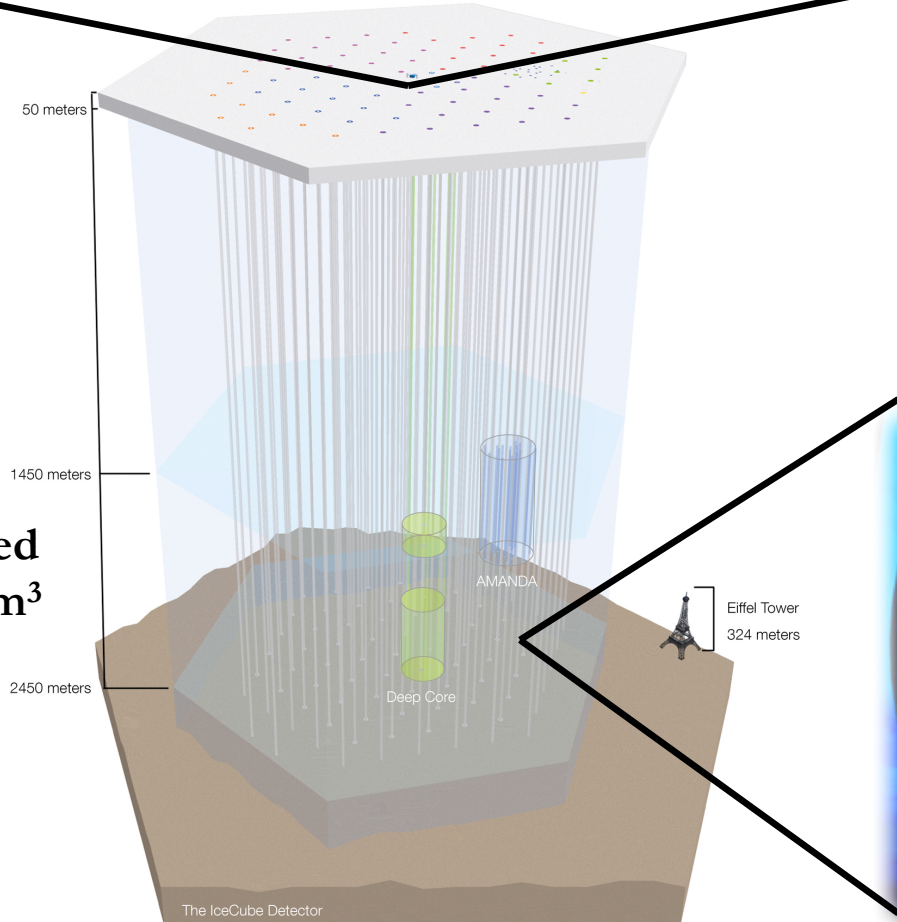




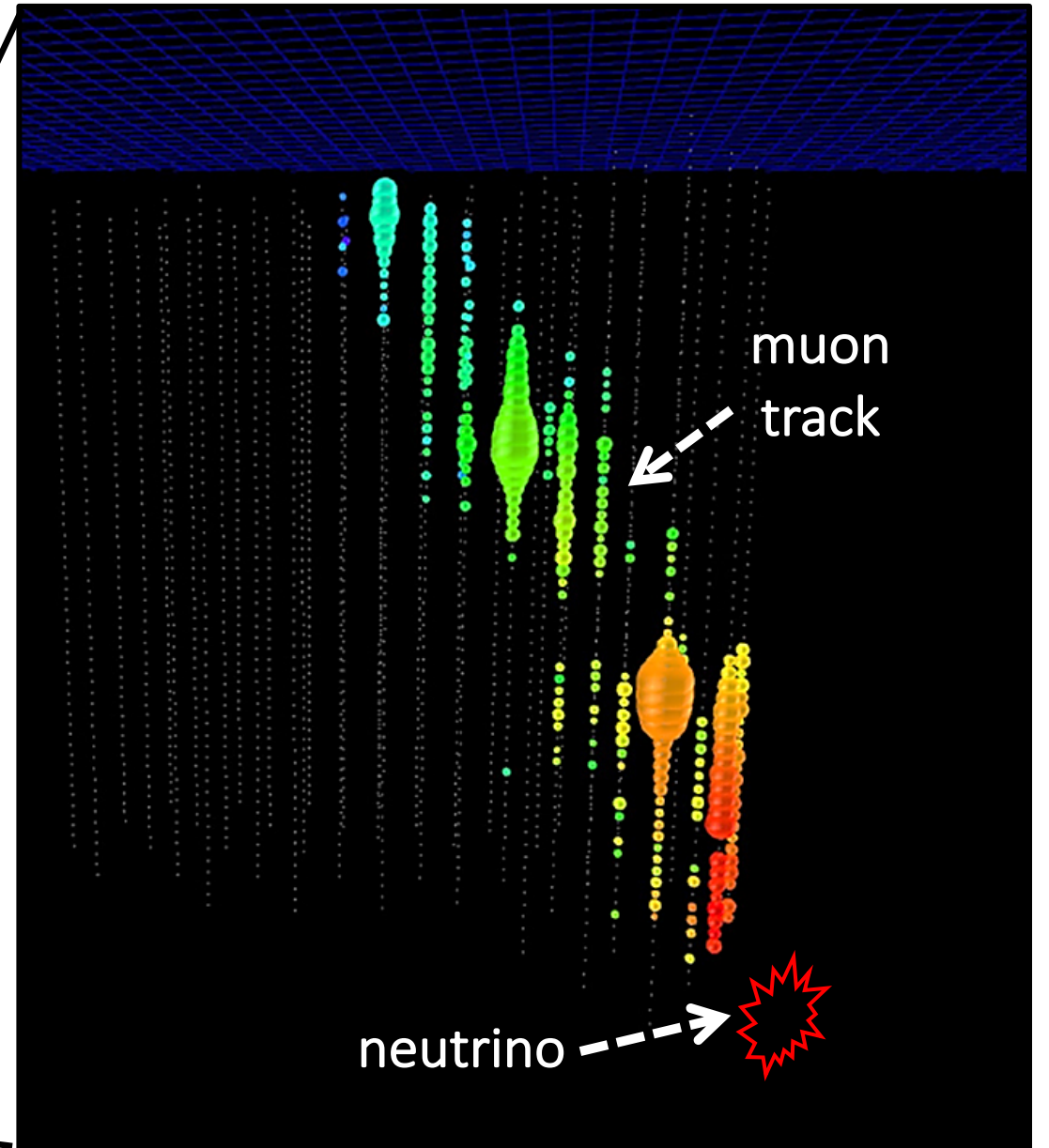
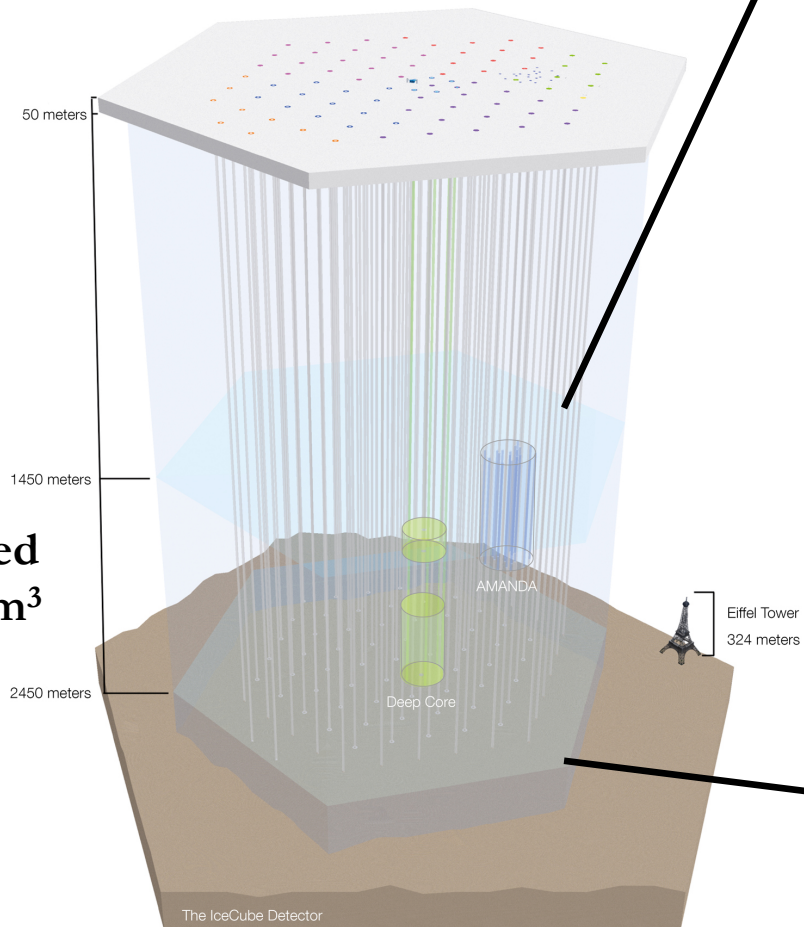
ICECUBE

86 Strings, 5160 modules

Instrumented volume: 1 km³



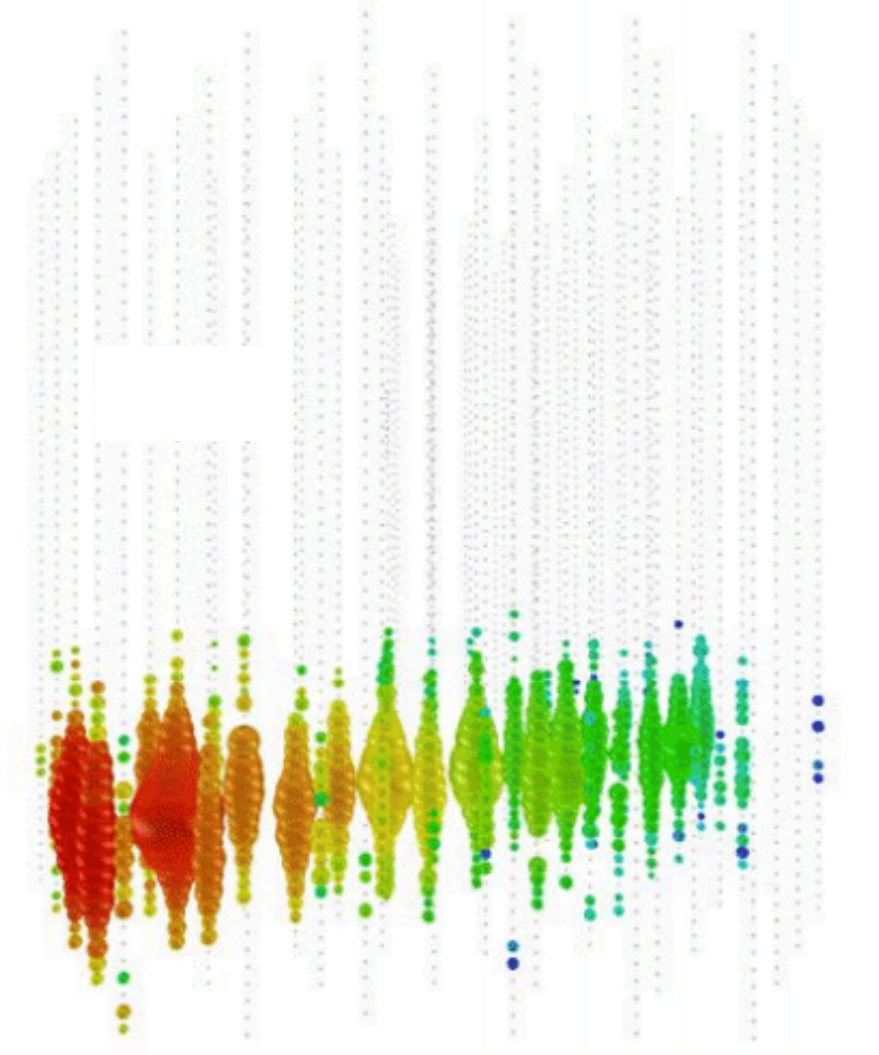
**Instrumented
volume: 1 km³**



Tracks

Charged-current ν_{μ}

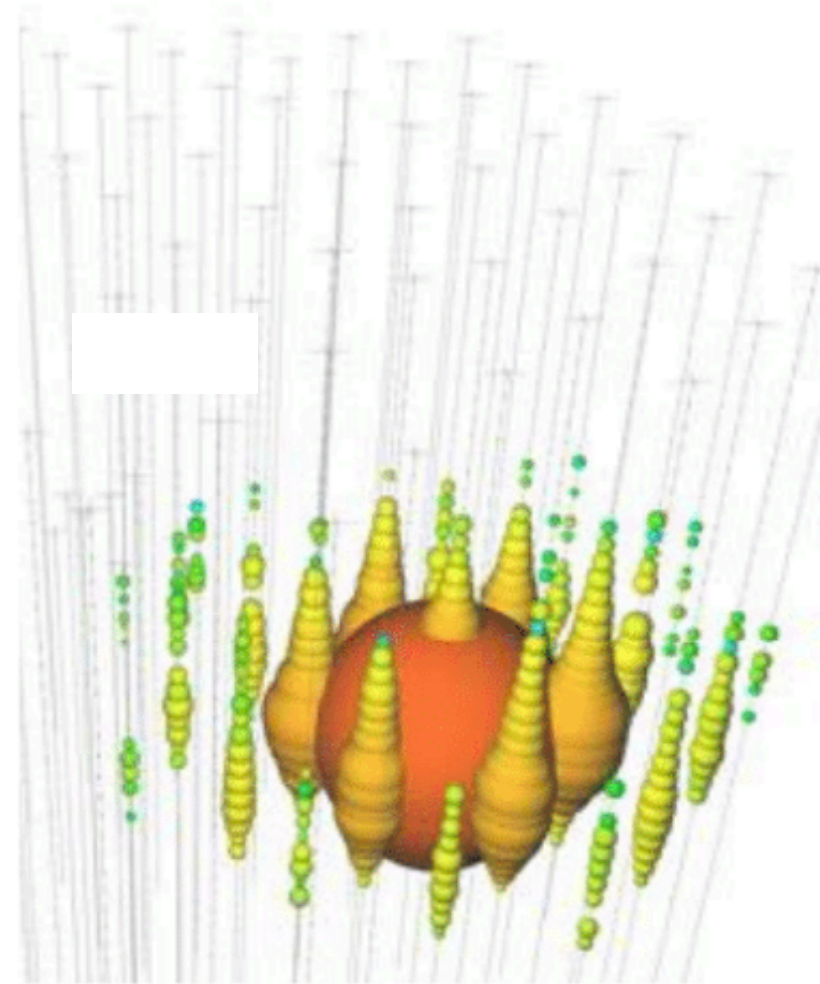
Good for directional reconstruction



Cascades

Charged-current ν_e or neutral current

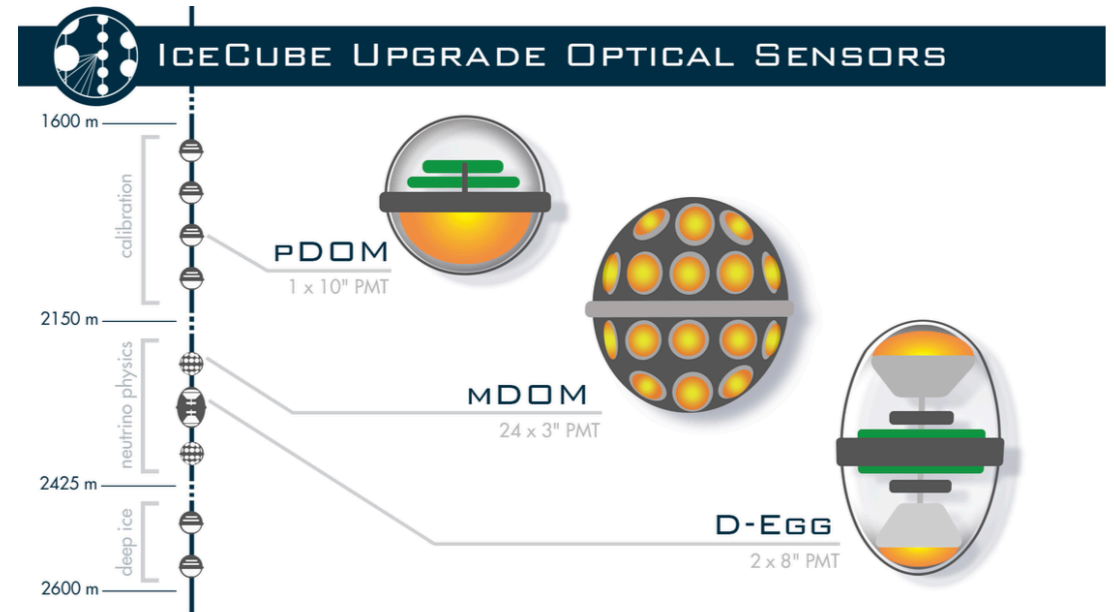
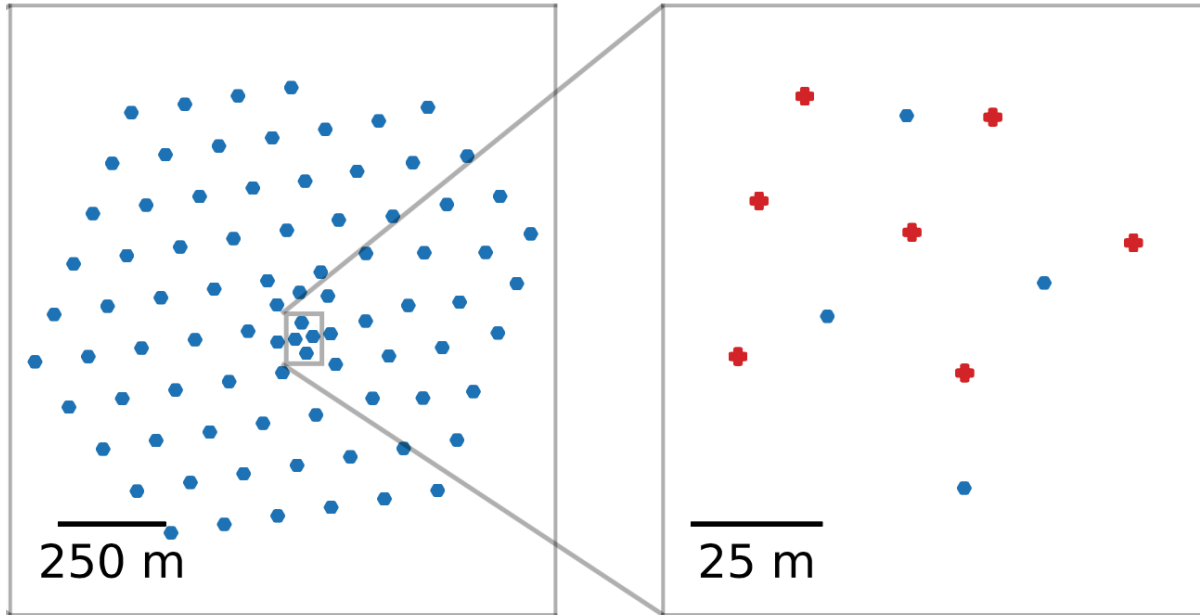
Good for energy reconstruction



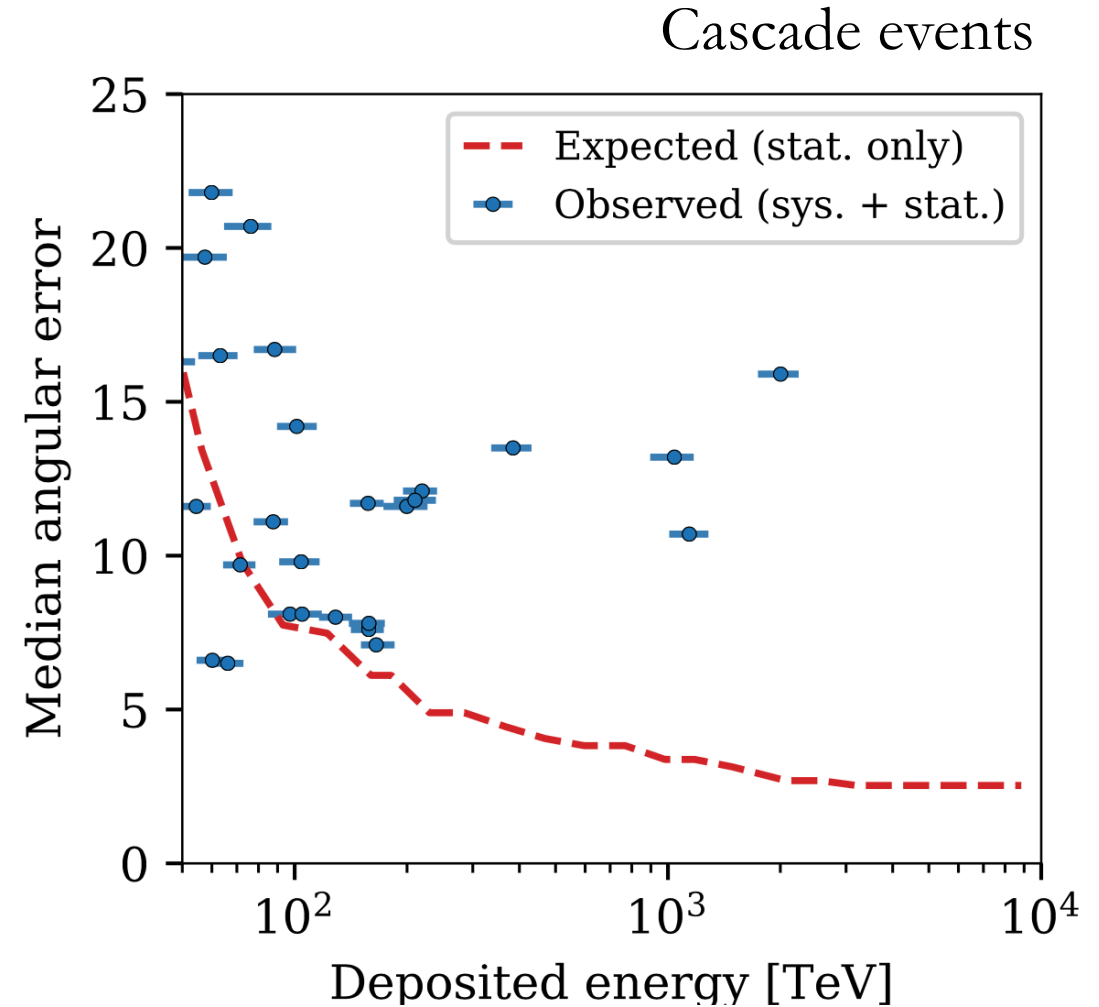
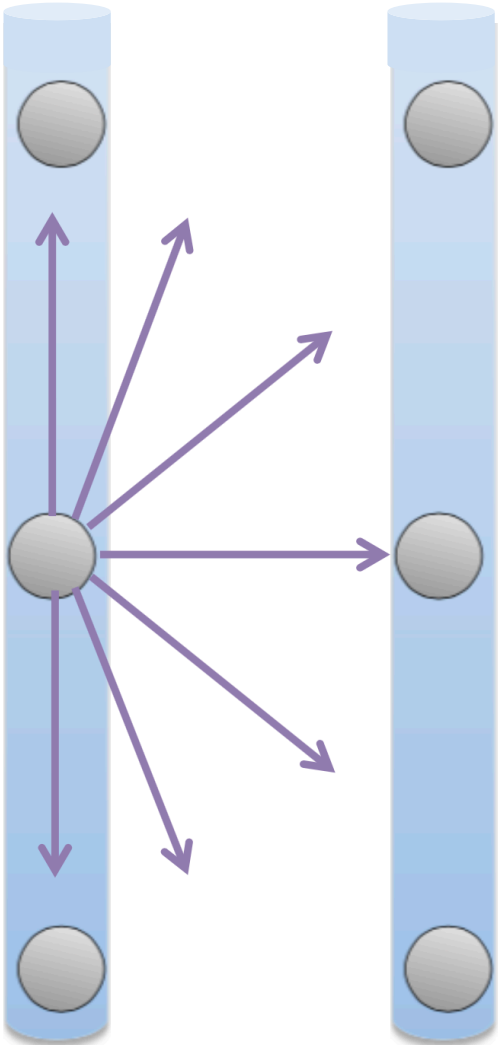
IceCube Upgrade in 2022/2023

● IceCube

✚ IceCube Upgrade



Better calibration = Improved resolution



IceCube-Gen2

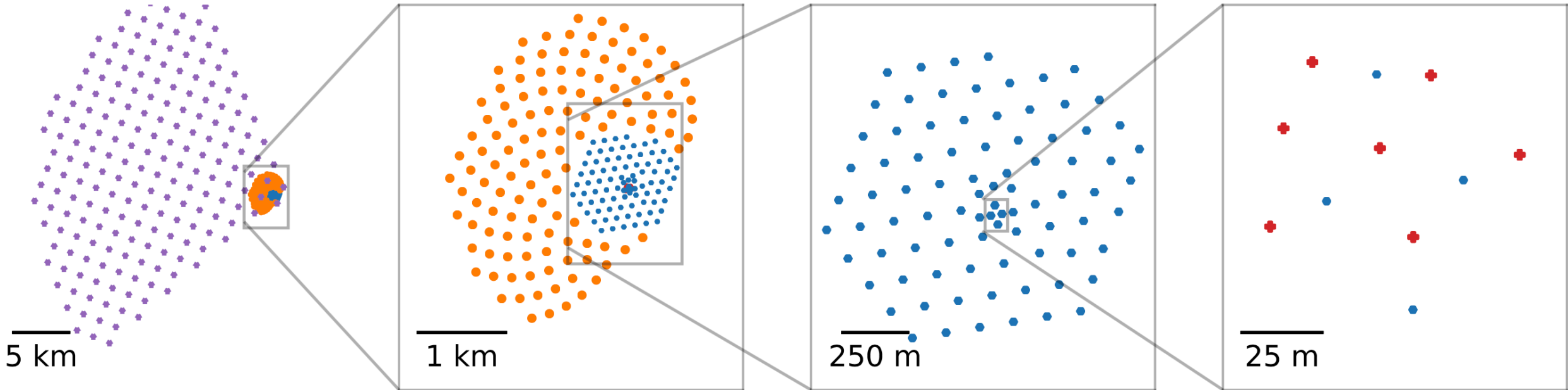
10 x sensitivity to high energy neutrinos

γ Gen2-Radio

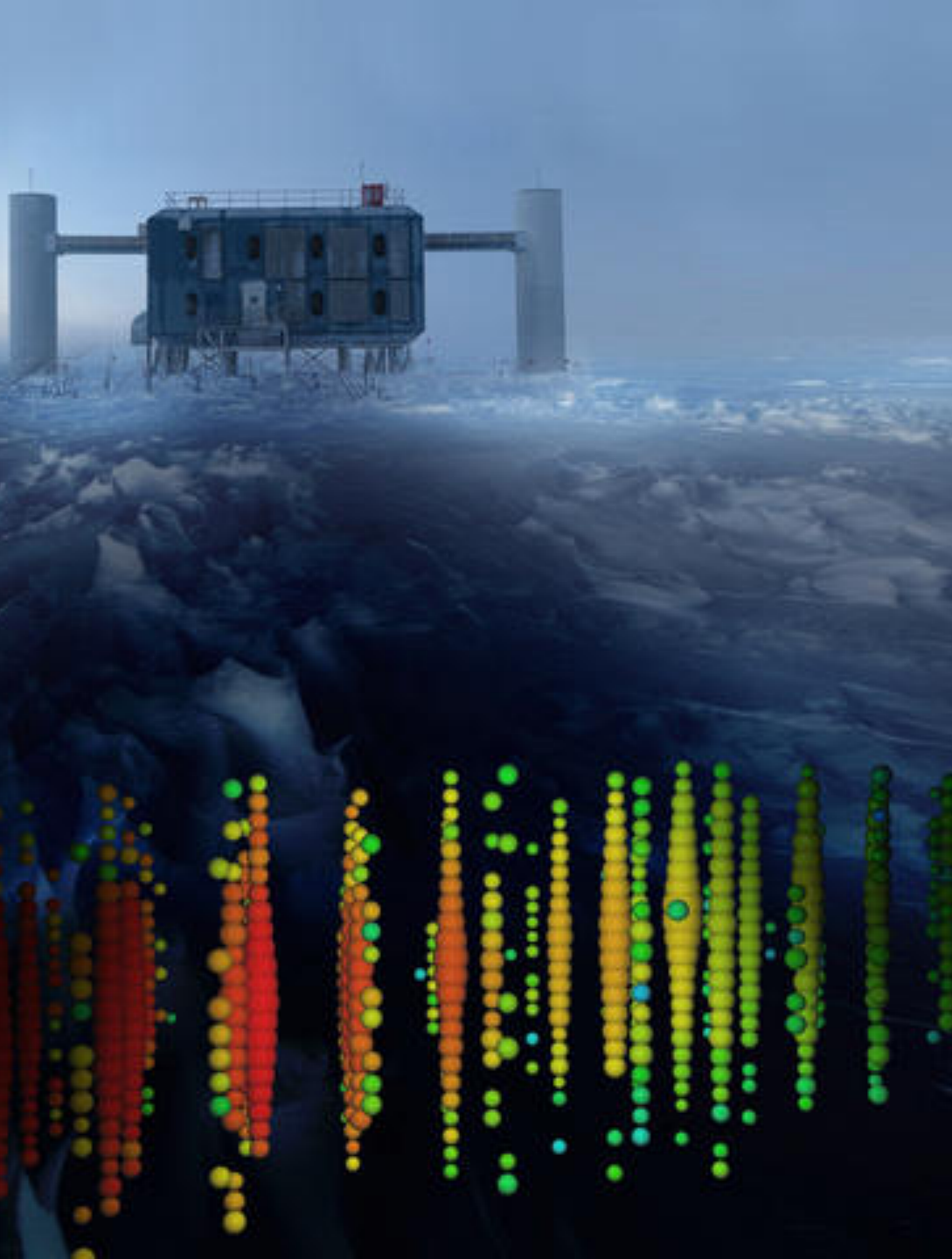
● IceCube-Gen2

◆ IceCube

⊕ IceCube Upgrade

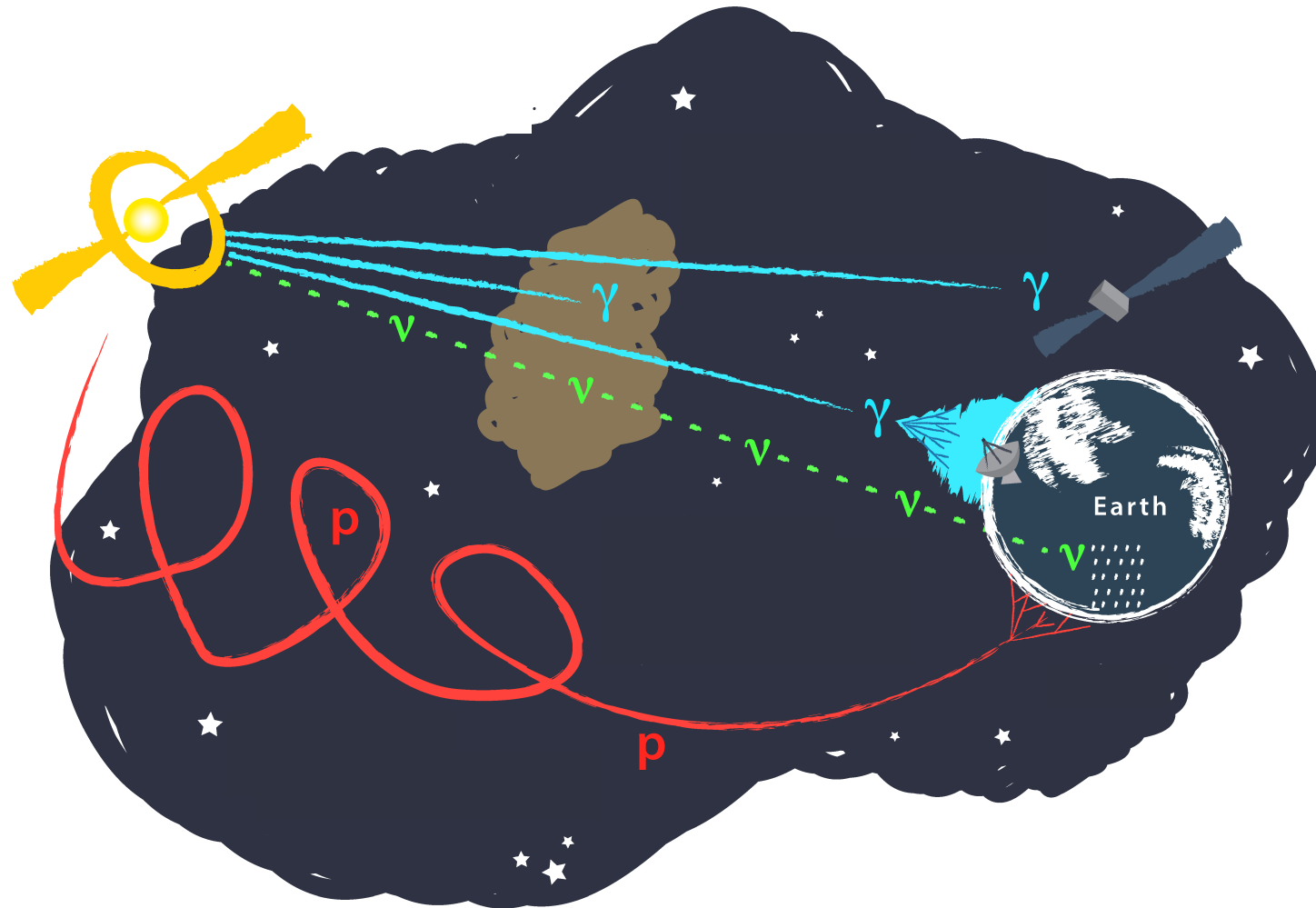


See Christian's talk next!



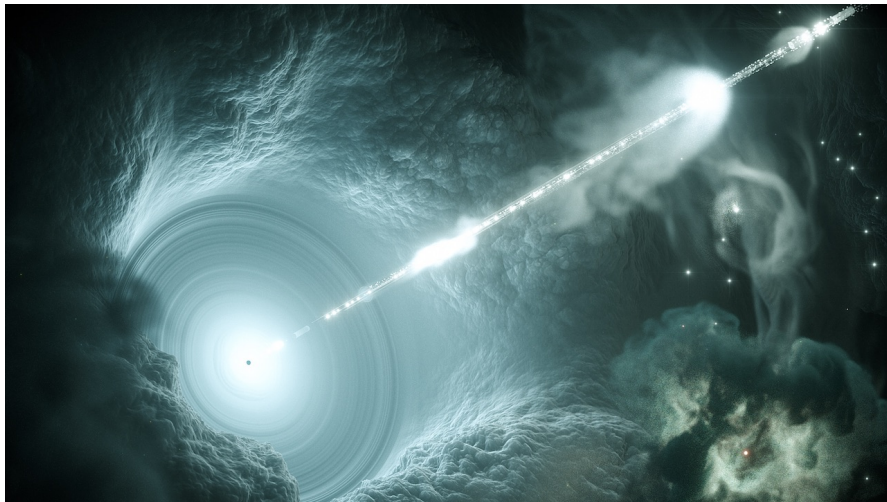
**Klas Hultqvist
Chad Finley
Olga Botner
Allan Hallgren
Carlos de los Heros
Erin O'Sullivan
Christian Glaser
Christian Walck
Christian Bohm
Ankur Sharma
Kunal Deoskar
Matti Jansson
Alexander Burgman
Nora Valtonen-Mattila**

Neutrinos as messengers

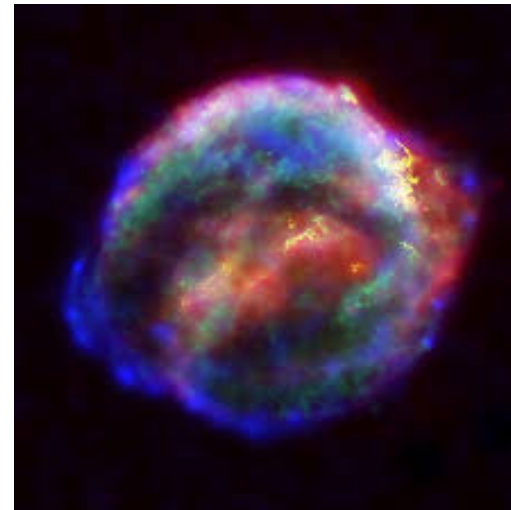


High energy neutrinos as messengers

We have identified one likely source, a blazar, but this is not the full picture. Can we identify other sources?



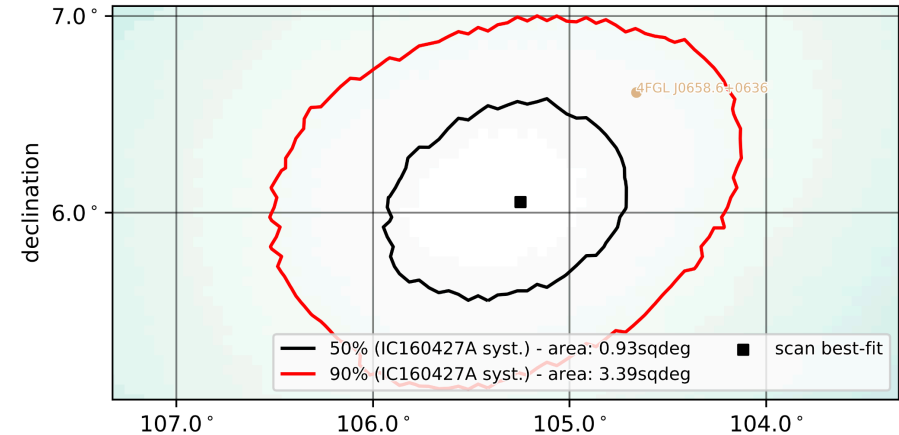
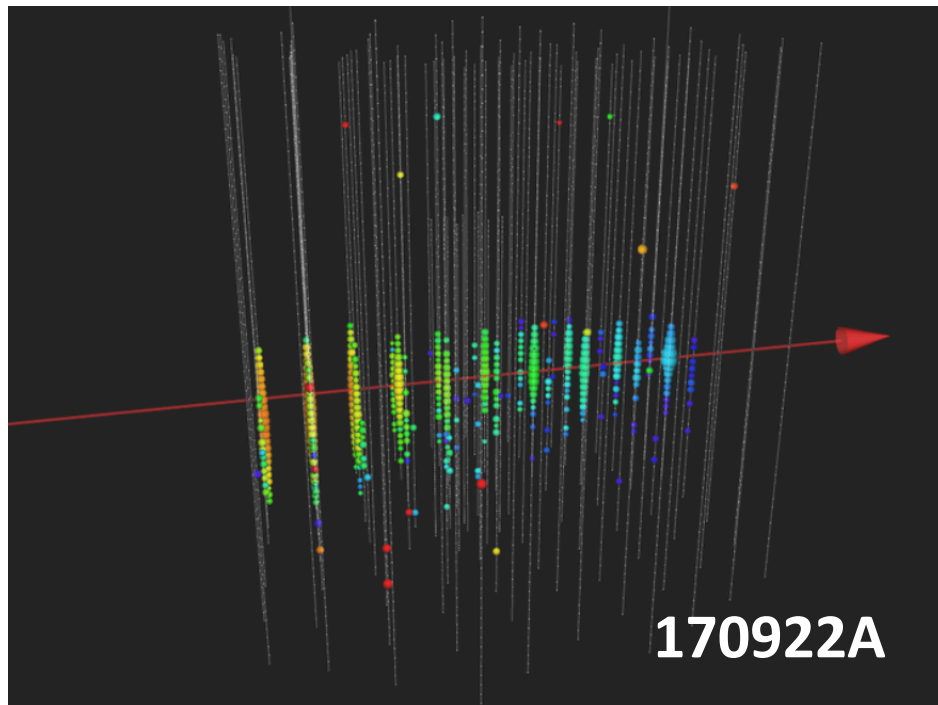
Gamma ray bursts
Kunal Deoskar



Supernovae
Nora Valtonen-Mattila

High energy neutrinos as multimessengers (neutrinos + photons or gravitational waves)

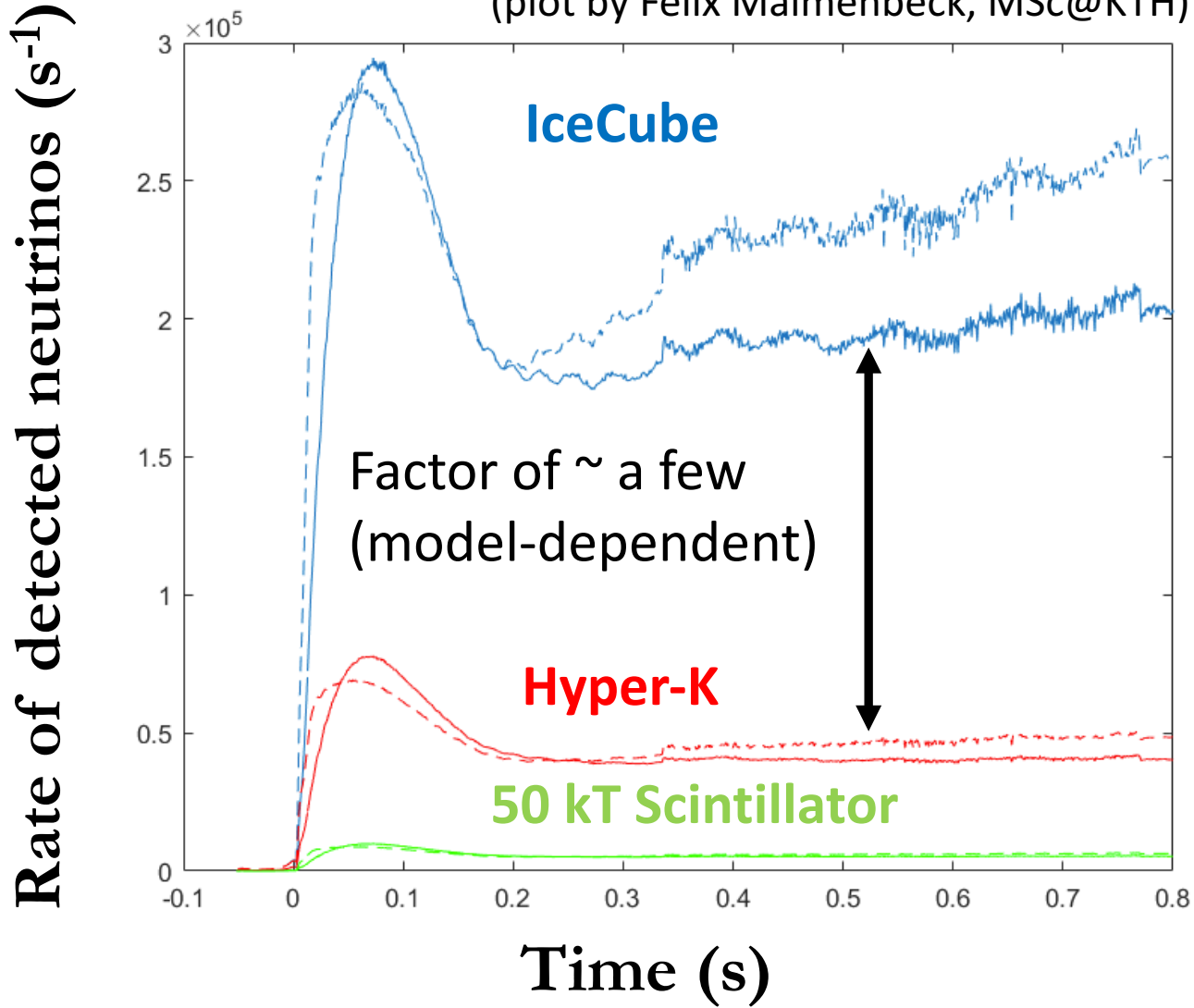
Our highest energy neutrino events are sent out in real time



Ankur Sharma: How to best report the directional uncertainty to the community?

Matti Jansson: can we improve angular resolution through better calibration of DOM positions?

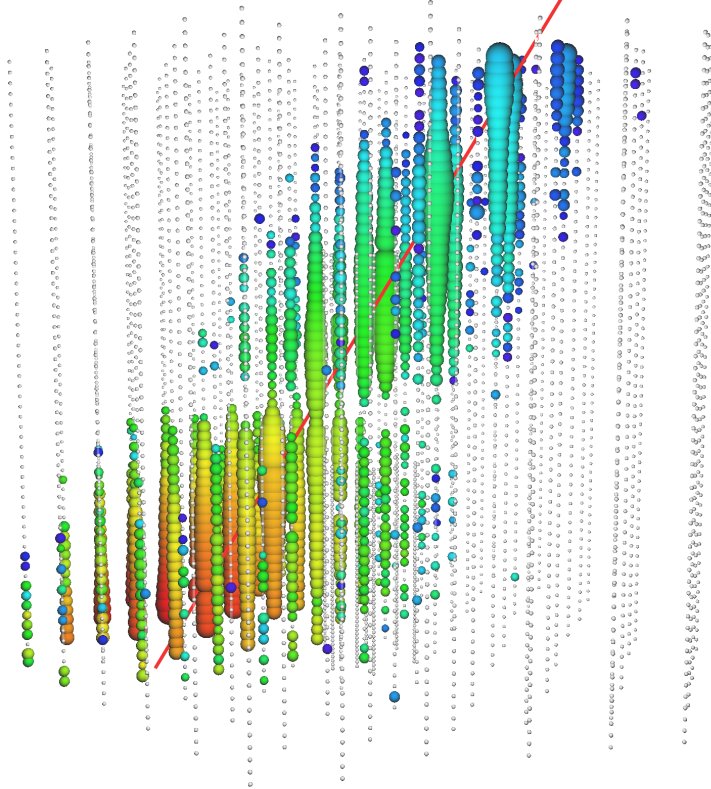
Supernova neutrinos as messengers



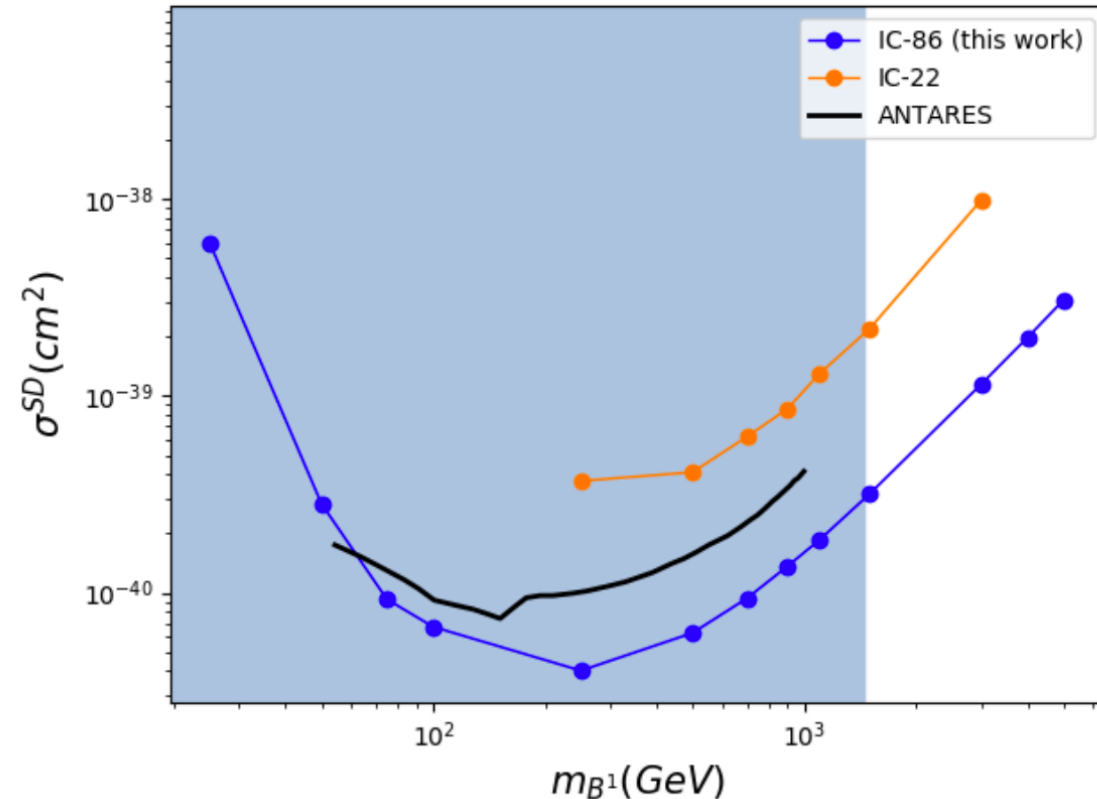
Alerting the astronomy
community with the
SuperNova Early Warning System

Beyond Standard Model

Monopole search
(Alex Burgman)

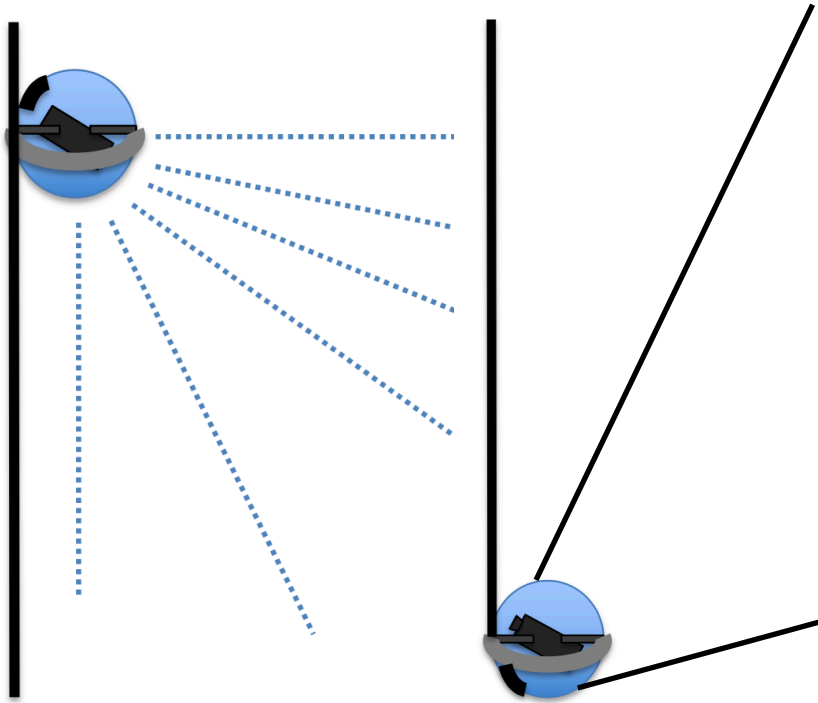


New (best) limits of Kaluza-Klein dark matter
(Miquel Colom i Bernadich + Carlos)

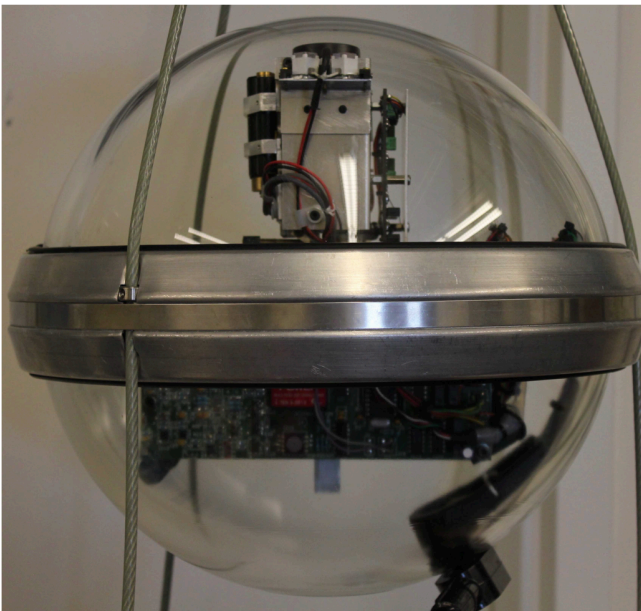


Colom i Bernadich and de los Heros
Eur. Phys. J. C, 80 2 (2020) 129, arxiv:1912.04585

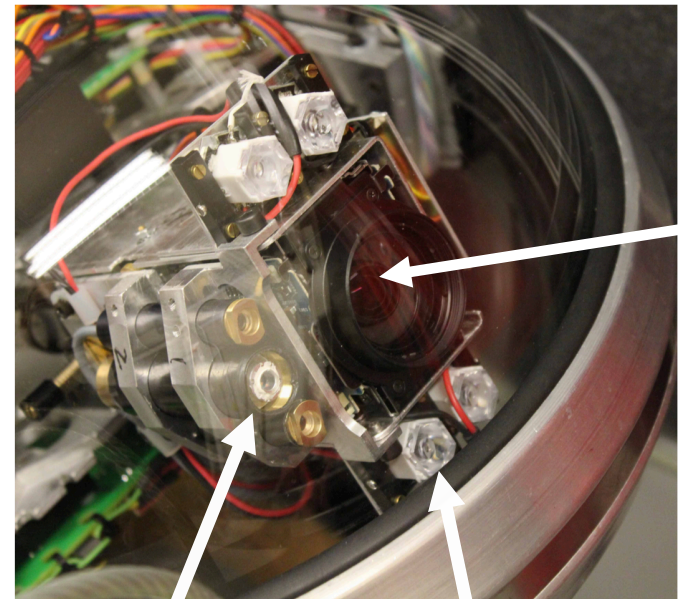
Sweden Camera2.0 for the Upgrade



Close together strings
allow us to see
neighboring modules



(Pictured here:
Sweden Camera 1.0, 2010)

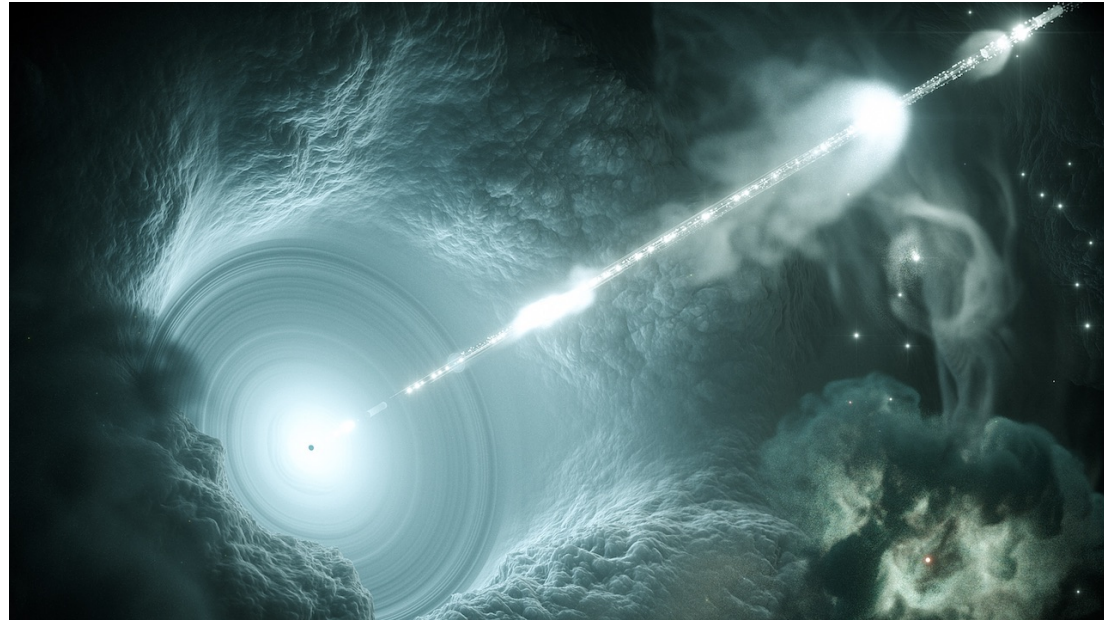


Lasers

LEDs

Camera

Neutrino astrophysics: this is just the beginning!



- IceCube: Discovery of high energy astrophysical neutrinos, first evidence of high energy neutrino source
- Upgrade: Improved directional reconstruction – reanalysis of all 10 years of data
- Gen2: Robust identification of high energy neutrino sources. The true vision of neutrino astronomy!