HIghlights from LOFAR & SKA



LOFAR cosmic ray Key Science Project

SKA High Energy Cosmic Particles Science Working Group

VUB members: Stijn Buitink, Vital De Henau, Tim Huege

5 November 2026, IIHE Annual meeting, Brussels

LOFAR cosmic-ray SKAO



One experiment's background is another experiment's research*

* This is an attempt at a joke -Vital De Henau 2026

A Few places where we work

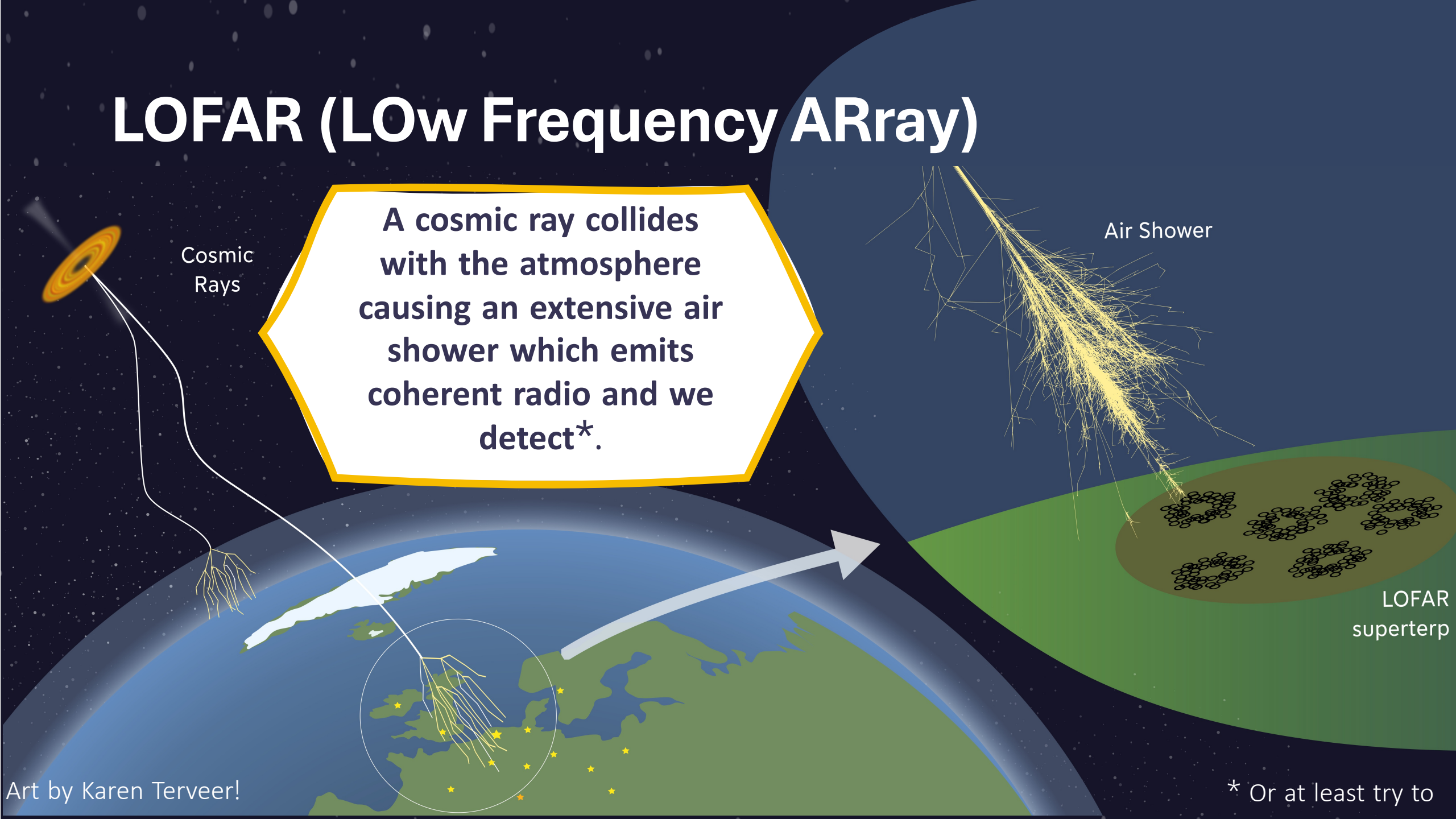
- LOFAR
- SKA-Low
- Monte Carlo Dreamland

Order by distance
I'm not being biased





LOFAR (LOw Frequency ARray)



LOFAR

- LBA (Low Band Antenna)
  - 10-80 MHz bandwidth
- HBA (High Band Antenna)
  - 120-240 MHz bandwidth
- LORA (LOfar Radboud air shower Array)
  - Scintillators



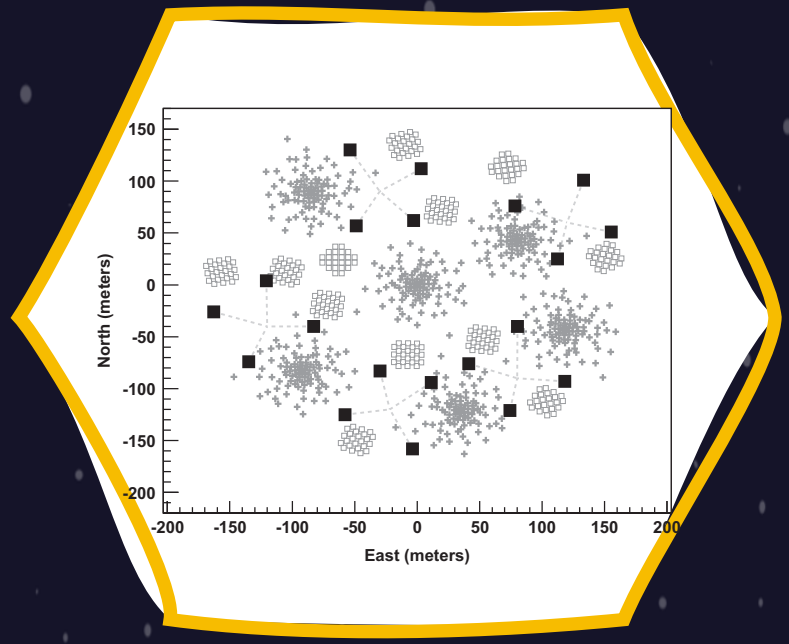




* This stick is highly important, other wise you can't see LORA and will hit it with the lawnmower. This is also why stuff looks so bushy.

LOFAR

- Going towards LOFAR2.0
  - Simultaneous LBA + HBA
  - triggered by LORA
- Adding more scintillators
  - In the core stations
  - Each gets 4 scintillators
- This year IIHe members will help with deployment of electronics*
- Lead by Katie Mulrey

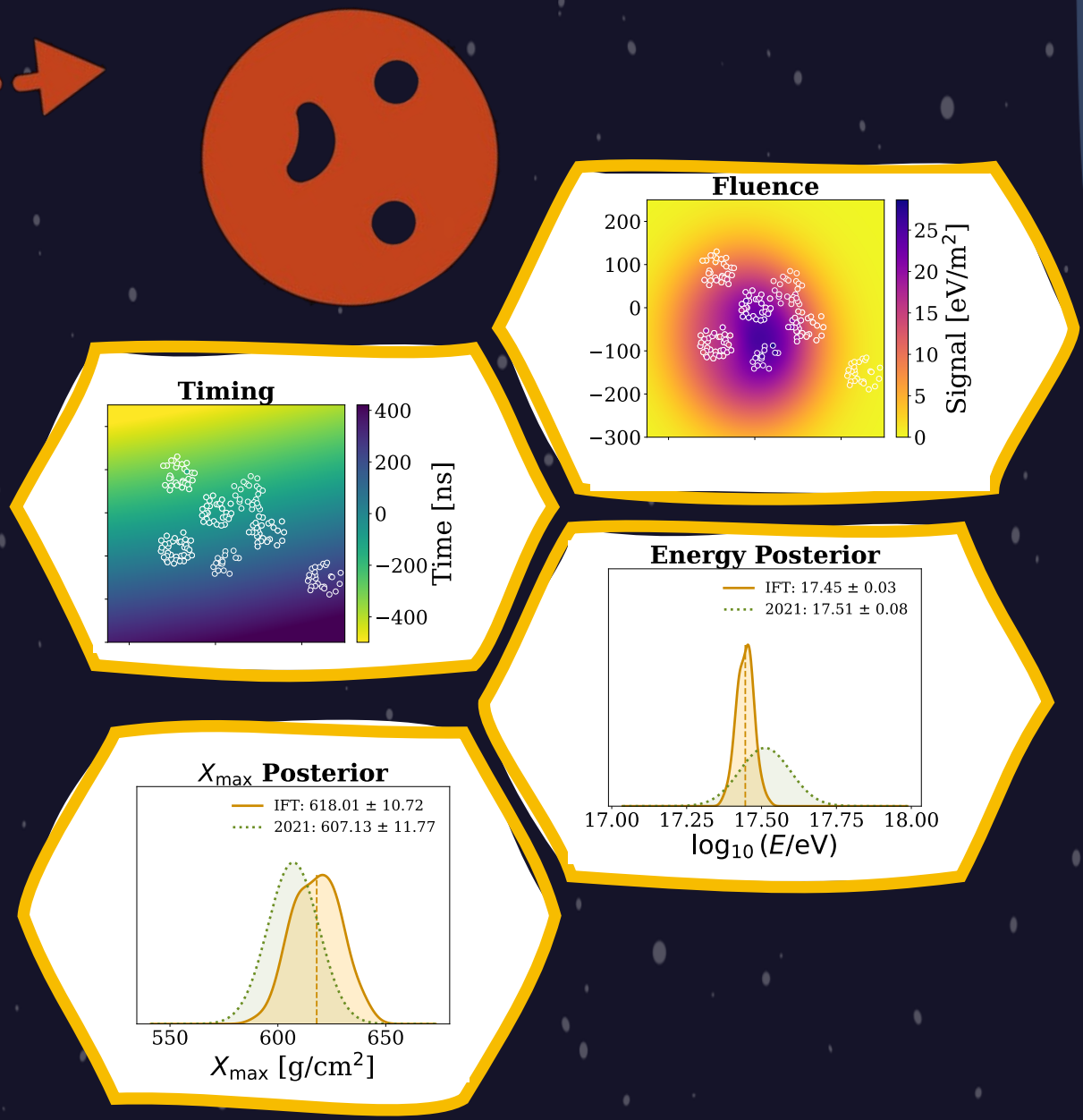




*Slight delay due to servers getting lost…

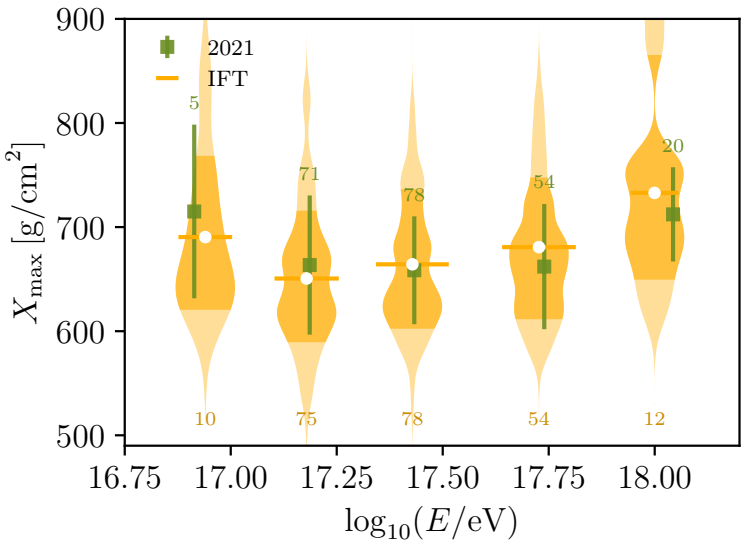
LOFAR

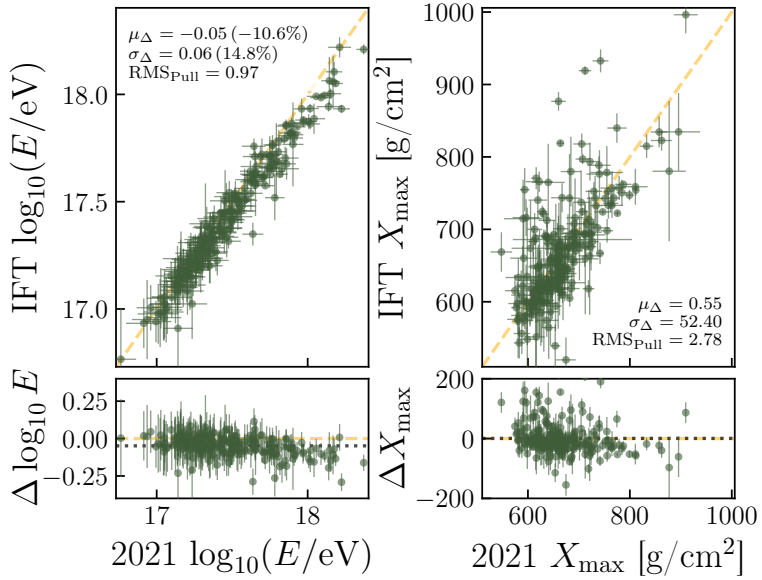
- New reconstruction technique!
- Work by Karen Terveer (FAU)
- A Bayesian Method for Air-Shower Reconstruction using Information Field Theory (IFT) [2602.19864]
  - IFT provides a probabilistic framework for reconstructing physical fields by treating them as continuous random functions defined through probability distributions.



LOFAR

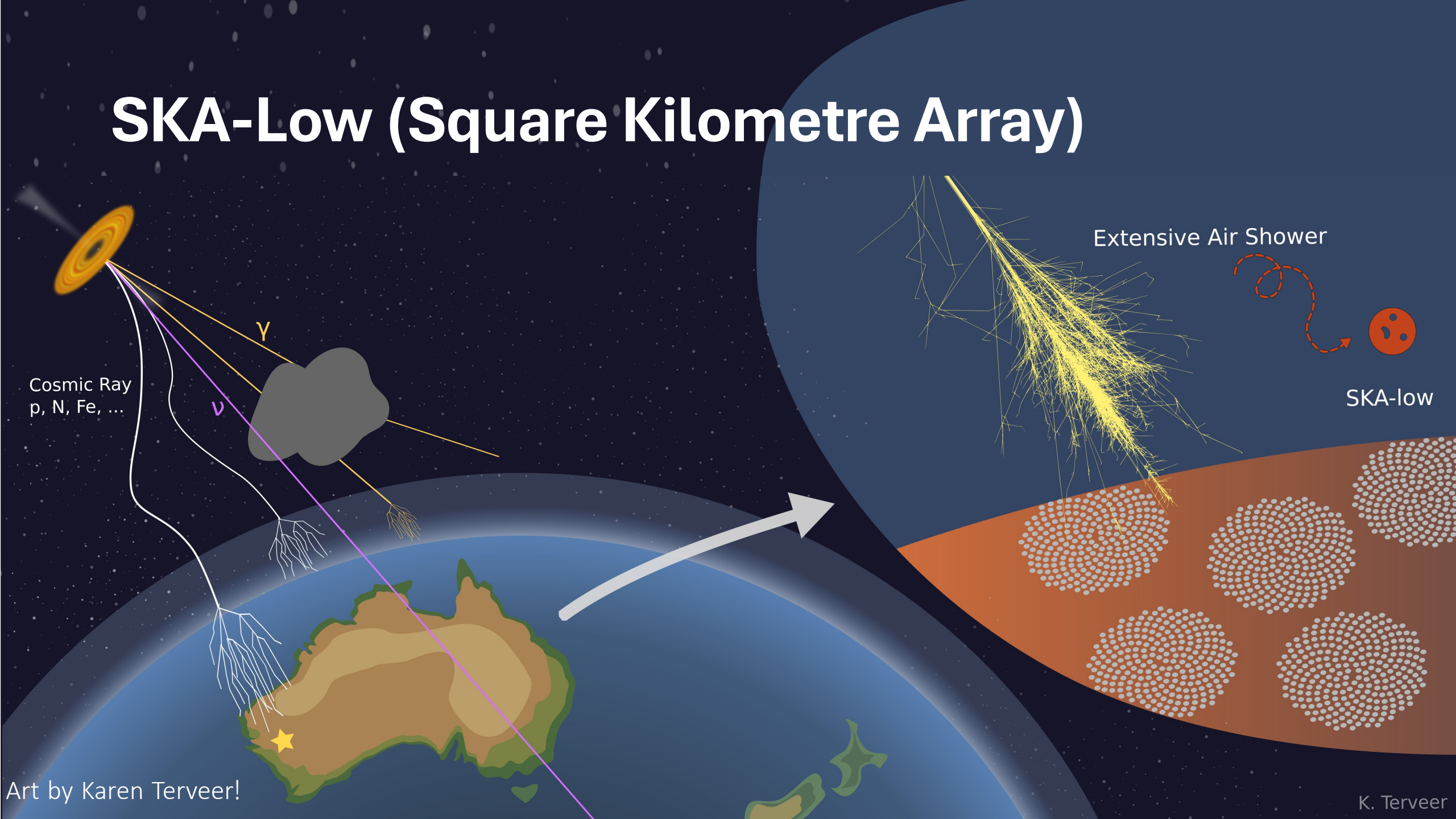
- New method agrees with old one
- Reconstruct more events that weren't possible before
- Extremely fast!
- Will carry over to SKA-Low*





*SKA-Low has to many antenna's to do 'brute force' reconstruction

SKA-Low (Square Kilometre Array)



SKA-Low

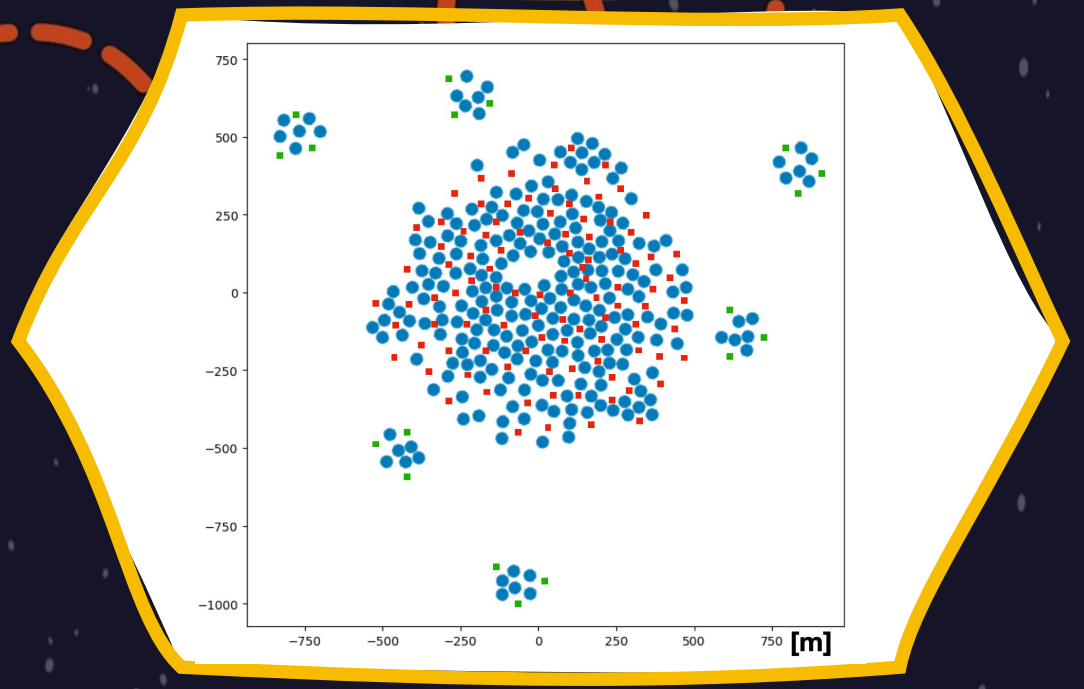
- 17.600 antennas assembled and installed
- 96.000 steel sheets laid
- 530 drums / 330 km of power cables installed
- 960km of fibre optic cable installed
- Science chapters [2606.20366]



SKA-Low

- First generation
  - 8 prototype stations*
  - Went well!
- Second generation
  - 100 scintillators fully funded (FWO, NOVA & KIT)
  - Construction underway

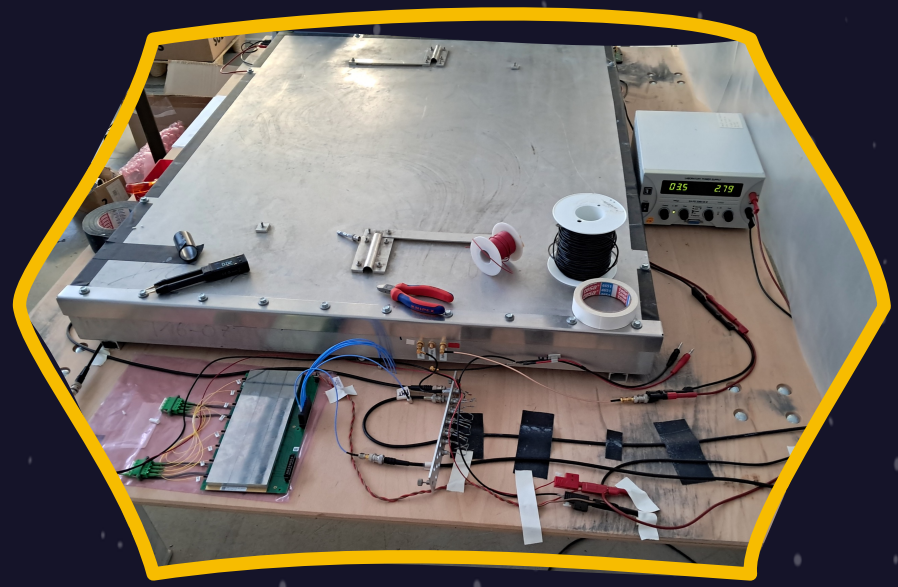


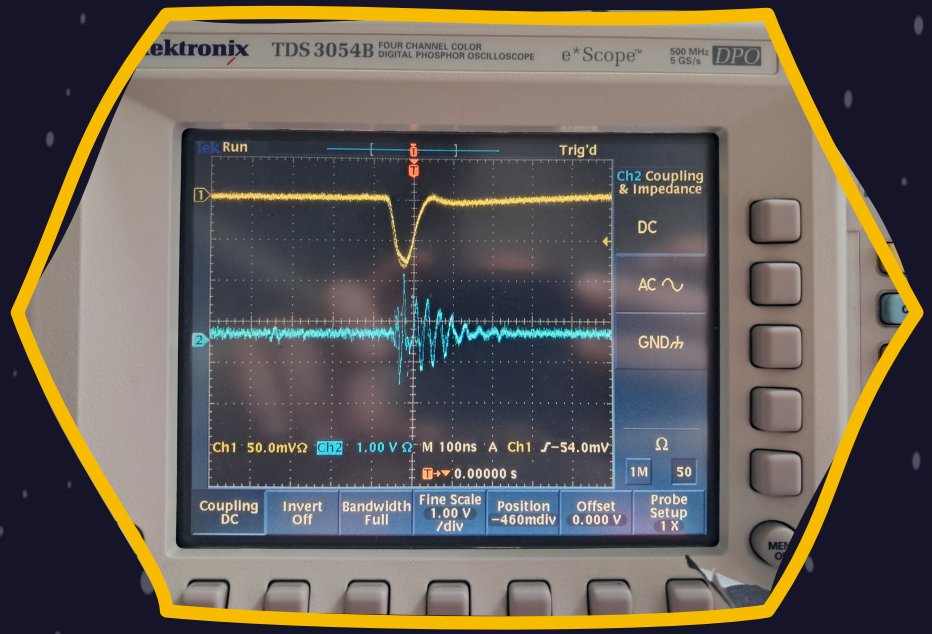


*They have little sun hats for the heat and little feet for the rain

SKA-Low

- Low noise
  - PMTs replaced with SIPMs
  - RFoF comm links
- Compatibility
  - Power/signal cables + digitization backend same as SKA-Low antennas
- Environment
  - Automatic T-sensitive gain control
- Muon tower results
  - Homogeneous!
  - Purity 94%-90%
  - Efficiency 90%-92%





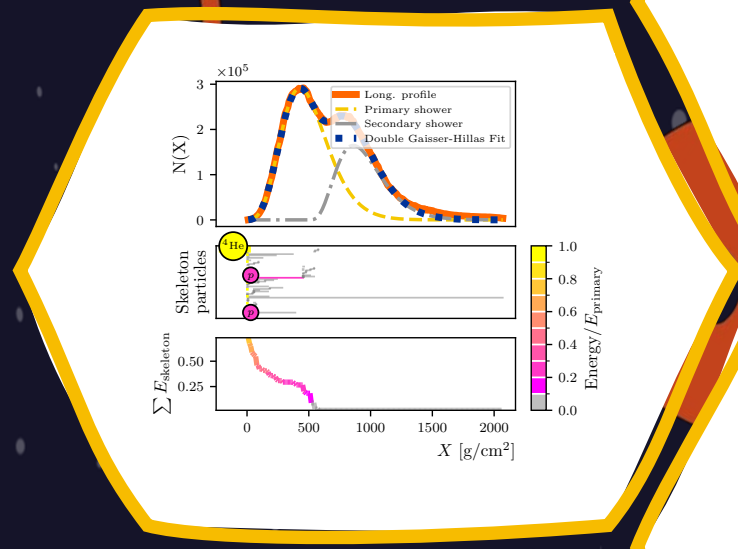
Monte Carlo Dreamland*

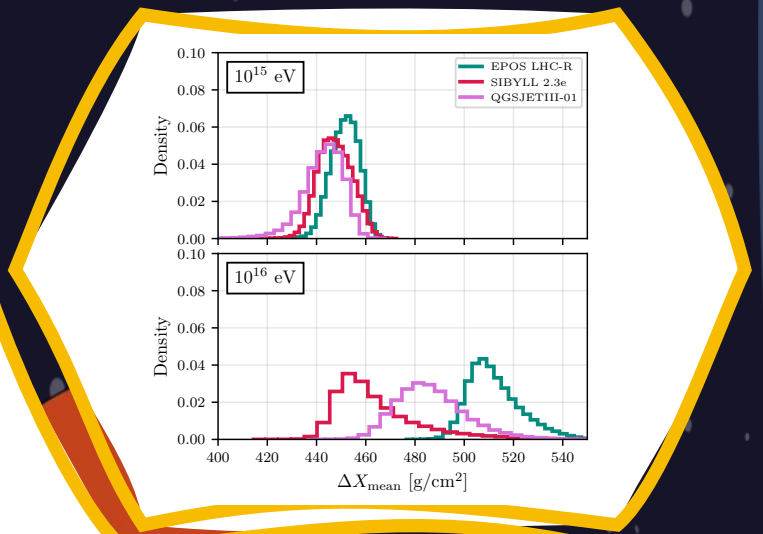
- Simulation studies
- Lots of simulations, ask IT (:

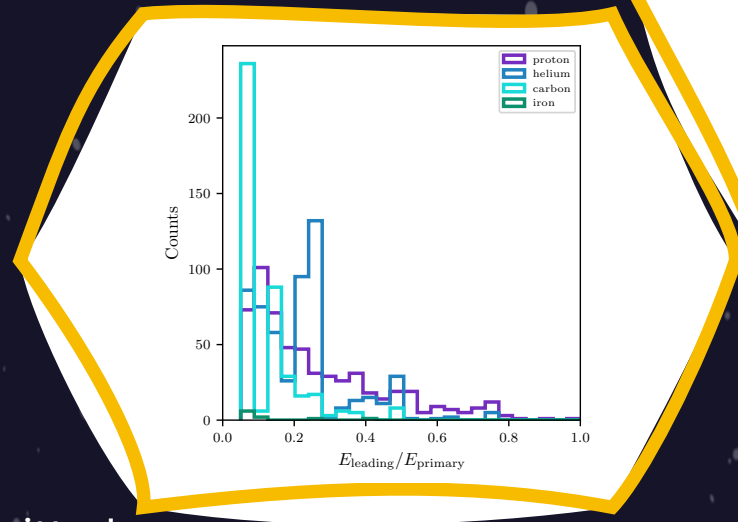
* This term is commonly used among colleagues and refers to the fact that working with simulations can often under-prepare one for how complicated real data can be. –Karen Terveer 2026

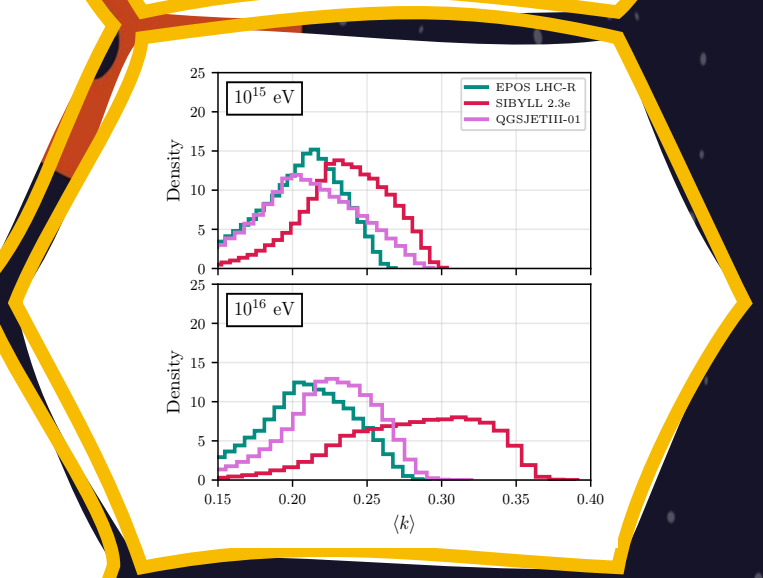
Monte Carlo Dreamland

- Anomalous showers
  - Mass composition sensitivity
  - Probing of Hadronic models
- Create possible models
  - A total of 10.000 showers
  - Mix of random H:He:C:Fe
  - Extract all the Double Bumps
  - Do physics!*





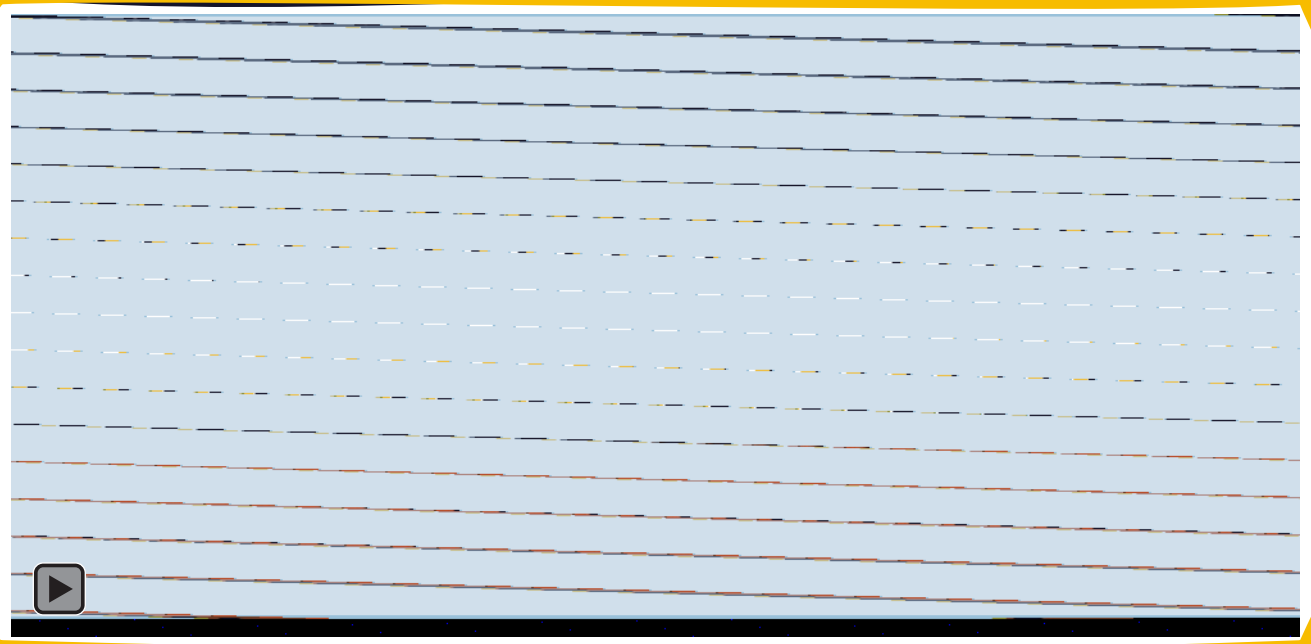




*The physics has been physicsed and will ‘soon’ be submitted

Monte Carlo Dreamland

- Advanced analytical coherence model
- Used to explain spectral features
- Inspired by work done in RET* hence collaboration of IIHE people



*Form looking at their screens during the all important 4tje

That’s it.

