

CNRS-JSPS-JST Celebration Event for the 50th  
Anniversary of France-Japan Scientific Cooperation

# Telescope Array

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for the TA Collaboration

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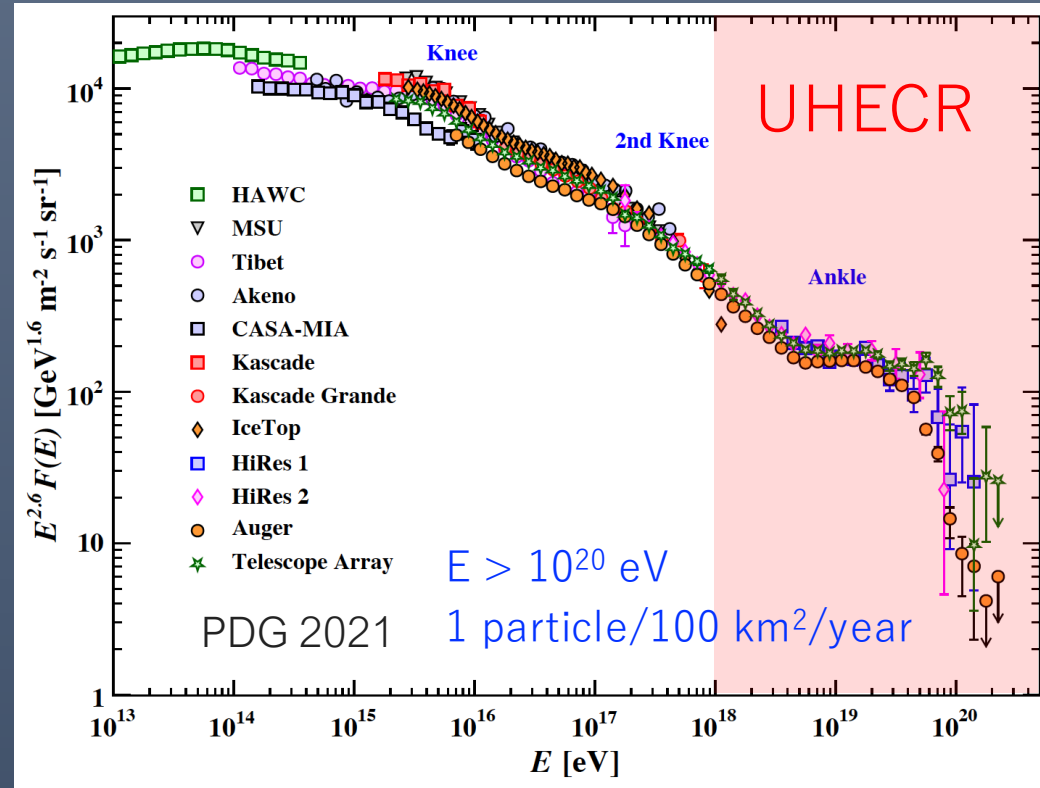
Wednesday, October 9, 2024 @ Miraikan, Tokyo

# Ultra High Energy Cosmic Ray (UHECR)

UHECRs ( $E > 10^{18}$  eV)

We **DO NOT KNOW** to produce UHECRs from

**What origin** and **How to accelerate** in the Universe.



UHECRs bring following novel information:

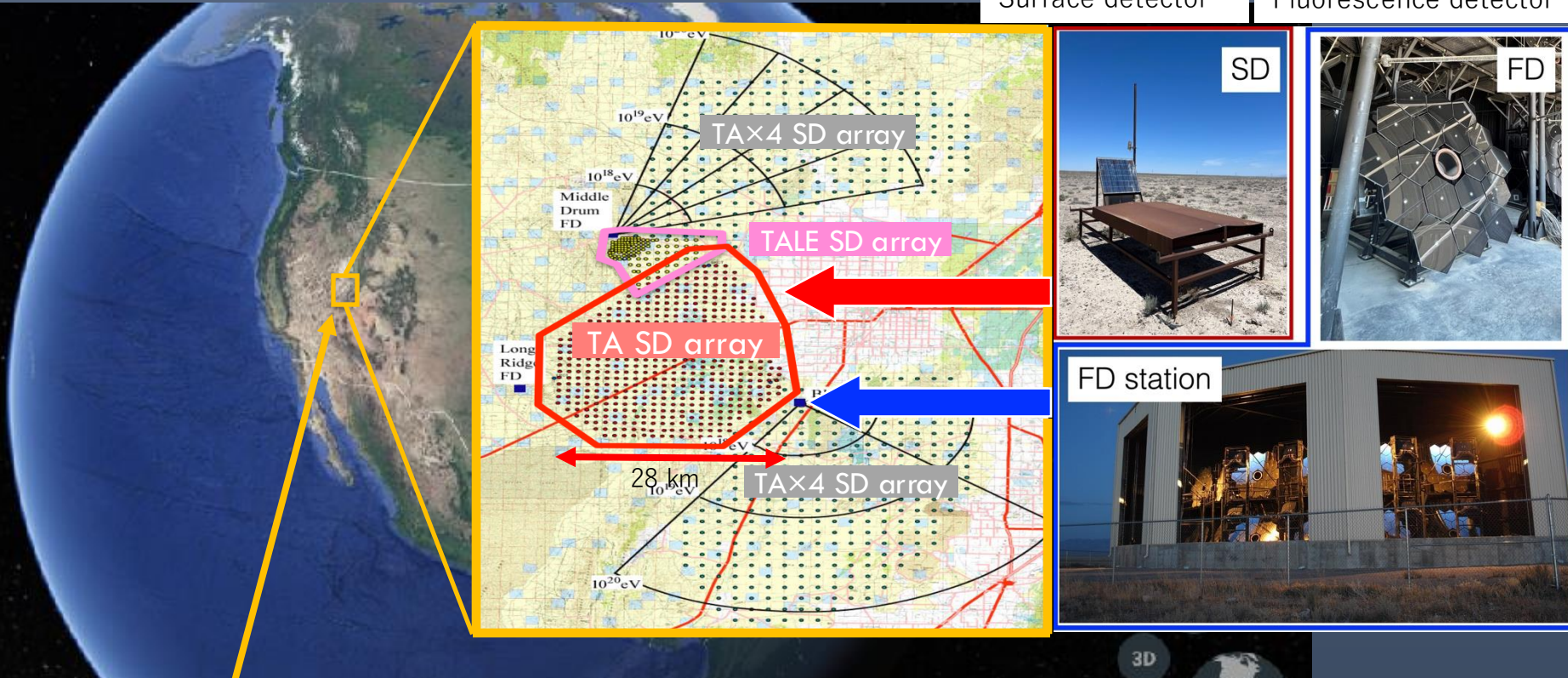
- Astrophysics at the Energy Frontier
- Particle physics at the Cosmic Frontier
- A sensitive probe to BSM physics and dark matter

# Telescope Array (TA) Experiment

TA is the largest cosmic-ray detector in the Northern hemisphere.  
TA had been running since 2008.

Surface detector

Fluorescence detector



- Delta, Utah, USA. 1370 m above sea level
- 507 surface detector array covers  $\sim 700 \text{ km}^2$
- 38 telescopes in 3 stations look over the array

# “Amaterasu (天照)” event

10:35:56 UTC on May 27, 2021

Estimated energy:  $244 \times 10^{18}$  eV

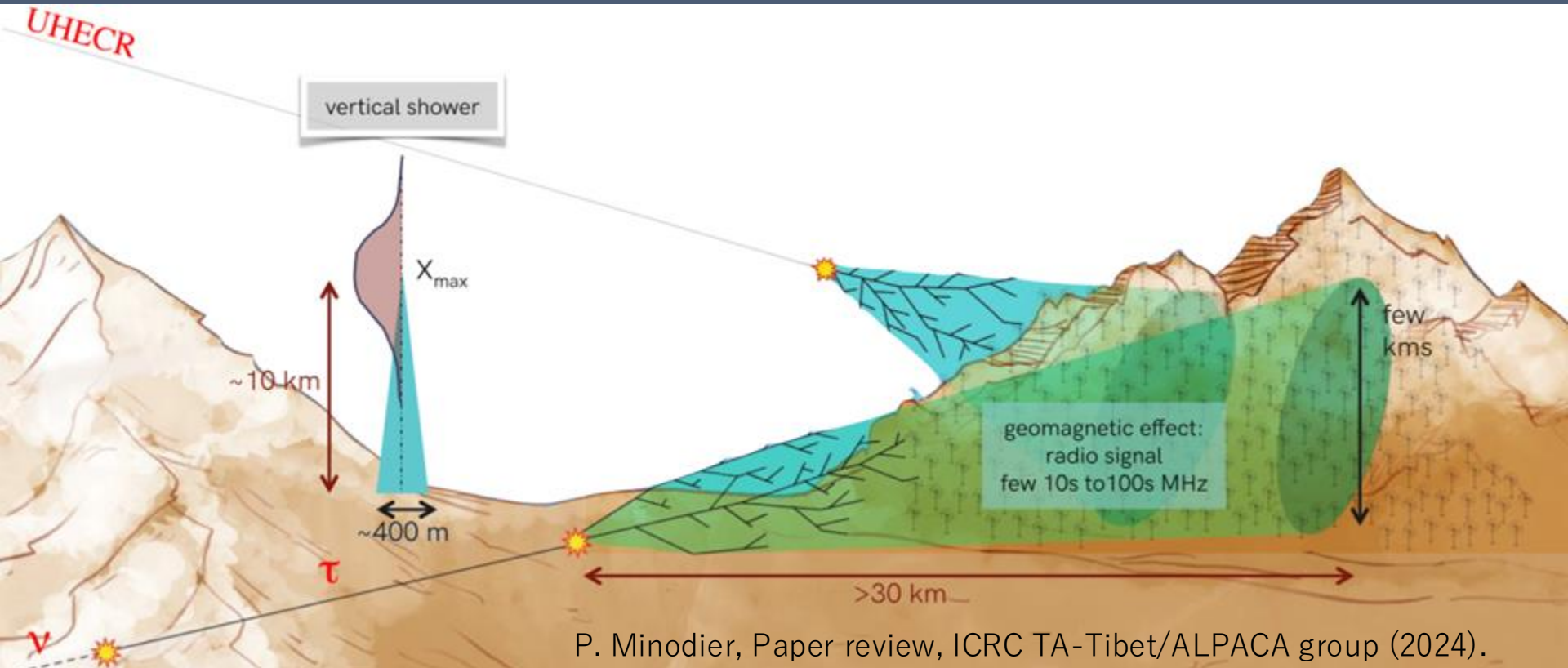
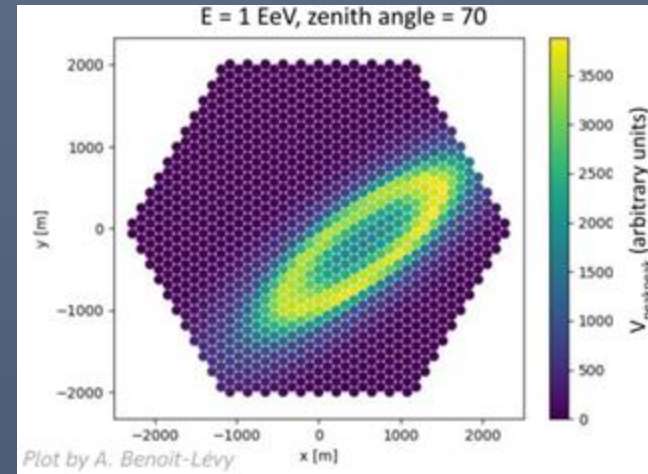
The most energetic observation  
in TA since 2008.



1.2 km 1.2 km

# GRAND : Giant Radio Array for Neutrino Detection

- France is the host institute.
- Optimized for earth-skimming  $\nu_\tau$  and inclined air shower induced by UHECRs.
- Some prototype antenna arrays have been working!



# Collaboration with GRAND

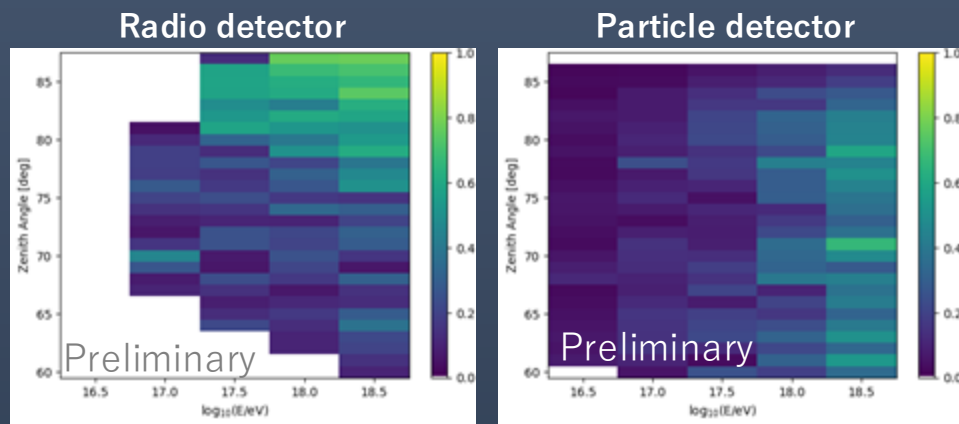
(Since 2024)

- Synergy / Complementarity of techniques
  - TA (Particle) + GRAND (Radio) detector
  - Common tools / methods for data analysis→ could be the first detection of UHE  $\gamma$
- Successful funding & personnel:
  - U. Tokyo & CNRS PhD program (2 PhD students)
  - 2 Masters interns (Paris → ICRR)
  - 1 postdoc exchanged (ICRR → IAP)
- Integrated in the ILANCE (U. Tokyo & CNRS) joint laboratory effort



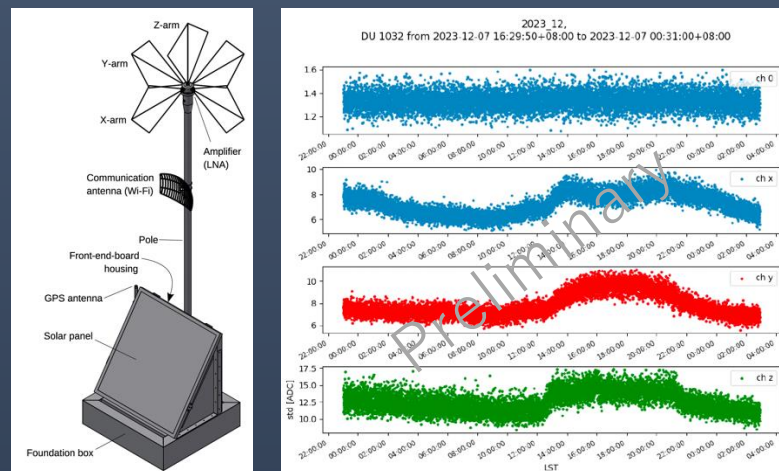
## Sensitivity study for UHECRs (Simulation)

By P. Minodier & K. Takahashi

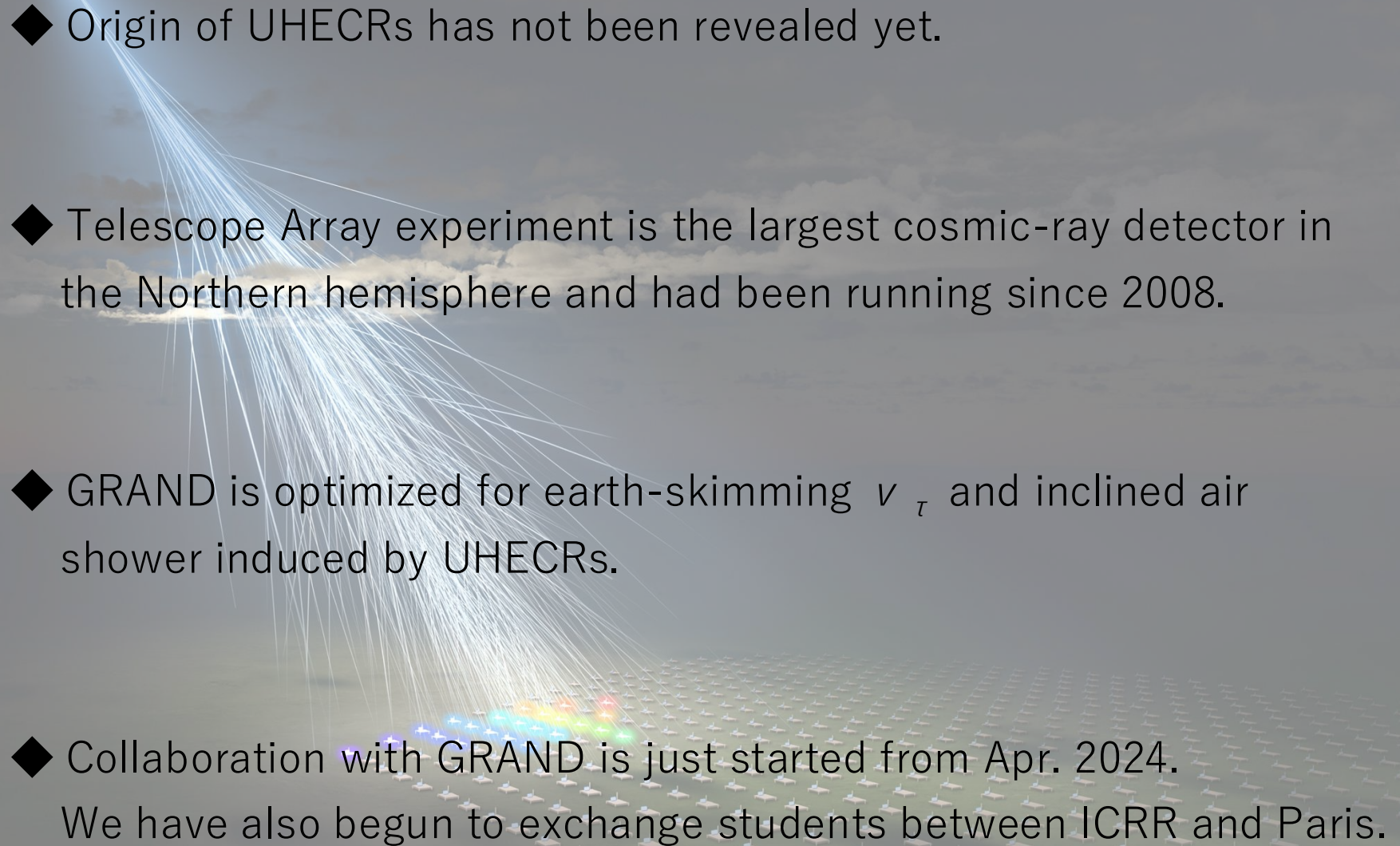


## Environmental noise study (Data)

By W. Erba



# Summary & Prospects

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- ◆ Origin of UHECRs has not been revealed yet.
  - ◆ Telescope Array experiment is the largest cosmic-ray detector in the Northern hemisphere and had been running since 2008.
  - ◆ GRAND is optimized for earth-skimming  $\nu_\tau$  and inclined air shower induced by UHECRs.
  - ◆ Collaboration with GRAND is just started from Apr. 2024.  
We have also begun to exchange students between ICRR and Paris.



Thank you for your attention!

TALE infill array deployment  
Nov 15, 2022.