

# Cherenkov Telescope Array Observatory



Vitor de Souza



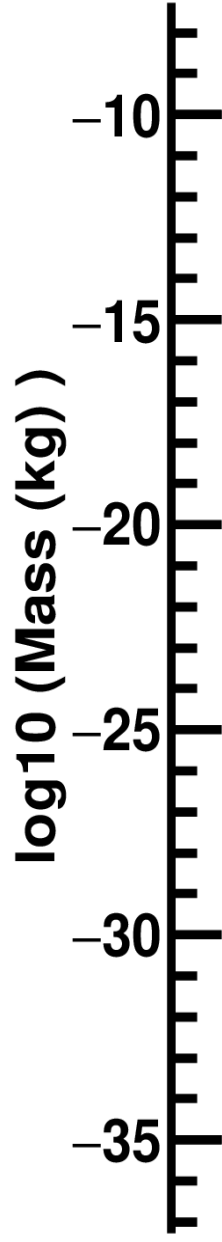
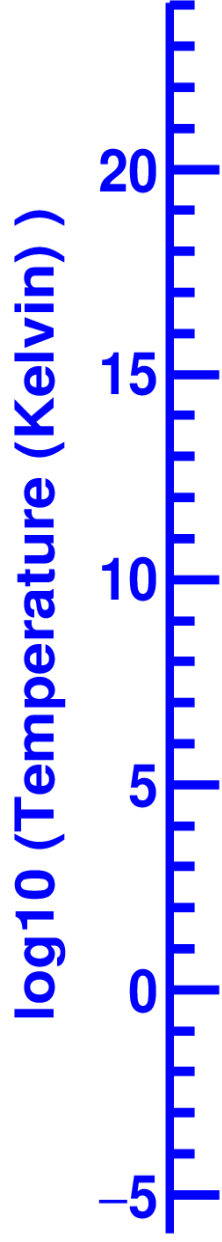
UNIVERSIDADE DE SÃO PAULO  
Instituto de Física de São Carlos



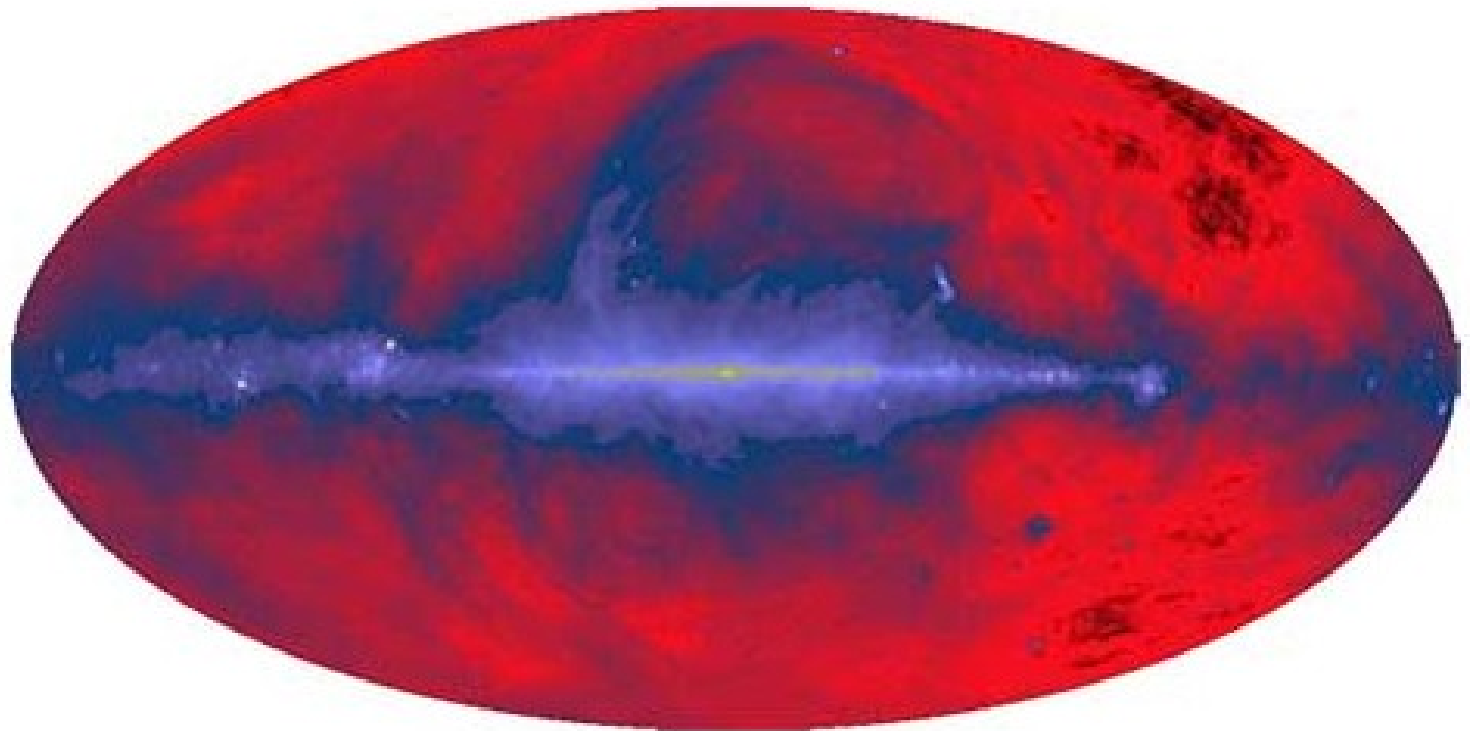
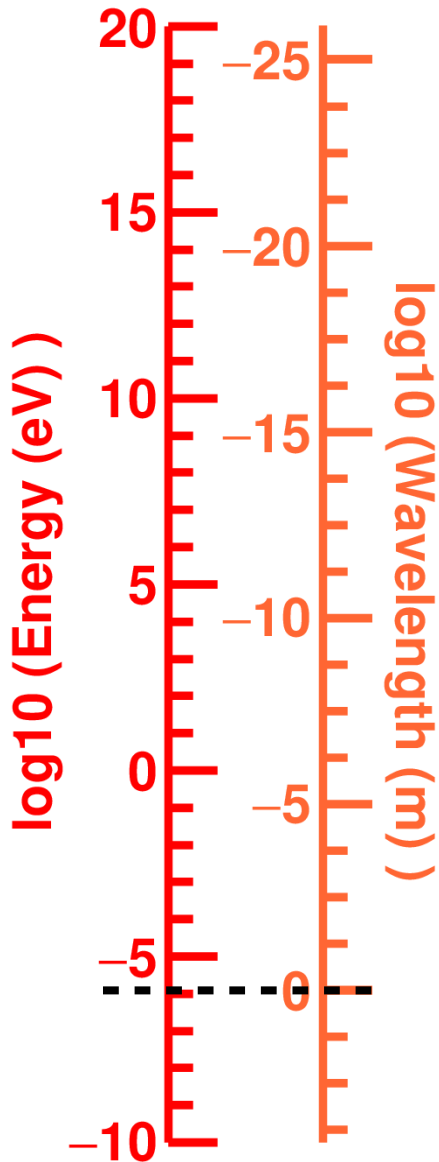
cherenkov  
telescope  
array

## CTAO/CTAC General Meeting Naples, Italy ~ 14-18 November 2022





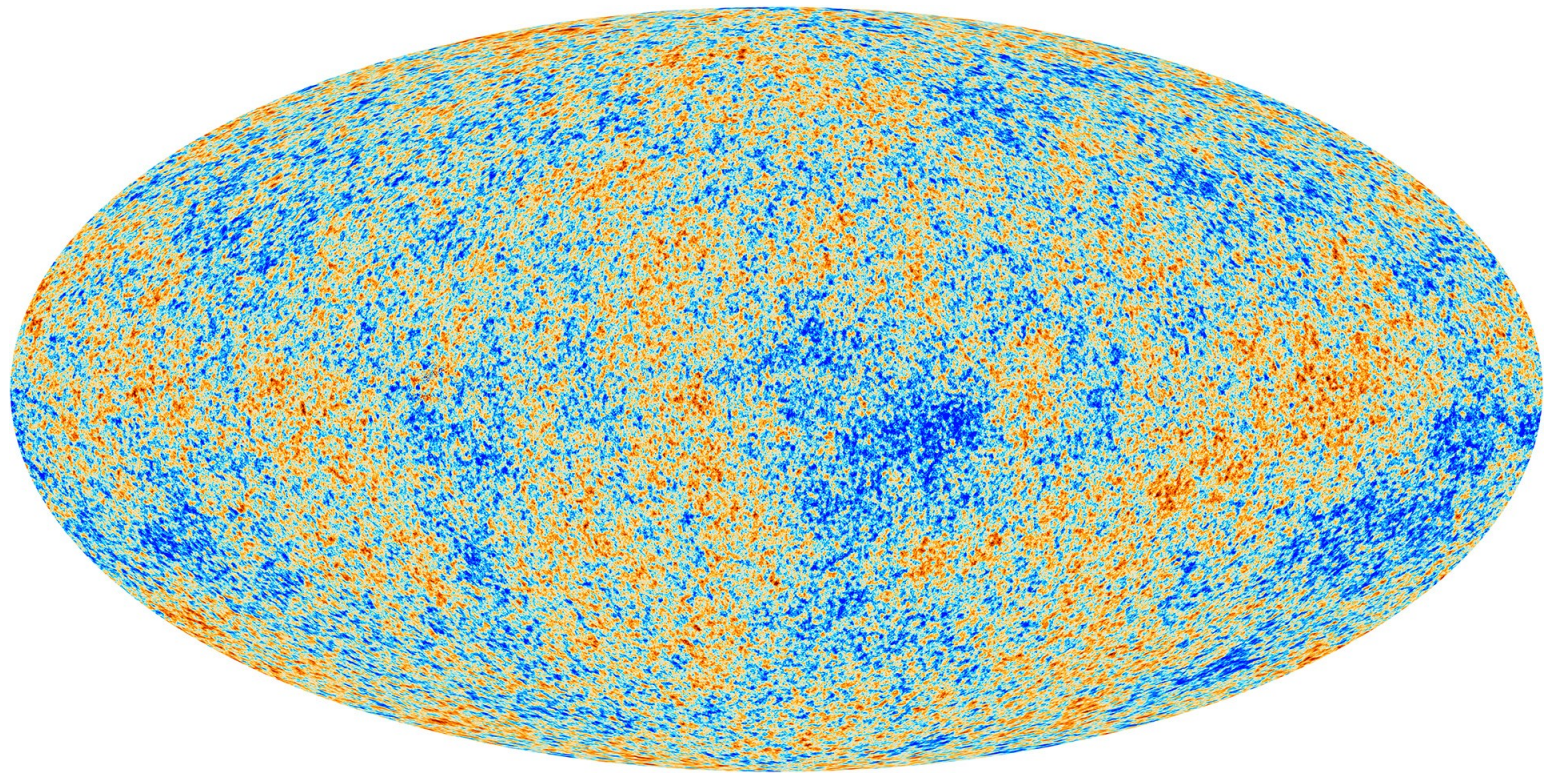
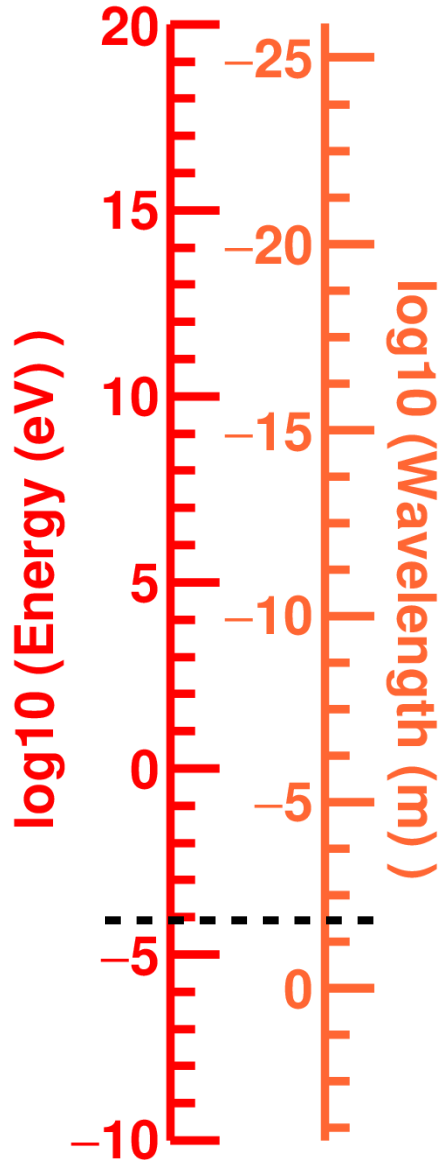
$$E \sim 10^{-6} \text{ eV} \Leftrightarrow \lambda \sim 1 \text{ m}$$



# Cosmic Microwave Background



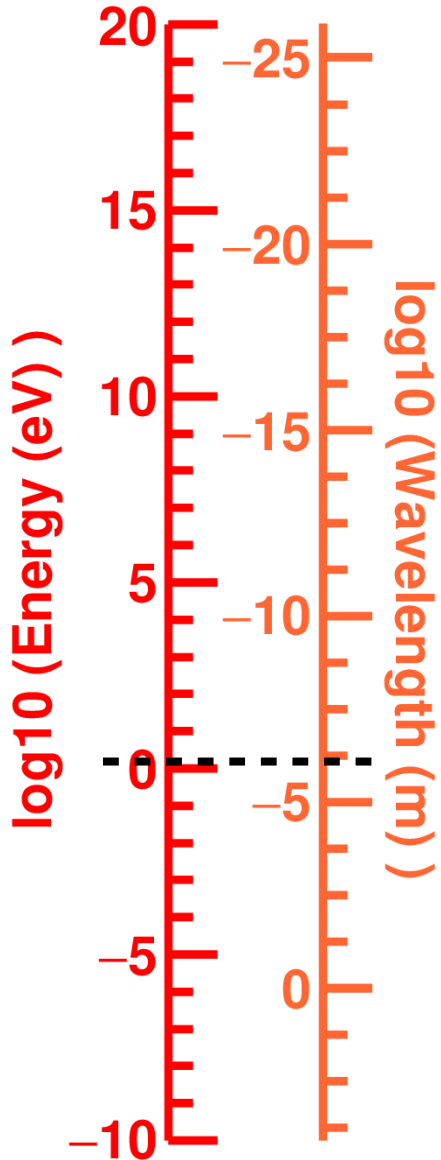
$$E \sim 10^{-4} \text{ eV} \Leftrightarrow \lambda \sim 10^{-2} \text{ m}$$



# Visible



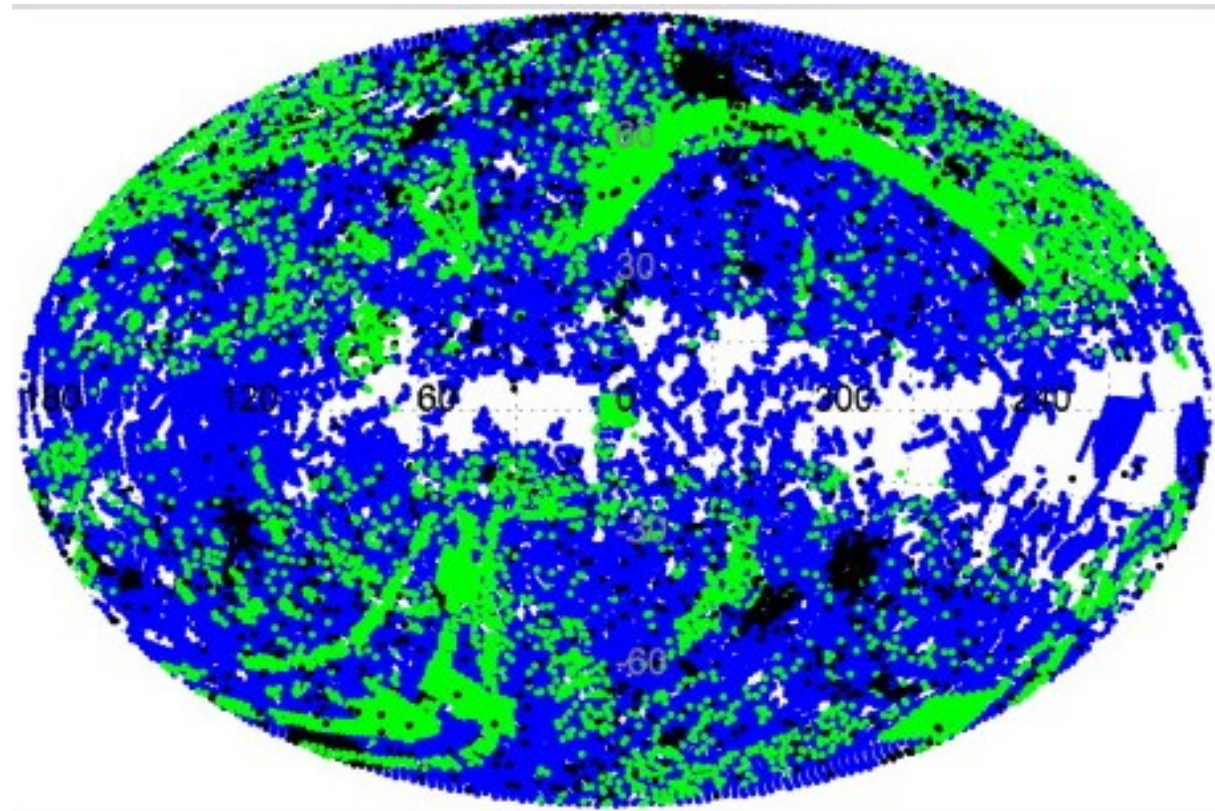
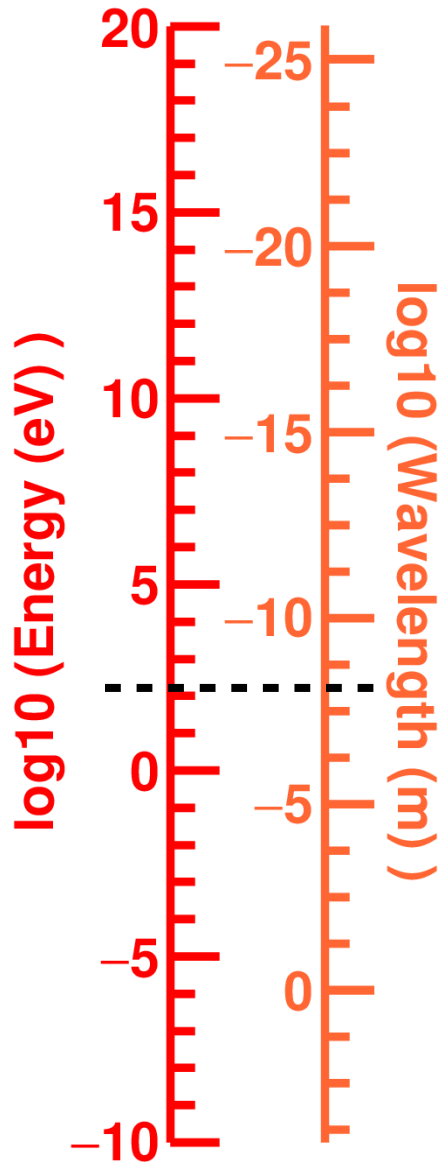
$$E \sim 1 \text{ eV} \Leftrightarrow \lambda \sim 10^{-6} \text{ m}$$



# Ultraviolet



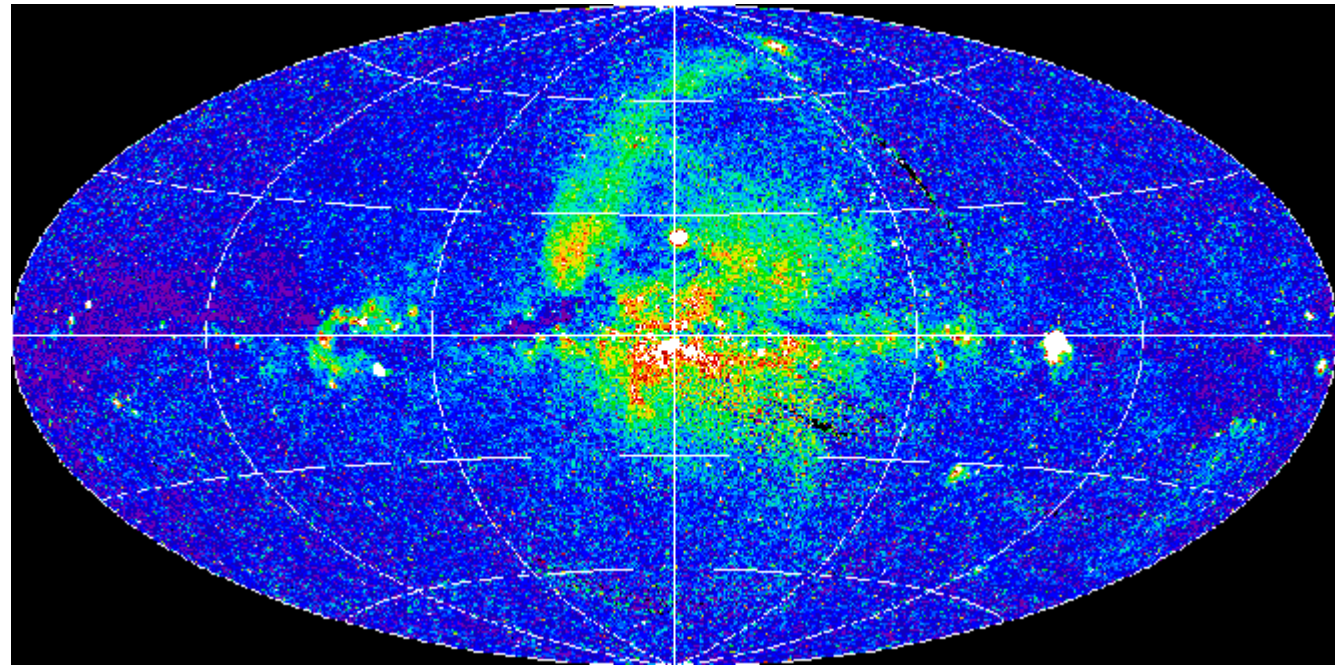
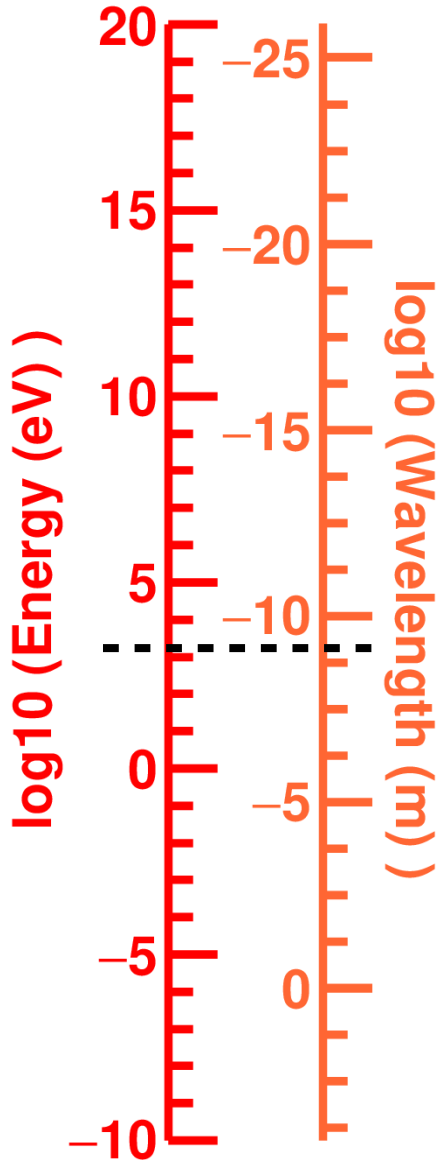
$$E \sim 100 \text{ eV} \Leftrightarrow \lambda \sim 10^{-8} \text{ m}$$

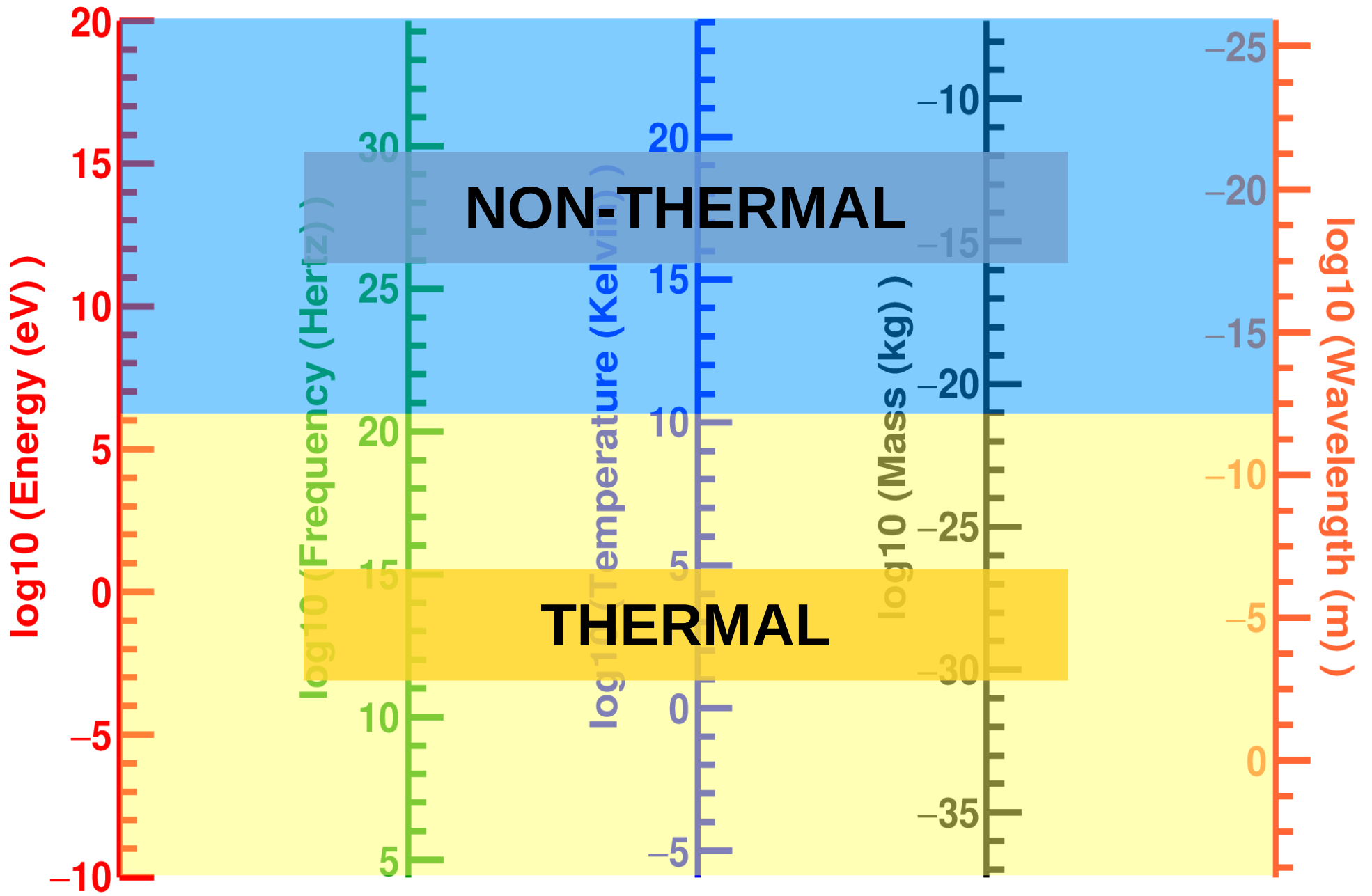


# X-rays



$$E \sim 1500 \text{ eV} \Leftrightarrow \lambda \sim 10^{-9} \text{ m}$$

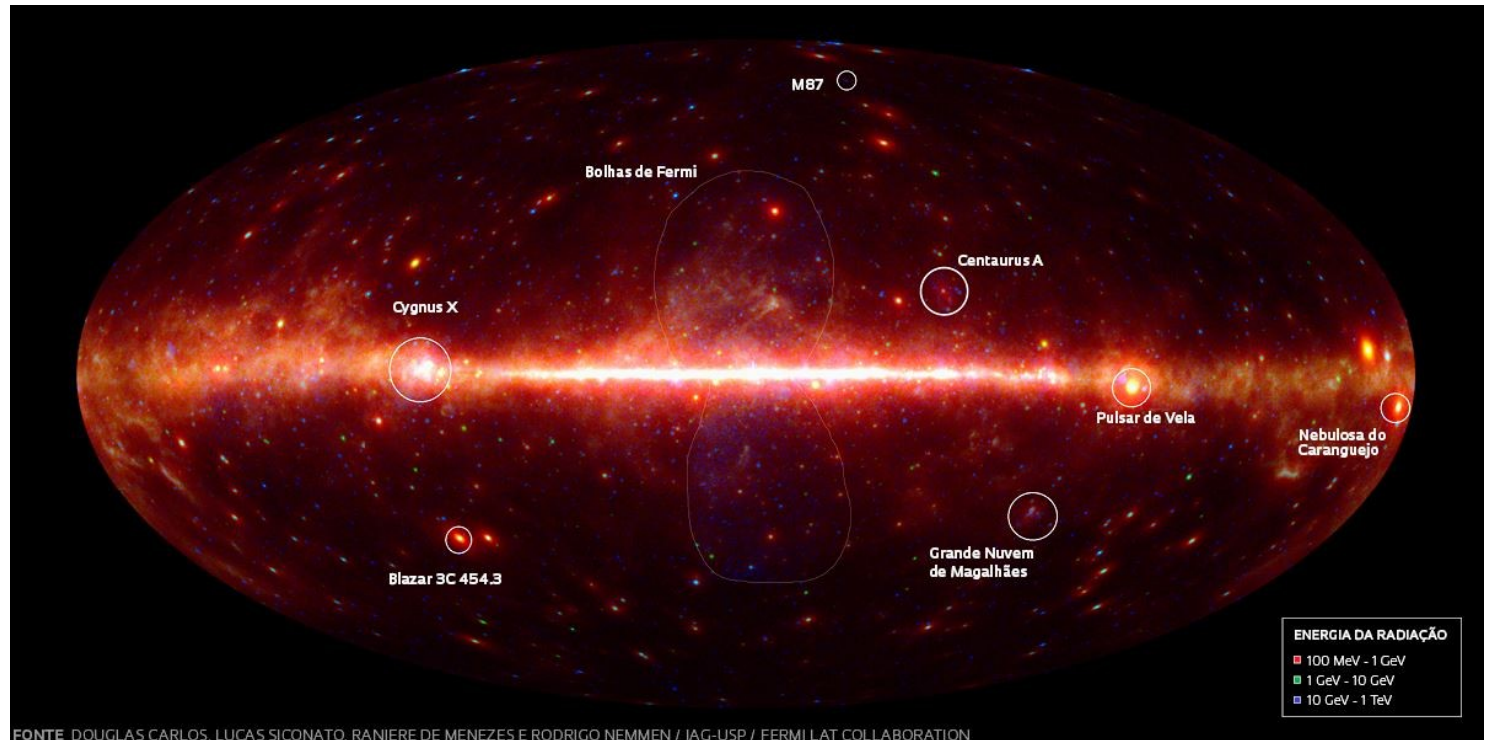
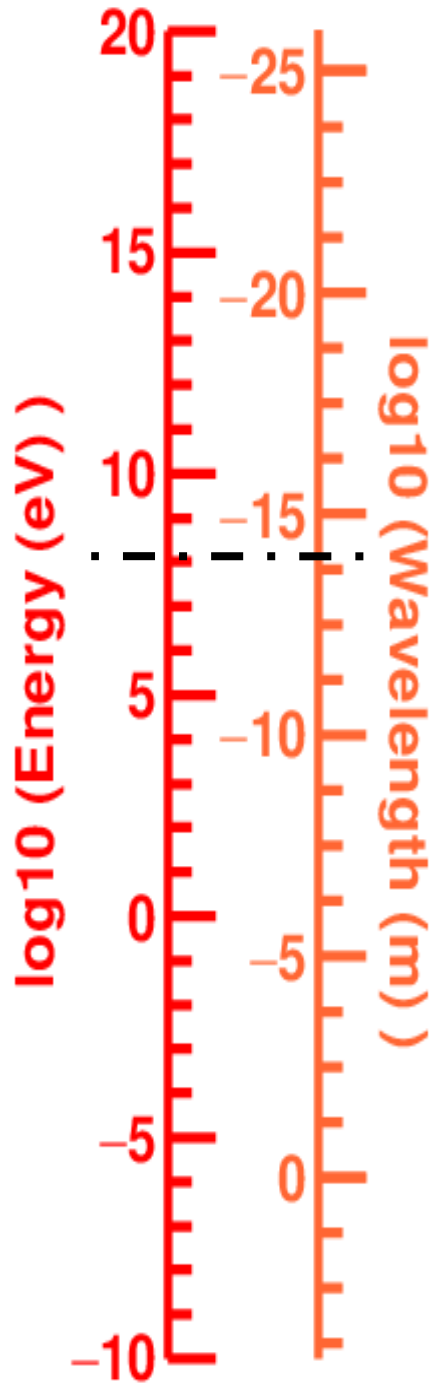






# Gamma rays

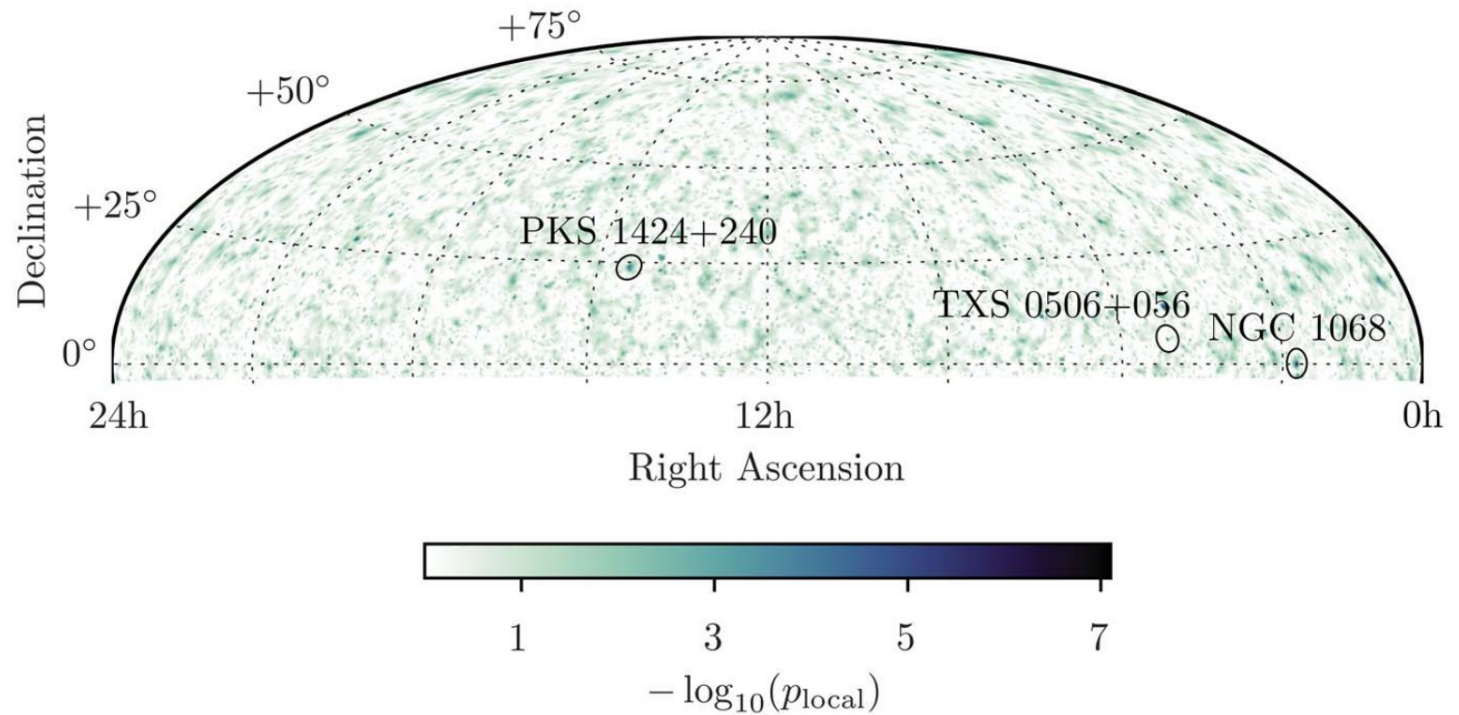
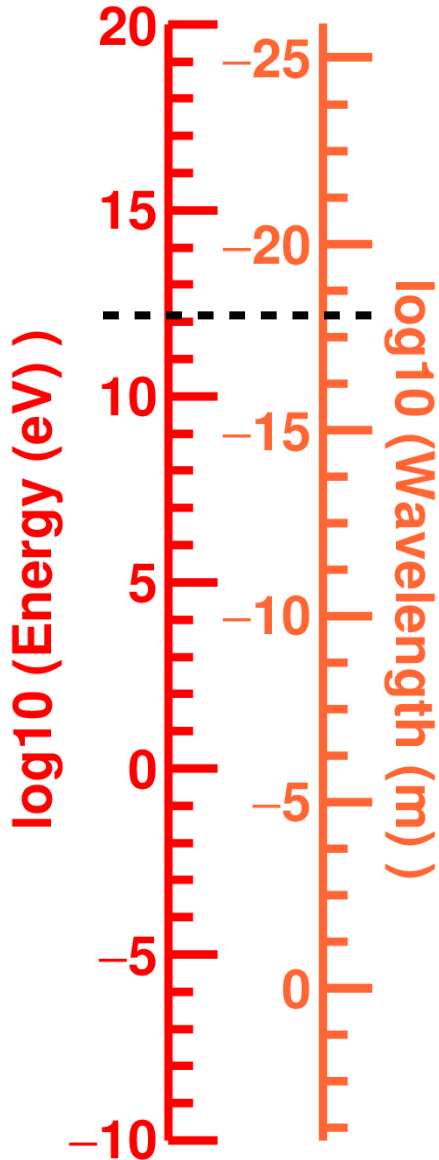
$$E > 10^8 \text{ eV} \Leftrightarrow \lambda < 10^{-14} \text{ m}$$



# Neutrinos TeV

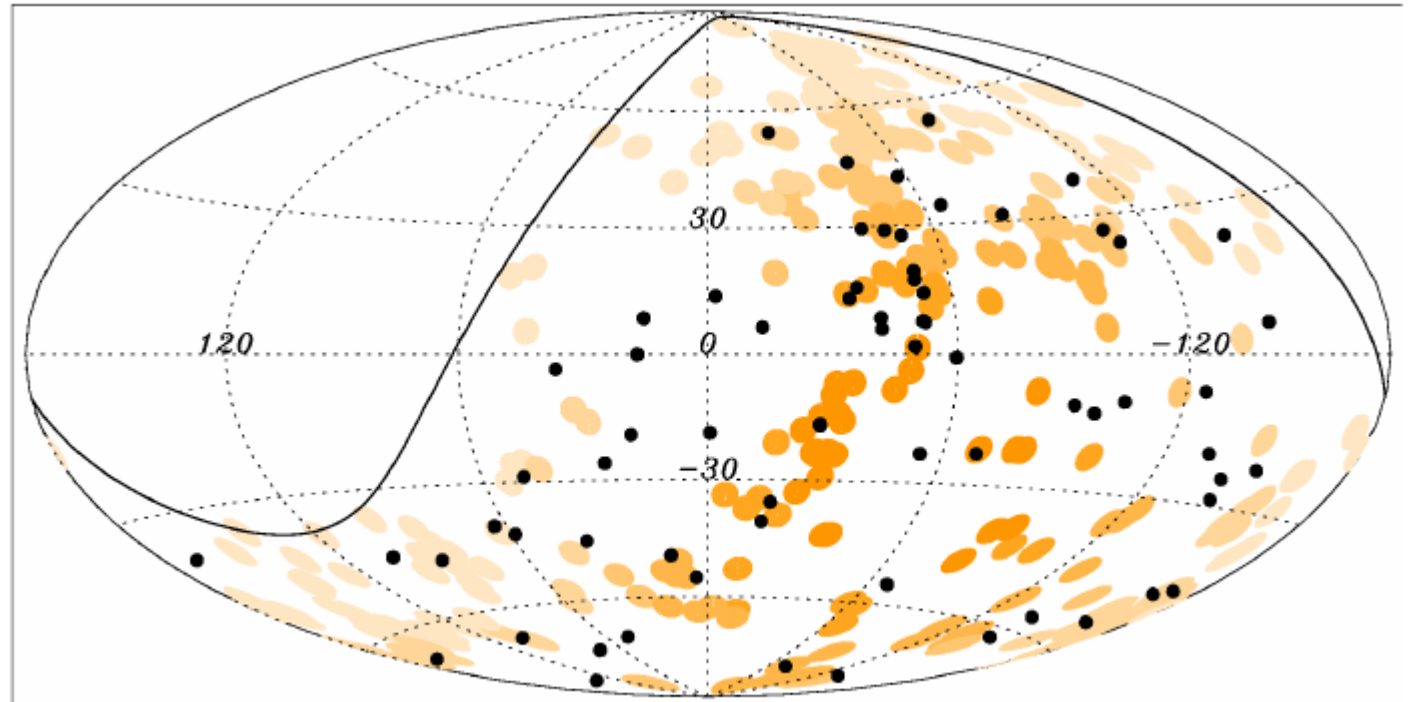
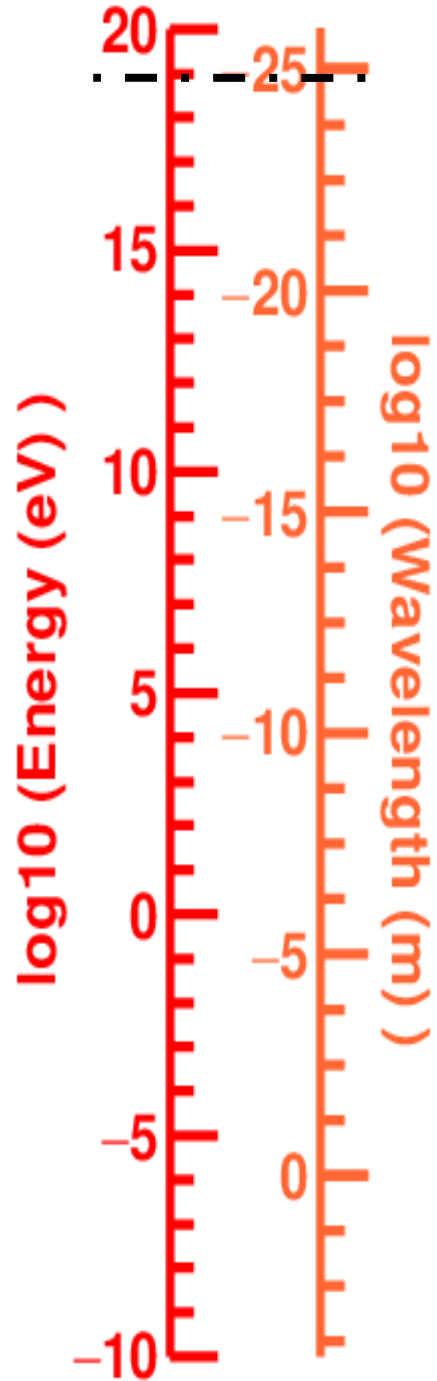


$$E > 10^{12} \text{ eV} \Leftrightarrow \lambda < 10^{-17} \text{ m}$$



# Charged Particles

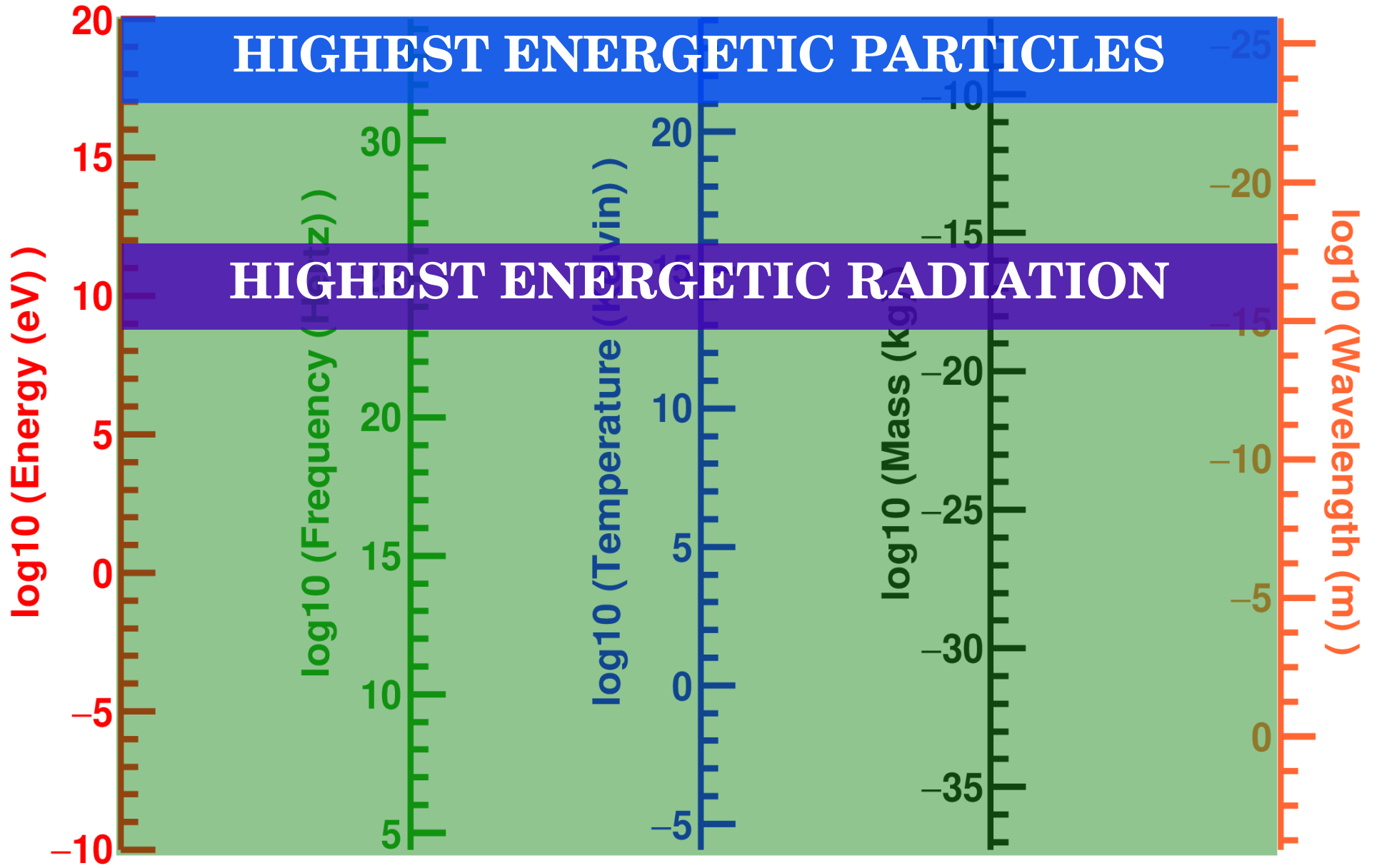
$$E > 10^{19} \text{ eV} \Leftrightarrow \lambda < 10^{-25} \text{ m}$$



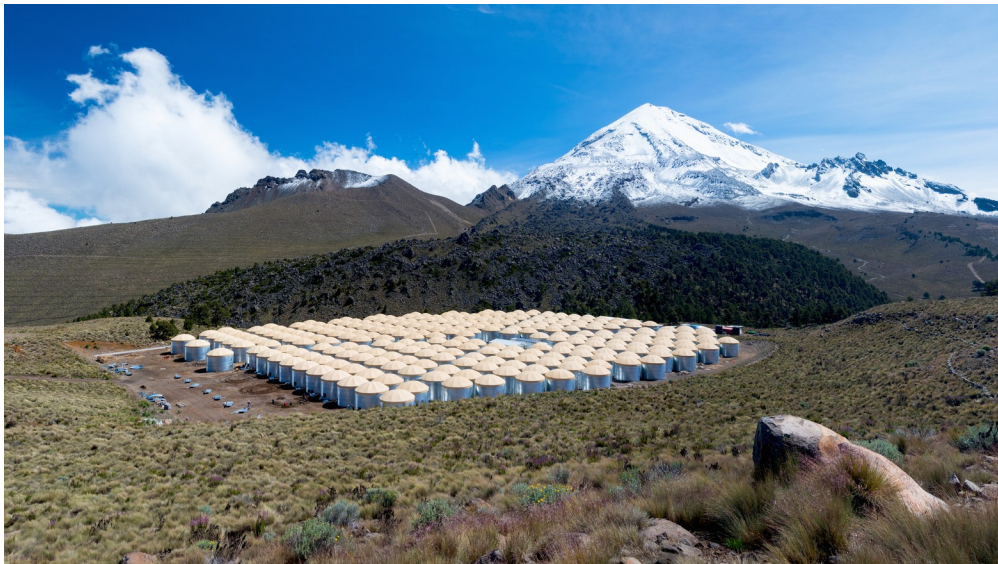
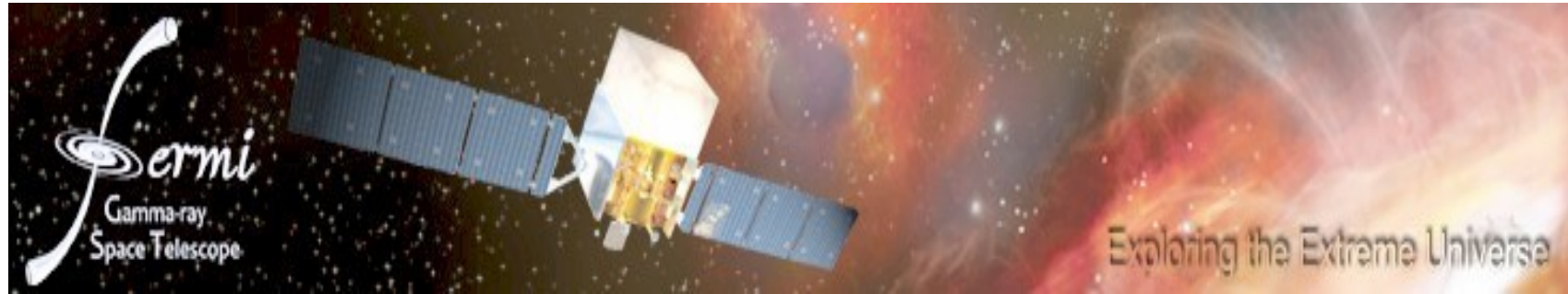
$$E > 10^{18} \text{ eV}$$

1 eV =  $1.6 \times 10^{-19}$  Joule

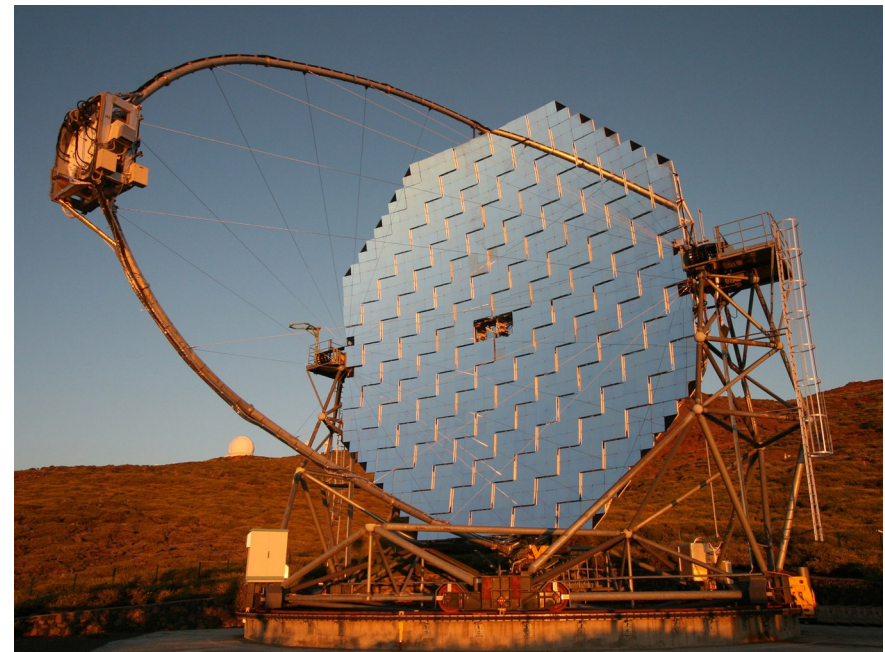
Pierre Auger Observatory



# Gamma ray astronomy

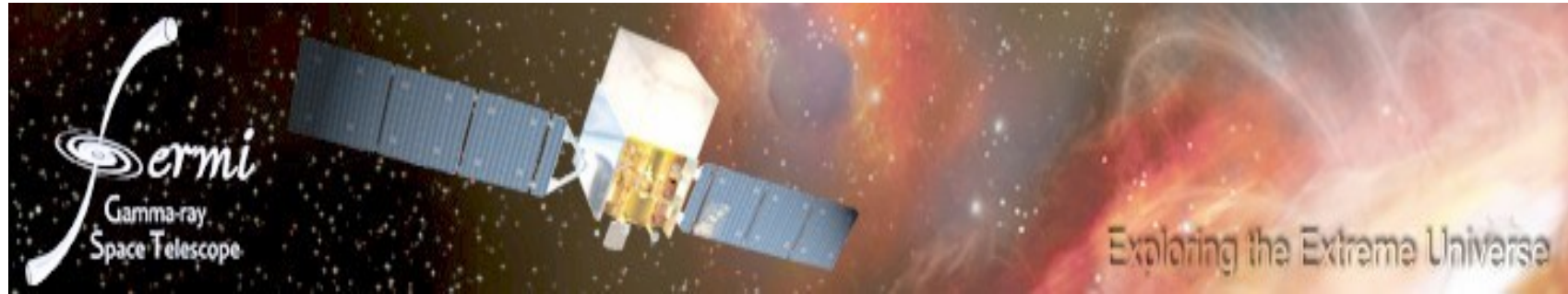


HAWC

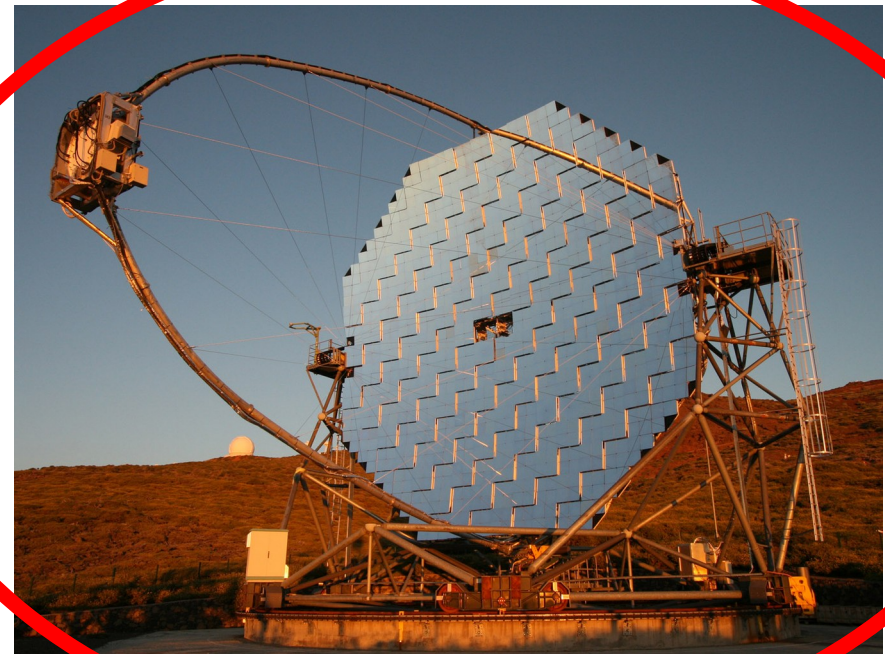


MAGIC CERENKOV TELESCOPE

# Gamma ray astronomy



HAWC



MAGIC CERENKOV TELESCOPE

**VERITAS**



**MAGIC**

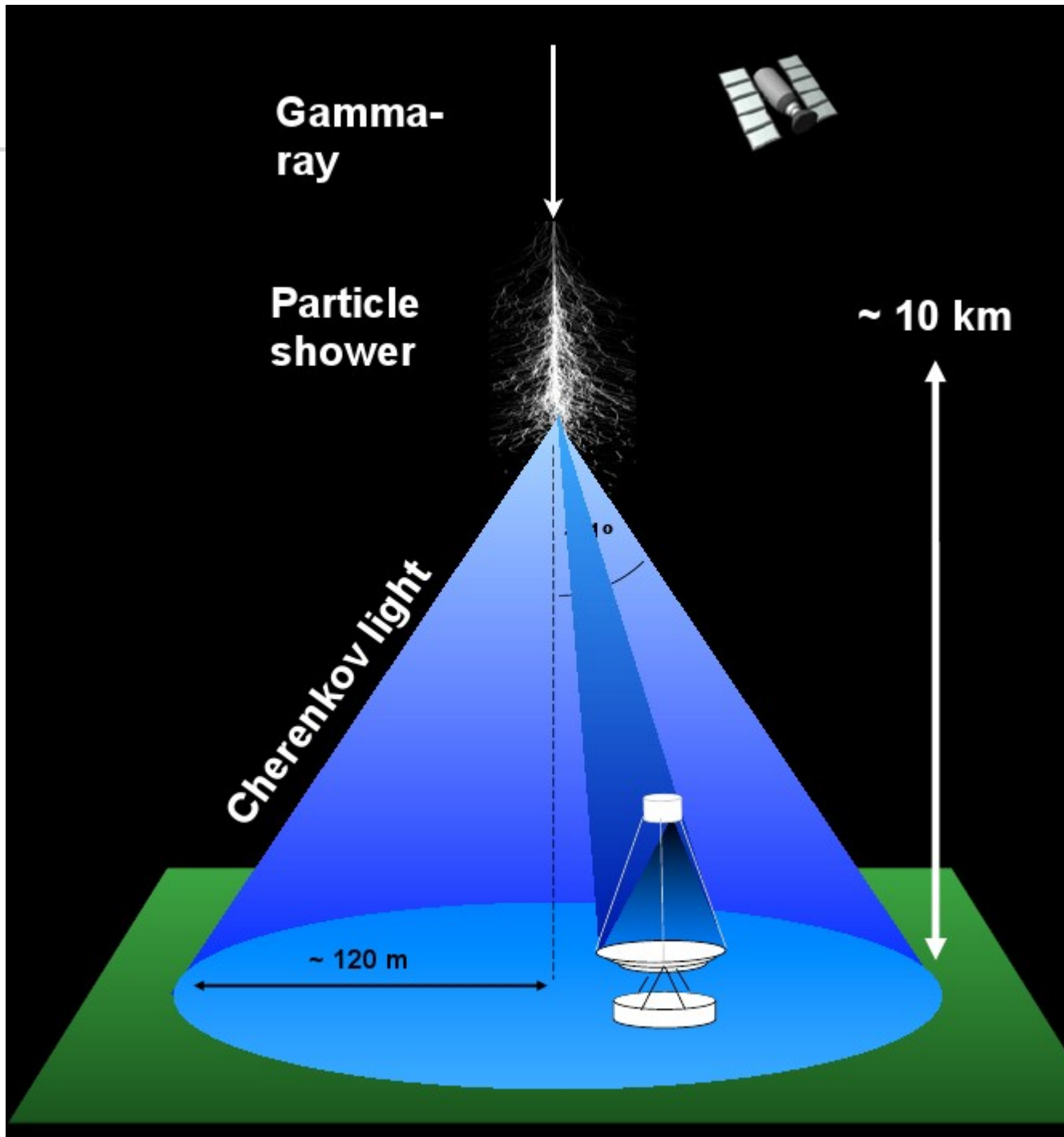


**cta**



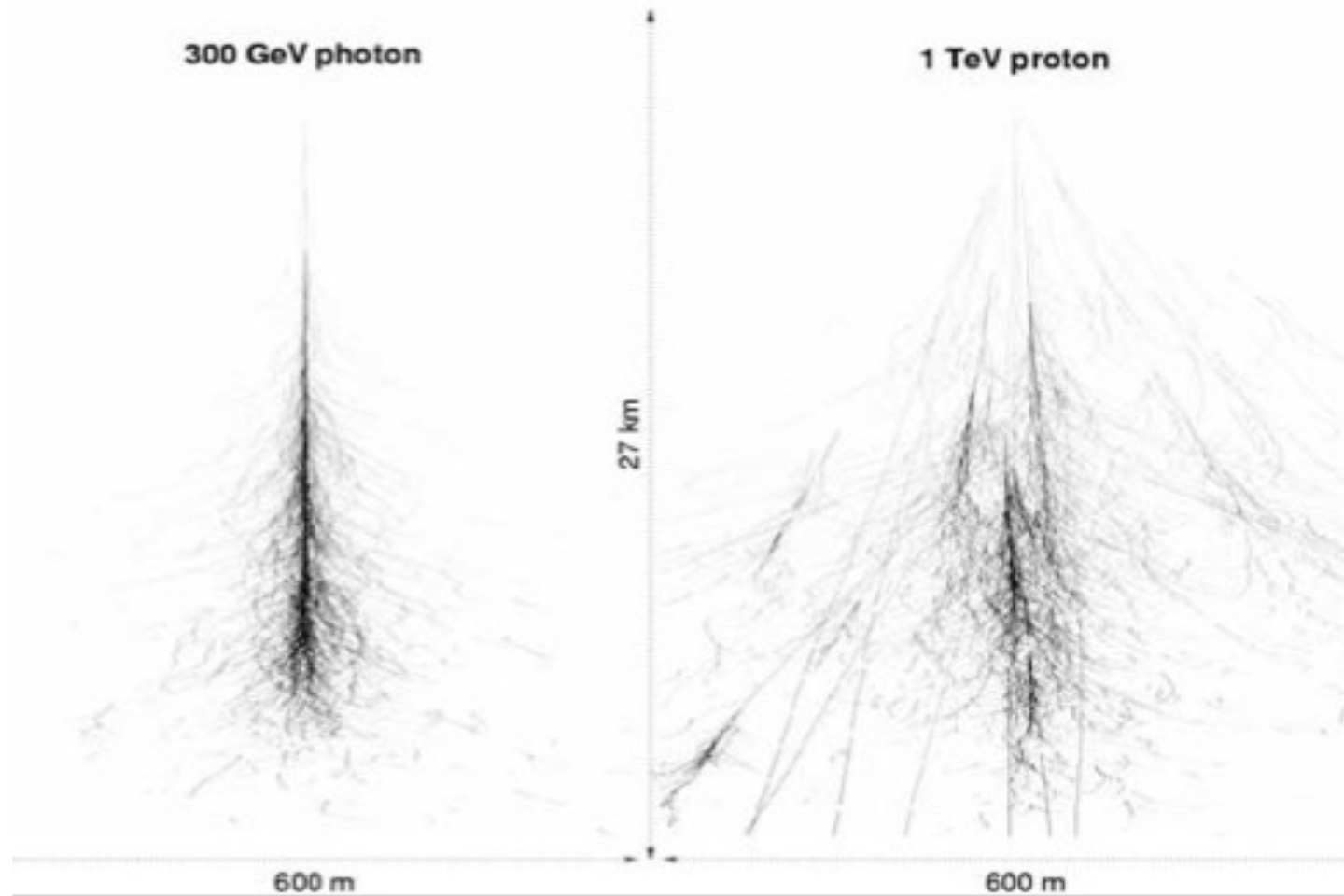
**HESS**







# Gamma / Hadron Separation



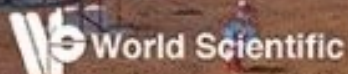
Protons are 1000 more abundance than photons



cherenkov  
telescope  
array

# Science with the Cherenkov Telescope Array

The CTA Consortium



**Unveil the extremes  
of the Universe**

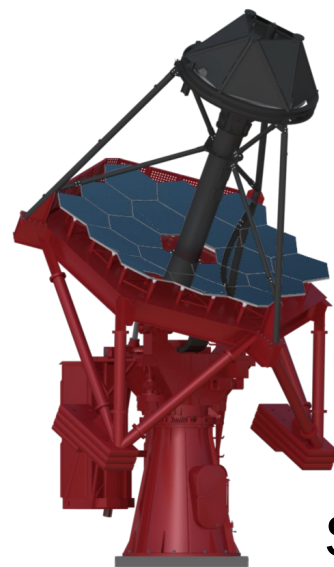
[https://arxiv.org/abs/  
1709.07997](https://arxiv.org/abs/1709.07997)

- Improve the sensitivity in one order of magnitude
- **Widen the energy range**
  - $20 \text{ GeV} < E < 300 \text{ TeV}$
- Increase the field of view
- **Improve the angular resolution**
  - 1- 3 arcmin
- **Flexibility in operation**

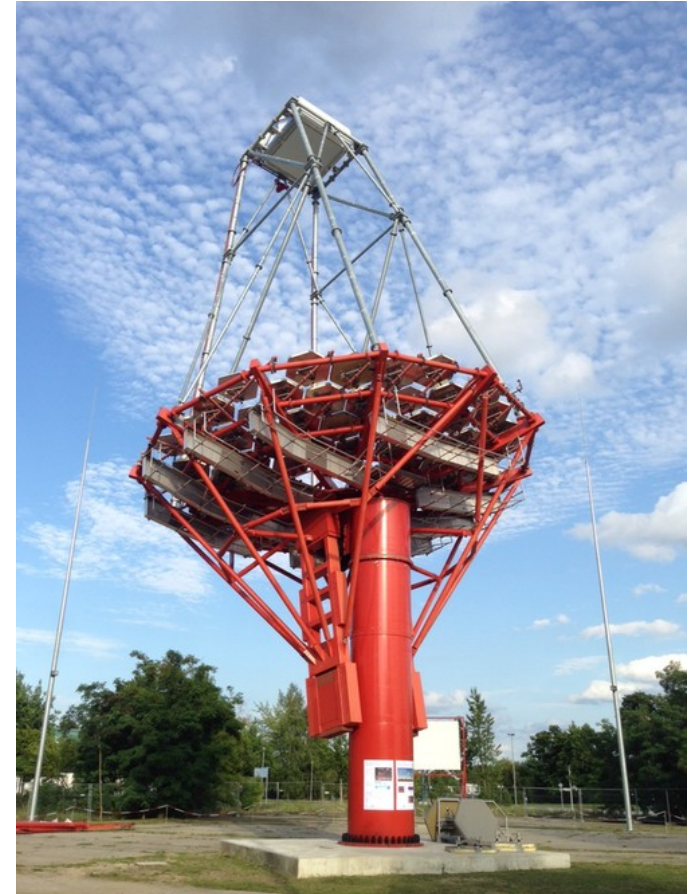
# Telescopes



LST



SST

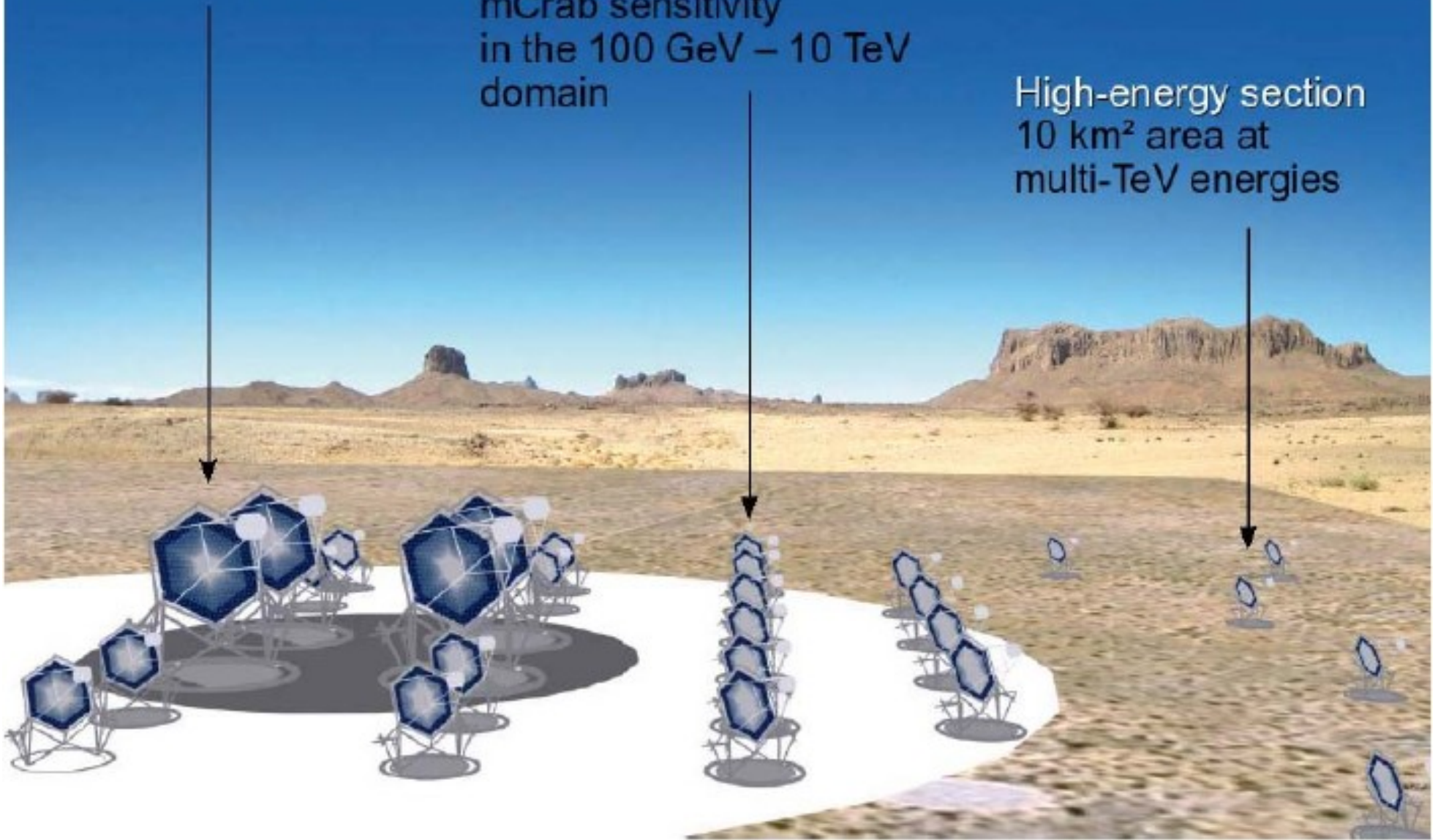


MST

Low-energy section  
energy threshold  
of some 10 GeV

Core array  
mCrab sensitivity  
in the 100 GeV – 10 TeV  
domain

High-energy section  
10 km<sup>2</sup> area at  
multi-TeV energies



# Instrumentation: MST Camera Support Structure



100% Brazilian



Project

Analysis

Prototype

Verification

Re-project

Final product

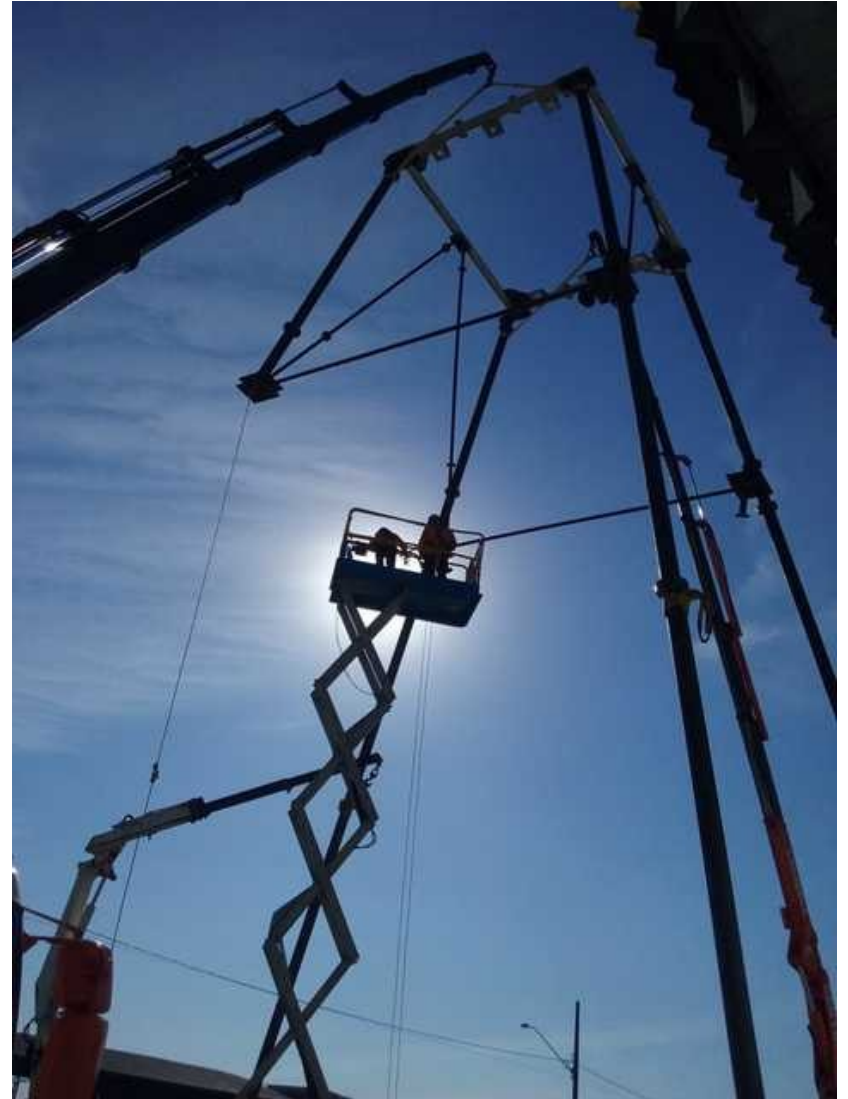
2 prototypes  
already  
constructed,  
delivered  
and  
approved



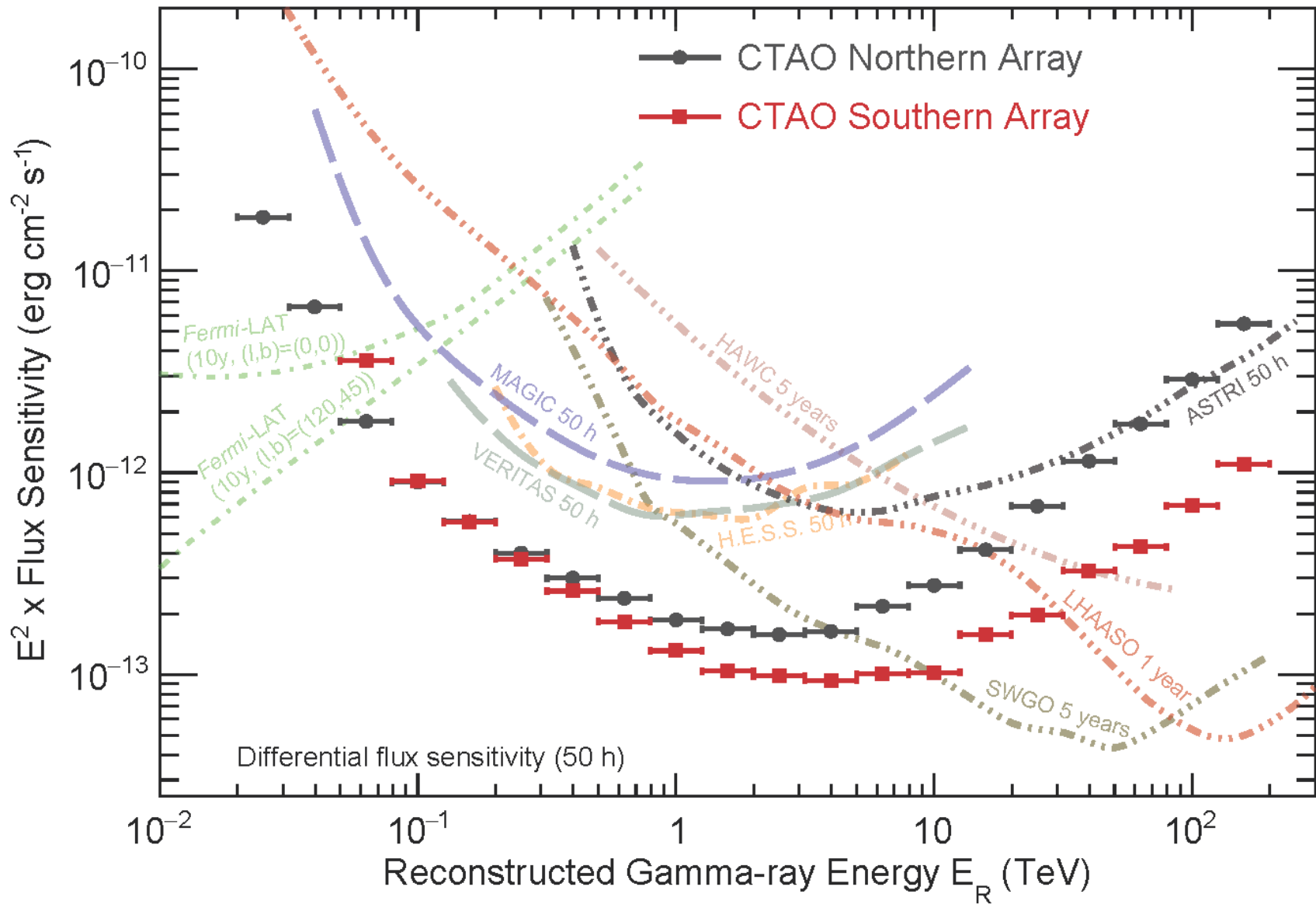
**Patent of positioning  
system**

**Budget approved for 10  
structures to be build in  
the next two years.**

**Budget pending for  
other 13 structures**

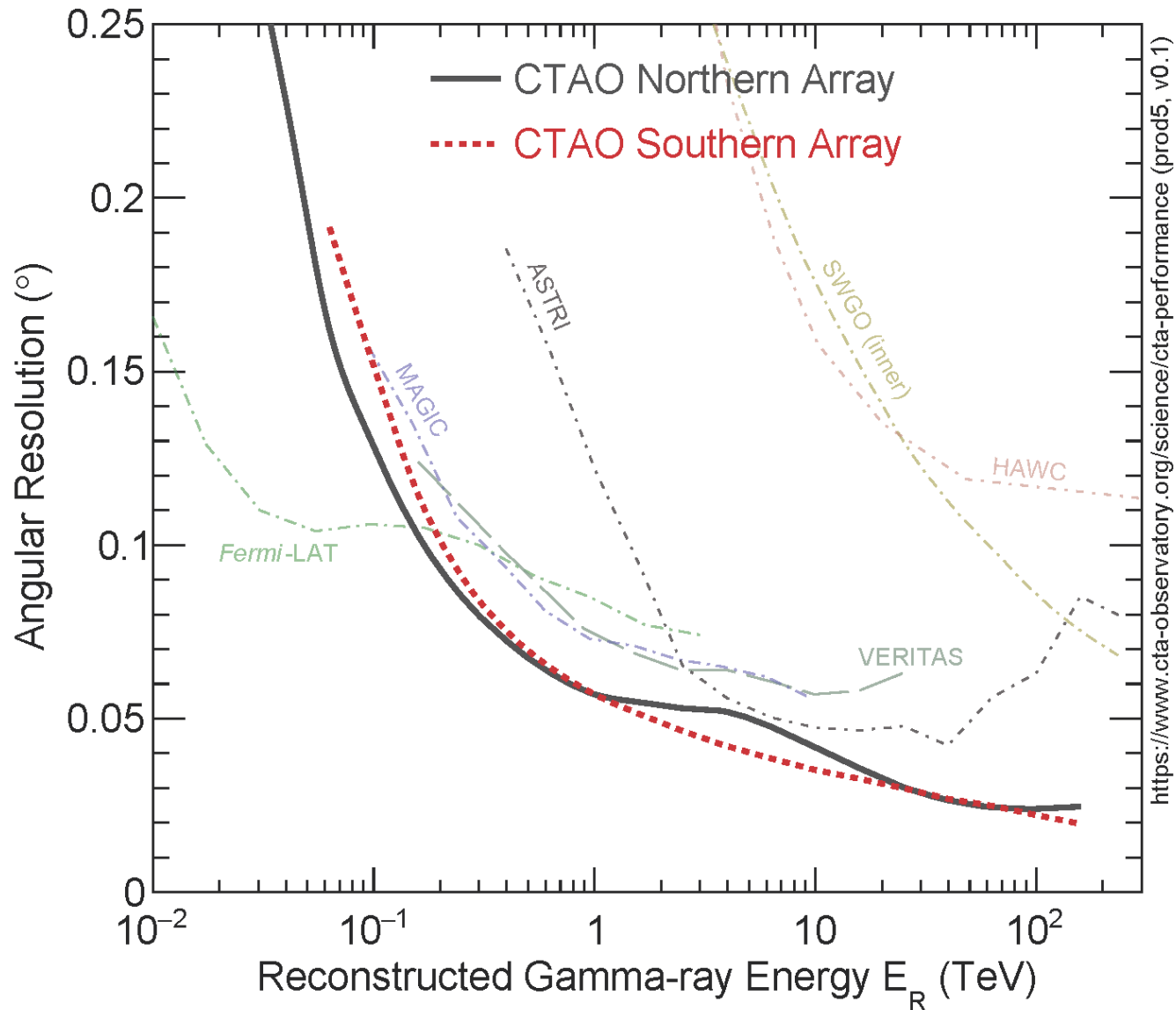


# Sensitivity





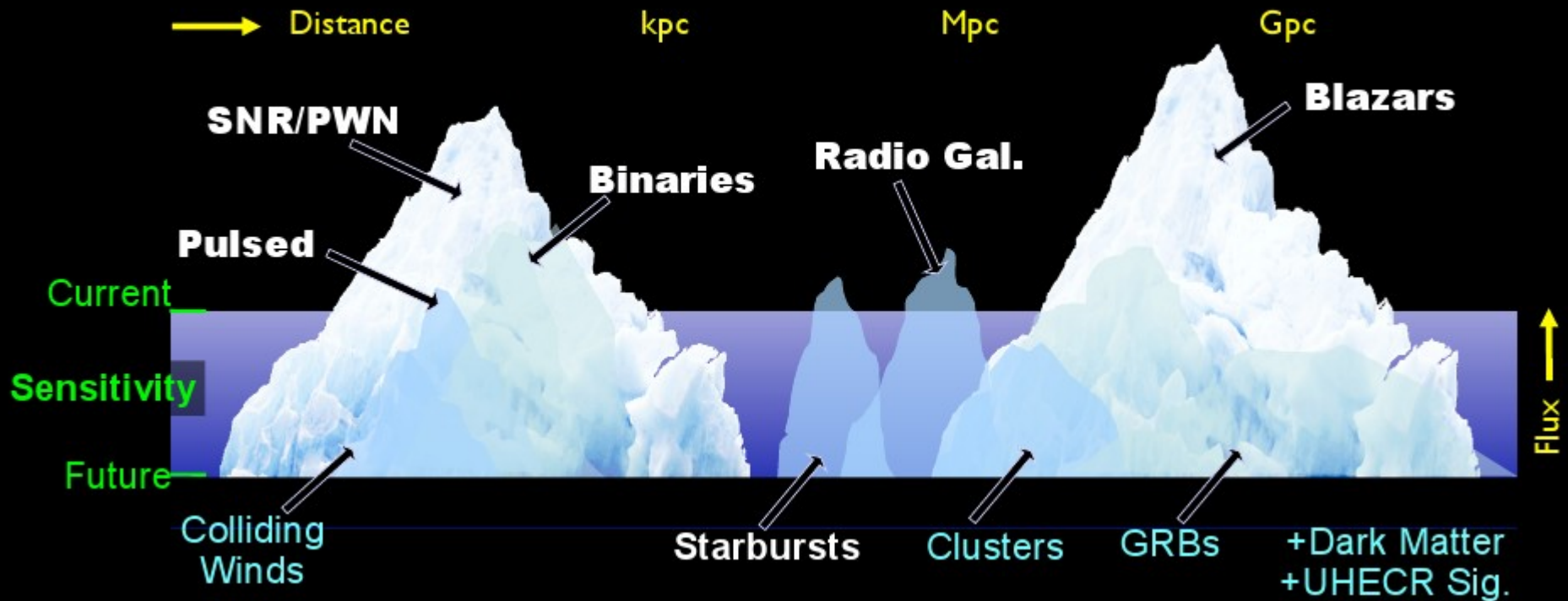
# Angular Resolution



# Discovery Potential



adapted from  
Horan & Weekes 2003



# Take away message



- CTA is launching
- Even prior to launch, CTA is making many important contributions
- CTA is a great opportunities for young people and for Latin America