# GRAPES-3 Muon Telescope

***Prelims:*** *Current events of national and international importance | Science and Technology*

## Why in News?

*Recently, A study proved that ground-based space particle counters can now track Earth's weather and solar storms in real-time, making climate and space research much stronger.*

| Key Details | |
|---|---|
| **GRAPES - 3 Observatory** | Cosmic-Ray Observatory |
| **GRAPES-3 Muon Telescope** | World's largest tracking ***Muon telescope.*** |
| **Operated by** | Tata Institute of Fundamental Research (TIFR) |
| **Location** | Ooty, Tamil Nadu |
| **Commissioned in** | 2000 |
| **Research team** | India and Japan |

## GRAPES-3 (Gamma Ray Astronomy at PeV EnergieS) Observatory

- A high-altitude observatory tracks ***cosmic muons*** (particles formed when cosmic rays hit the atmosphere).
- Scientists measure how changes in upper-atmosphere temperature and the Sun's magnetic field affect the number of muons (tiny particles) that reach Earth's surface
- It has counted billions daily to study the upper atmosphere and the Sun's magnetic field, making it a unique ground tool for *climate and solar weather monitoring.*

## Positive Observation – Atmosphere Link

- Shows a direct link between upper-atmosphere temperature and muon counts.

- Warmer atmosphere, it expands outward resulting in fewer low-energy muons reaching ground.
- Therefore, *lower muons mean a warmer upper atmosphere, i.e. Muon count directly reflects temperature changes.*

### Negative Observation – Solar Magnetic Field Link

- Shows an *inverse link between Sun's magnetic field and muon counts.*
- *Stronger solar field blocks more cosmic rays,* so only fewer muons detected.
- So, *a stronger solar magnetic shield means low muon counts, i.e. Muon counts inversely reflects solar magnetic strength.*

### Neutral Observation – Stable Baseline

- Scientists applied Fast Fourier Transform (FFT) and repititive algorithms to separate signals.
- Seasonal and solar cycle effects are filtered out using mathematical tools.

**Reference**

Researchmatters | Grapes-3

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