FREQUENTLY ASKED QUESTIONS

What is the CTAO (Cherenkov Telescope Array Observatory)?

The CTAO (www.ctao.org) will be the **world's largest and most powerful observatory for gamma-ray astronomy**. The Observatory's unique capabilities will help us to address some of the most perplexing questions in astrophysics, falling under three major themes: understanding the origin and role of relativistic cosmic particles; probing extreme environments, such as black holes or neutron stars; and exploring frontiers in physics, searching for dark matter or deviations from Einstein's theory of relativity.

The CTAO is an international observatory with facilities located in Europe and South America: **two arrays of telescopes** in each hemisphere, CTAO-North in La Palma (Spain) and CTAO-South in the Atacama Desert (Chile), as well as the **Headquarters** in Bologna (Italy) and its **Science Data Management Centre** in Zeuthen (Germany).

The CTAO requires the collaboration and investment of a wide international network of countries and contributors. The Observatory is supported financially by a growing list of shareholders, which includes more than ten countries and an intergovernmental organisation. More than 1,500 people working in different international teams contribute to the implementation of the CTAO, as well as to its scientific, software and hardware development.

The CTAO was included in the 2008 roadmap of the European Strategy Forum on Research Infrastructures (ESFRI) and promoted to a Landmark project in 2018 and is a top-ranked priority amongst new ground-based infrastructure projects in ASTRONET's "Roadmap 2022-2035: A Strategic Plan for European Astronomy."

Contact and Interview Inquiries:
Dr. Alba Fernández-Barral, CTAO Chief Communications Officer, alba.fernandezbarral@cta-observatory.org

What is the CTAO Science Data Management Centre or SDMC?

The CTAO SDMC is one of the Observatory's four facilities. Located on the Deutsches Elektronen-Synchrotron DESY campus in Zeuthen, Germany, it **serves as the scientific gateway** for data received from the two telescope arrays and will coordinate both software and computing efforts, making CTAO's data products available to the worldwide community. This approach stems from CTAO's commitment to **Open Science**, making it the **first observatory of its kind to operate as an open, proposal-driven observatory** providing public access to its high-level science data and software products.

The CTAO SDMC will be the **home of the CTAO Computing Department**. From handling the proposal submissions to the dissemination of data to scientists, the computing team is working to develop a package of hardware and software products to support the flow of data. Operating from the CTAO SDMC, they will coordinate with several off-site data centre partners for the Observatory's data processing and simulation needs and are directly responsible for the installation of the on-site data centres and control rooms at the two array sites.

100+	2,000	100s	3
experts needed to build CTAO software systems	computer cores needed to handle data online	of petabytes of raw data per year CTAO will produce	petabytes per year after compression

What is the relationship between the CTAO and DESY?

DESY is member of the CTAO Council and one of the CTAO's hosting partners, providing both infrastructure and space to support the SDMC. In addition to this role, scientists at DESY are deeply involved in the Observatory's development. On one hand, they lead the development of one of the three types of telescopes the CTAO will employ, the Medium-Sized Telescope (MST). A total of 23 MSTs are planned, 14 on the CTAO-South array site and nine on CTAO-North. On the other hand, DESY scientists are active members of the CTAO Consortium, the scientific enterprise that devised the CTAO concept more than a decade ago and is now focused on the science exploitation of the Observatory.

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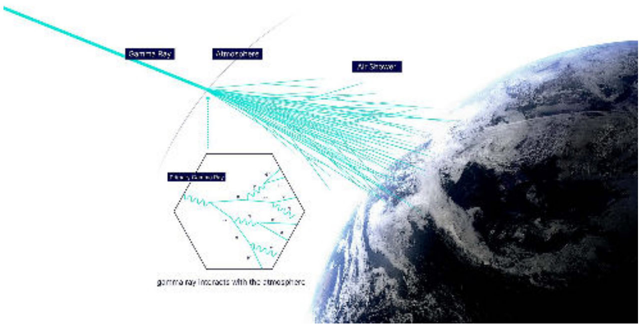
CTAO

FREQUENTLY ASKED QUESTIONS

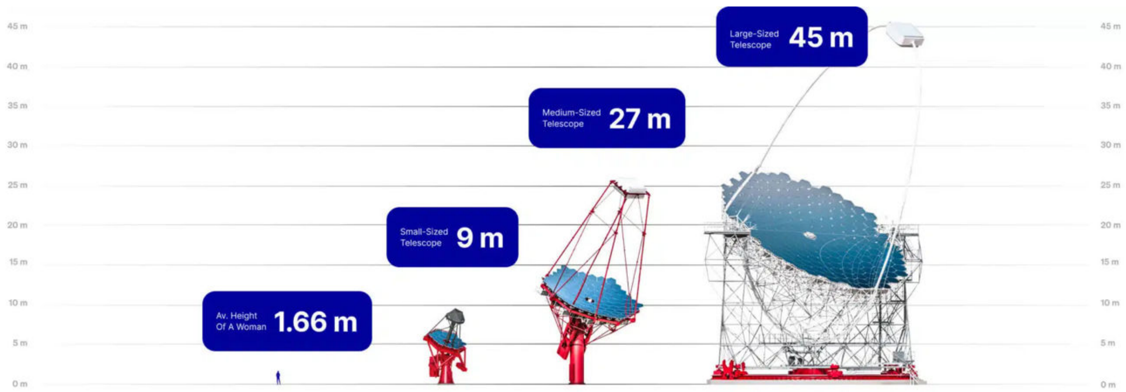
How does the CTAO work?



When gamma rays reach the Earth's atmosphere they interact with it, producing cascades of subatomic particles. These cascades are also known as air or particle showers. Nothing can travel faster than the speed of light in a vacuum, but light travels 0.03 percent slower in air. Thus, these ultra-high energy particles can travel faster than light in air, creating a blue flash of "**Cherenkov light,**" like the sonic boom created by an aircraft exceeding the speed of sound. Although this Cherenkov light is spread over a large area (250 m in diameter), it only lasts a few billionths of a second. It's too faint and fast for the human eye to see but not for the sensitive light sensors of the CTAO's telescopes.

These cascades are so rare that the CTAO will be using more than 60 telescopes spread between the two array sites to improve our chances of capturing them. When the Cherenkov light reaches the CTAO's telescopes, the mirrors reflect the light so the cameras can record the event, capturing a billion frames per second. Three classes of telescopes are needed to cover CTAO's broad energy range (20 GeV to 300 TeV): the Large-Sized Telescope (LST), the Medium-Sized Telescope (MST) and the Small-Sized Telescope (SST).

The cameras use extremely fast sensors that are able to detect a single photon. They capture the light and then convert it into an electrical signal that is digitised and transmitted so that scientists can study it and discover more about the gamma-ray's cosmic source.



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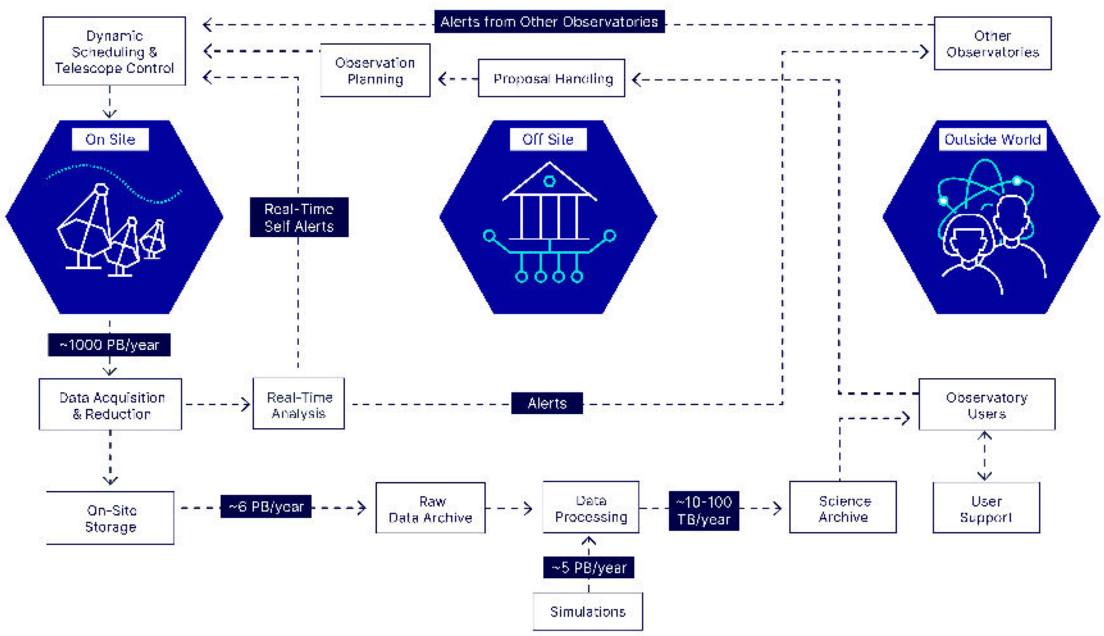
How much data will the CTAO produce and how will it be handled?

The CTAO is a BIG DATA project. The Observatory will generate hundreds of petabytes (PB) of data in a year (~3 PB after compression). To grasp the scale of data the Observatory will handle, consider that each standard song is approximately 3 MB, which means that the CTAO could accommodate over one billion songs every year!

Once the telescopes record the Cherenkov light of a cascade, any undesirable “noise” in the image will be suppressed to reduce its size before it is analysed in real time. If any of the real-time analysis reveals an unexpected gamma-ray signal, alerts will be generated to adapt the CTAO observing schedule and to notify other observatories. This instant alert system will help to ensure CTAO and its partners do not miss significant cosmic events. Processed data will then be transmitted to central computing facilities for further processing and to be archived.



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