



A New Era in Exploring the Extreme Universe: the Large-Sized Telescope Sub-Array is Inaugurated on CTAO-North

La Palma, Spain, 15 October 2026. Two hundred and fifty scientists and representatives from leading research institutions around the world celebrated the inauguration of the Large-Sized Telescope (LST) sub-array at the CTAO-North site at the Roque de los Muchachos Observatory in La Palma, Spain. The completion of the four telescopes marks a significant milestone for the global astrophysics community and represents a crucial step toward the full scientific operation of the Cherenkov Telescope Array Observatory (CTAO).

Each telescope features a 23-meter-diameter reflector and is equipped with state-of-the-art ultra-fast cameras. Designed to detect the faint Cherenkov light flashes when very high-energy gamma rays interact with the Earth's atmosphere, the LSTs are the most sensitive instruments in the world for observing gamma rays at energies between approximately 20 gigaelectronvolts (GeV) and several teraelectronvolts (TeV).

This exceptional sensitivity is crucial for detecting distant and transient gamma-ray sources. As very high-energy gamma rays are increasingly absorbed as they travel across the Universe, the LSTs' low-energy threshold enables scientists to probe sources at cosmological distances, to look further back in cosmic history, and to see the very short variability of dynamically evolving gamma-ray sources with greater statistical accuracy.

A productive pioneer: the LST-1

Even during its commissioning phase, the Large-Sized Telescope prototype (LST-1) has produced groundbreaking results since 2020. These include observations of pulsars, studies of active galactic nuclei at cosmological distances, and rapid follow-up observations of transient phenomena such as novae and gamma-ray bursts.

With the three new LSTs (LST-2, LST-3, and LST-4) joining the existing LST-1, the four telescopes will become a true array. By observing the same gamma-ray showers simultaneously from multiple directions, the sub-array will provide substantially improved sensitivity, angular resolution, and energy reconstruction, opening up a new level of precision in the study of the gamma-ray Universe.

"The completion of the LST sub-array is the culmination of more than fifteen years of international collaboration and technological innovation," said Prof. Masahiro Teshima, the Principal Investigator of the LST Collaboration and Spokesperson of the CTAO Consortium. "These telescopes will allow us to explore some of the most extreme environments in the Universe, including supermassive black holes, neutron stars, the possible origins of cosmic rays, and the nature of dark matter."

Reaching out to the early Universe

The LSTs form the low-energy core of CTAO-North and will provide a unique opportunity to probe the Universe at an epoch roughly 12 billion years ago, when it was less than two billion years old. Their sensitivity to the lowest-energy gamma rays will enable the detection and study of bright VHE gamma-ray bursts at high redshift, potentially extending gamma-ray observations to sources at redshifts of around $z \sim 4$, and providing new insights into the early Universe.

Over the coming years, the LSTs will undergo commissioning and integration into CTAO operations. Alongside the other CTAO telescopes, planned for both of its arrays, they will address fundamental questions in astrophysics, particle physics, and cosmology, such as the nature of dark matter, the origin of cosmic rays, and the physics of extreme cosmic accelerators.

About the LST Collaboration

The Large-Sized Telescope (LST) Collaboration is an international consortium of scientists, engineers, and institutions dedicated to designing, constructing, and commissioning the LSTs for the CTAO. The collaboration has developed advanced technologies in optics, photodetectors, mechanics, and high-speed electronics to achieve the lowest energy threshold ever reached by ground-based gamma-ray observatories.

The project was made possible by a strong international partnership, involving institutions from Brazil, Bulgaria, Czech Republic, Croatia, France, Germany, Italy, Japan, Poland, Spain, and Switzerland. The University of Łódź is the only Polish scientific institution participating in the LST Collaboration. The group from the University of Łódź has worked mainly on calibration and data cleaning algorithms used in LST-1, which will also be used in the other LSTs. The LST array will use the ACADA control software, to whose development the team from the Nicolaus Copernicus Astronomical Center (CAMK) made a major contribution.

About the CTAO

The CTAO (Cherenkov Telescope Array Observatory; www.ctao.org) will be the world's largest and most powerful observatory for gamma-ray astronomy. The CTAO's unprecedented accuracy and broad energy range (20 GeV- 300 TeV) will help 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.

To cover its broad energy range, the CTAO will use three types of telescopes: the Large-Sized Telescope (LST), the Medium-Sized Telescope (MST), and the Small-Sized Telescope (SST). More than 60 telescopes will be distributed between two observation stations: CTAO-North in the northern hemisphere at the Roque de los Muchachos Observatory on La Palma, Spain, and CTAO-South in the southern hemisphere at the Paranal Observatory in the Atacama Desert, Chile.

The CTAO is a Big Data project. The Observatory will generate hundreds of petabytes (PB) of data in a year (~ 12 PB after compression). Based on its commitment to Open Science, the CTAO will be the first gamma-ray 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 Central Organisation (legally, the CTAO ERIC) is in charge of the construction and operation of the Observatory, as well as the management of the CTAO's four sites. The CTAO ERIC members include Austria, Croatia, the Czech Republic, the European Southern Observatory (ESO), France, Germany, Italy, Poland, Slovenia, Spain, and Switzerland. The Netherlands is also part of the CTAO ERIC as Observer. Further contributing countries — Australia, Brazil, Japan, South Africa,

and the United States — are engaged in the process of joining the CTAO ERIC as Strategic Partners or Third Parties.

This group works in close cooperation with partners from around the world, including In-Kind Contribution Collaborations that are developing essential hardware and software, as well as the CTAO Consortium, a group of researchers who works on the scientific exploitation of the Observatory.

Poland in CTAO

Polish teams participating in the CTAO project are brought together within the Polish Consortium of the Cherenkov Telescope Array, which comprises 13 Polish scientific institutions. Poland's contribution to the construction of the Observatory includes both hardware and software development. The University of Łódź provides an in-kind contribution to the construction of the LSTs. Poland is also responsible for delivering key components of the mechanical structure and drive systems for the MSTs, half of the mirrors for the MSTs at the southern CTAO site (Institute of Nuclear Physics Polish Academy of Sciences, IFJ PAN), and software for the ACADA (Nicolaus Copernicus Astronomical Center Polish Academy of Sciences) and SUSS (ACC Cyfronet AGH) packages.

A team of scientists and engineers from IFJ PAN has been involved in research and development activities related to the CTAO project from the outset. The Institute designed and built two prototypes of small-sized Cherenkov telescopes, known as SST-1M, which were proposed as one of the possible solutions for the SST sub-array. IFJ PAN staff also contributed to work on the mechanical structure and optical system of the medium-sized telescopes (MSTs). The Institute developed an innovative technology for manufacturing composite mirrors for these telescopes. IFJ PAN scientists also contributed to establishing the scientific foundations of the CTAO project.

The Henryk Niewodniczański Institute of Nuclear Physics (IFJ PAN) is currently one of the largest research institutes of the Polish Academy of Sciences. A wide range of research carried out at IFJ PAN covers basic and applied studies, from particle physics and astrophysics, through hadron physics, high-, medium-, and low-energy nuclear physics, condensed matter physics (including materials engineering), to various applications of nuclear physics in interdisciplinary research, covering medical physics, dosimetry, radiation and environmental biology, environmental protection, and other related disciplines. The average yearly publication output of IFJ PAN includes over 600 scientific papers in high-impact international journals. Each year the Institute hosts about 20 international and national scientific conferences. One of the most important establishments of the Institute is the Bronowice Cyclotron Centre (CCB), which is an infrastructure unique in Central Europe, serving as a clinical and research centre in the field of medical and nuclear physics. In addition, IFJ PAN runs four accredited research and measurement laboratories. IFJ PAN is a member of the Marian Smoluchowski Kraków Research Consortium: "Matter-Energy-Future", which in 2012-2017 enjoyed the status of the Leading National Research Centre (KNOW) in physics. In 2017, the European Commission granted the Institute the HR Excellence in Research award. As a result of the categorization of the Ministry of Higher Education and Science, the Institute has been classified into the A+ category (the highest scientific category in Poland) in the field of physical sciences.

CONTACTS:

LST Collaboration:

Prof. Masahiro Teshima

LST Principal Investigator (PI)

email: mteshima@icrr.u-tokyo.ac.jp

LST Outreach Team:

email: lst-outreach@cta-observatory.org

CTAO (Cherenkov Telescope Array Observatory):

CTAO Communications Office

Dr. Alba Fernández-Barral

CTAO Chief Communications Officer

email: alba.fernandezbarral@cta-observatory.org

Head of the Polish CTAO Consortium:
Prof. Jacek Niemiec
Institute of Nuclear Physics, Polish Academy of Science
tel.: +48 12 6628035
email: jacek.niemiec@ifj.edu.pl

Polish LST team:
Prof. Julian Sitarek
University of Łódź
email: jsitarek@uni.lodz.pl

LINKS:

<http://www.ifj.edu.pl/>

The website of the Institute of Nuclear Physics, Polish Academy of Sciences.

<http://press.ifj.edu.pl/>

Press releases of the Institute of Nuclear Physics, Polish Academy of Sciences.

<https://www.ctao.org/>

The website of Cherenkov Telescope Array Observatory ERIC

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Aerial view of the Roque de los Muchachos Observatory on the island of La Palma, Spain. The four LST telescopes, each with a 23 m-diameter reflector, are visible in the centre of the image. To their left are two MAGIC telescopes of the previous generation, each with a 17 m-diameter reflector. Nine medium-sized telescopes (MSTs) are planned to be built near the LSTs. Together, the MSTs and LSTs will form the northern site of the CTA Observatory (CTAO). (Source: LST Collaboration)

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Four LST telescopes (centre) and two MAGIC telescopes (left) at the Roque de los Muchachos Observatory, La Palma, Spain. (Source: LST Collaboration)