Venturing Beyond the High-Energy Frontier

CTA is an initiative to build the world’s largest and most sensitive very high-energy gamma-ray observatory. With 118 telescopes located in the northern and southern hemispheres, the CTA Observatory will detect high-energy radiation with unprecedented accuracy and will be approximately 10 times more sensitive than current instruments.

The current generation of very high-energy gamma-ray detectors (H.E.S.S., MAGIC and VERITAS) have been collecting results since 2003, increasing the number of known gamma-ray-emitting celestial objects from 10 to more than 150. CTA will build on the advances pioneered by its predecessors in order to expand this catalogue tenfold, detecting more than 1,000 new objects.

CTA’s unique capabilities will help us to address some of the most perplexing questions in astrophysics. CTA will seek to understand the impact of high-energy particles in the evolution of cosmic systems and to gain novel insight into the most extreme and unusual phenomena in the Universe. CTA will search for annihilating dark matter particles and deviations from Einstein’s theory of special relativity and even conduct a census of particle acceleration in the Universe.

CTA will be the first ground-based gamma-ray observatory open to the world-wide astronomical and particle physics communities as a resource for data from unique, high-energy astronomical observations.

CTA’s unique capabilities will include:

- An energy resolution of 10 percent will improve CTA’s ability to look for spectral features and lines associated with the annihilation of dark matter particles. Energies as low as 20 GeV will allow CTA to probe transient and time-variable gamma-ray phenomena in the very distant Universe with unprecedented precision.

- Energies up to 300 TeV will push CTA beyond the edge of the known electromagnetic spectrum with unprecedented accuracy, providing a completely new view of the sky and allowing us to search for extreme particle accelerators.

- A field of view of eight degrees will allow CTA to survey the sky much faster and measure very extended regions of gamma-ray emission.

- An angular resolution approaching one arcminute will allow CTA to resolve many cosmic sources to understand how ultra-relativistic particles are distributed in and around these systems.

CTA will explore the most extreme phenomena in the Universe

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Ground-based gamma-ray astronomy is a young field with enormous scientific potential. The current generation instruments have already demonstrated the huge physics potential of astrophysical measurements at teraelectronvolt (TeV) energies.

With its superior performance, the prospects for CTA combine guaranteed science – the in-depth understanding of known objects and mechanisms – with anticipated detection of new classes of gamma-ray emitters and new phenomena, and a very significant potential for fundamentally new discoveries.

CTA will seek to address questions in and beyond astrophysics falling under three major themes:

**Theme 1:** Understanding the Origin and Role of Relativistic Cosmic Particles

**Theme 2:** Probing Extreme Environments

**Theme 3:** Exploring Frontiers in Physics

CTA will be able to detect hundreds of celestial objects in our Galaxy. These galactic sources will include the remnants of supernova explosions, the rapidly spinning ultra-dense stars known as pulsars and more normal stars in binary systems or in large clusters.

Beyond the Milky Way, CTA will detect star-forming galaxies and galaxies with supermassive black holes at their centres (active galactic nuclei) and, possibly, whole clusters of galaxies. The gamma rays detected with CTA may also provide a signature of dark matter, evidence for deviations from Einstein’s theory of special relativity and definitive answers to the contents of cosmic voids, the empty space that exists between galaxy filaments in the Universe.

More specifically, CTA will observe the key targets listed to the right in order to address its three major themes. Learn more about what CTA will seek to discover and its expected performance at www.cta-observatory.org.

The CTA Consortium includes more than 1,400 members from 200 institutes in 31 countries.