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The Cherenkov Telescope Array: a new key player in the multi-messenger era

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Very-high-energy (VHE) gamma-ray astroparticle physics is a relatively young field, and observations over the past decade have surprisingly revealed almost two hundred VHE emitters which appear to act as cosmic particle accelerators. These sources are an important component of the Universe, influencing the evolution of stars and galaxies. At the same time, they also act as a probe of physics in the most extreme environments known - such as in supernova explosions, and around or after the merging of black holes and neutron stars. However, the existing experiments have provided exciting glimpses, but often falling short of supplying the full answer. A deeper understanding of the TeV sky requires a significant improvement in sensitivity at TeV energies, a wider energy coverage from tens of GeV to hundreds of TeV and a much better angular and energy resolution with respect to the currently running facilities. The next generation gamma-ray observatory, the Cherenkov Telescope Array (CTA), is the answer to this need. In this talk I will present the scientific capabilities of this future facility that will allow to address in detail many of the still open questions of the gamma-ray astrophysics. In addition, CTA will allow the entire astronomical community to explore a new discovery space that will likely lead to paradigm-changing breakthroughs. In particular, CTA has an unprecedented sensitivity to short (sub-minute) timescale phenomena, placing it as a key instrument in the future of multi-messenger and multi-wavelength time domain astronomy. In the talk I will cover the main science cases that will strongly benefit from coordinated observations with other facilities, from gravitation waves detectors, to neutrino telescopes and astronomical observatories operating at all wavelengths.

Email

Primary author: Dr ZANIN, Roberta (University of Barcelona)

Presenter: Dr ZANIN, Roberta (University of Barcelona)

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