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MESA REDONDA

The Cherenkov Telescope Array: An advanced facility for the Ground-based High Energy Gamma Ray Astronomy.

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Abstract. In the past 15 years, Very High Energy (VHE) γ-ray experiments as H.E.S.S., MAGIC and VERITAS have been very successful unveiling the mysteries of the non thermal Universe using Cherenkov telescopes based on Earth. The next logical step in the evolution of the γ-ray Astronomy was to gather their efforts to built a global and innovating ground based facility: the Cherenkov Telescope Array (CTA). This has been conceived as an array of Cherenkov telescopes working as an open observatory, covering a wide energy range, with an enhanced sensitivity and improved spatial, temporal and energy resolution. The project is at the end of its Preparatory Phase. The decision on its location is about to be taken and the construction is expected to begin in 2015. We briefly describe the general status of the project and the argentinean participation.

Resumen. En los últimos 15 años, los experimentos de rayos γ de altas energías como H.E.S.S., MAGIC y VERITAS han tenido un gran éxito revelando los misterios del Universo no-térmico, usando telescopios Cherenkov instalados en la Tierra. El paso lógico siguiente en el desarrollo de la Astronomía γ consistio en aunar los esfuerzos para construir una nueva facilidad experimental, innovadora y global: el Cherenkov Telescope Array (CTA). CTA fue concebido como un arreglo de telescopios Cherenkov funcionando con un observatorio abierto, cubriendo un amplio rango de energías con una mayor sensibilidad y una resolución espacial y temporal superiores a la de los instrumentos actuales. El proyecto se encuentra finalizando la etapa preparatoria. El comienzo de su construcción se prevé para 2015. Describimos brevemente el status general del proyecto y la participación argentina en el mismo.

1. Introduction

Current IACT (Imaging Air Cherenkov Technique) instruments, such as the H.E.S.S.[1], MAGIC[2] and VERITAS[3] telescope systems, together with FERMI[4] and AGILE[5] satellites, have produced very exciting results and have demonstrated that VHE phenomena are present throughout the Universe. Almost 150 sources between 0.1 TeV and 10 TeV have been discovered so far. But many of the results have raised new questions which require more and better data for a deeper understanding of the underlying phenomena. CTA will try to answer these questions by enabling the detection of more than 1000 sources over the whole sky. The project is being designed to provide an increase in sensitivity of at least a factor ten compared to current installations, along with a significant extension of the observable energy range down to a few tens of GeV and up to > 100 TeV (CTA Consortium et al. 2013). For the first time in this field, CTA will be operated as a true observatory, open to a wider scientific community and providing support for easy access and data analysis. The large number of telescopes also will allow for independent operation of subarrays in different observation modes(Acharya et al. 2013). Three sizes of telescopes will be placed in different configurations and covering areas related to the desired sensitivity (see Fig. 1: *SST* (Small size telescopes of 5-8m diameter); *MST* (Medium size telescopes of 10-12m diameter); and LST (Large size telescopes of 20-30m diameter). Few LSTs should observe the sub-100 GeV photons thanks to their large reflective area. Several tens of MSTs will perform the bulk TeV search. Finally, several tens of SSTs will complete the array to perform the super-TeV search.

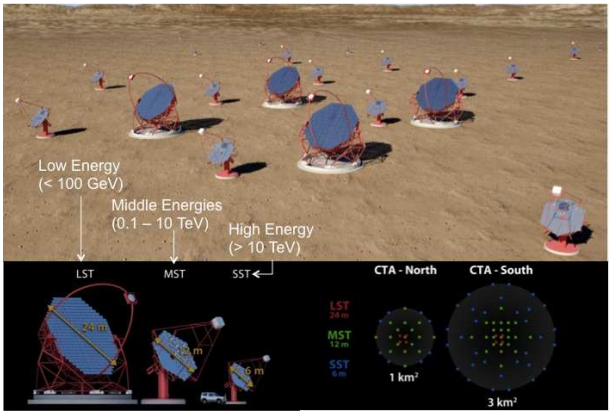

Figure 1. Possible layout for the CTA Observatory (North and South).

[1]https://www.mpi-hd.mpg.de/hfm/HESS/

[2]https://magic.mpp.mpg.de/

[3]https://veritas.sao.arizona.edu/

[4]http://fermi.gsfc.nasa.gov/

[5]http://agile.rm.iasf.cnr.it/

2. Status of the Project

Currently, the CTA Consortium consists of over 1000 scientists and engineers from 27 countries. Since 2008, CTA has been included, as a high-priority project, in the roadmap of various European funding agencies for research as ESFRI[6]), ASPERA[7] and ASTRONET[8]. The CTA Consortium started in 2007 to design the installation and to work towards its implementation. A Design Study phase has been ended in 2010 with the publication of a extensive report (Actis et al. 2011). We are now at the end of a European Union funded Preparatory Phase, aimed to deliver a Technical Design Report. The construction period could be started in 2015. An important landmark will be the selection of the location for the two CTA observatories. The candidates for the Northern site are in Arizona, Mexico and on Canary Islands, while for the southern site are in Argentina, Chile and Namibia. Since 2012 the suitability of all sites is investigated by means of dedicated instrumentation installed in each of them and the analysis of available satellite data and weather broadcast simulations. The site decision is intended to be taken in early 2014. In Fig. 2 an updated timeline for the project is shown.

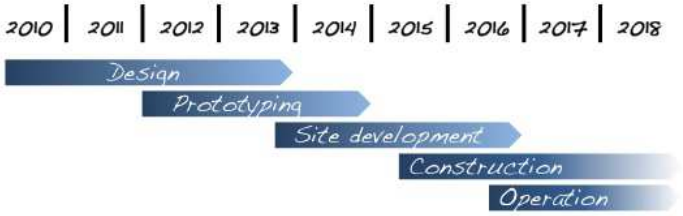

Figure 2. Updated timeline for the CTA project.

2.1. Site Characterization and selection

Selection of the sites is crucial for achieving the wished performance for CTA. Criteria for site selection include geographical conditions, observational and environmental conditions and questions about logistics, accessibility, availability, stability of the host region, and local support. See (Actis et al. 2011) for a detailed description of the requirements.

The characterization of the proposed site includes the use of remote-sensing (and local) archival data to evaluate the long term behavior of the environmental conditions; the use of information gathered on logistics capacities and the analysis of dedicated CTA measurements in situ of variables such as cloud coverage, night sky background, wind speed, temperature and humidity.

After these extensive studies and simulations of the science performance at each candidate site, the scientific evaluation of the nine candidate sites is finishing. The evaluation output is based, essentially, on the annual number

[6] http://ec.europa.eu/research/infrastructures/

[7] http://www.aspera-eu.org/

[8] http://www.astronet-eu.org/

of hours with suitable observing conditions combined with expected sensitivity of the telescope arrays at each site. Considering these results, a committee composed of international experts in the evaluation of astronomical sites will provide an independent assessment of the candidate sites. On the basis of these assessments as well as additional factors (host country's contribution to the construction of the observatory and future operational costs), the selection of the final CTA sites for the Northern and Southern hemisphere will be done by a board composed of representatives of the funding agencies that plan to contribute to the construction of CTA.

2.2. Argentinean participation

Argentina is part of the CTA Consortium since its beginning. More than 34 scientist from 7 institutions participate actively in different working groups inside the Consortium[9]. Different groups have made contributions to telescopes design (SST) (Rovero et al. 2013), mirrors testing (Medina et al. 2013), calibration (Pallotta et al. 2013), MonteCarlo simulations (Bernlohr et al. 2013), physics and outreach. A great effort has been put in supporting and developing the Argentinean candidate sites (Allekotte et al. 2013). Different groups are deeply involved on the characterization of the sites, installing and doing maintenance of the dedicated instruments, analyzing satellite and meteorological data, gathering historical data and contacting local authorities. Regional and national support, both at scientific and political level, are provided for the sites with the official commitment to contribute to CTA construction and operation with infrastructure and man power.

3. Summary

The CTA project is now at the end of its Preparatory phase. This means that the beginning of the Construction phase is near. The next big step will be the election of its location in 2014. Argentina is one of the candidate countries to host CTA and a great part of the astrophysics community is deeply involved on this project.

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[9] http://astrum.frm.utn.edu.ar/CTA-Argentina/