

# THE CHERENKOV TELESCOPE ARRAY (CTA) IN THE MULTI-MESSENGER ERA



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#### **CHERENKOV TELESCOPE ARRAY**







## **SENSITIVITY / ENERGY RANGE / ANGULAR RESOLUTION**



UNIVERSITÄT

## **SENSITIVITY / ENERGY RANGE / ANGULAR RESOLUTION**



ERLANGEN CENTRE FOR ASTROPARTICLE PHYSICS







#### 2 LOCATIONS + HEADQUARTER AND SCIENCE DATA MANAGEMENT CENTER



#### SOUTHERN SITE: CHILE



#### **SOUTHERN SITE: CHILE**



## NORTHERN SITE: LA PALMA

- Observatorio del Roque de los Muchachos
- Immediate vicinity of MAGIC telescopes
- Potential location of TMT (30m telescope)







## **CONSTRUCTION OF CTA – FINANCIAL ASPECTS**



- Estimated total costs for the baseline design (two sites) amount to
  400M€ (Invest + Personal). Threshold for start of construction:
  250M€.
  - MoU signed by a few countries (Germany, Czech Rep., Switzerland, Spain, Japan, Italy) totalling 201.4M€. France, UK, Austria and Australia to sign soon

		CTA Baseline	CTA Implementation Threshold
Northern Array	Number of LSTs	(€400101)	(€2501VI)
	Number of LSTS	4	4
	Number of MSTs	15	5
Southern Array	Number of LSTs	4	0
	Number of MSTs	25	15
	Number of SSTS	70	50





#### LATEST NEWS

- CTA observatory general manager: F. Ferrini, project manager: W. Wild
- ► Site preparation:
  - Northern site: contracts signed
  - Southern site: still ongoing
    - Contract text finished end of 2016
    - Approved by ESO and CTAOcouncil but not yet signed
    - Discussions with Chilean ministry ongoing









#### **PROTOTYPE TELESCOPES (E.G. LST-1)**









### **CTA TELESCOPE TREE**



Next up: consolidation of telescope systems





#### FERMI-LAT LEGACY

## 1. Open observatory

## 2.Data challenges





## FERMI-LAT LEGACY I: CTA – AN OPEN OBSERVATORY



- Strict separation between CTA-Consortium (CTAC) and CTA-Observatory (CTAO)
  - ► CTAC: Scientific motivation, specifications and requirements, telescope design, ...
  - CTAO: Construction and running of observatory (including time allocation)





## **KEY SCIENCE PROGRAM AS MAJOR LEGACY PROJECTS (CTAC)**



## LARGE-SCALE SURVEYS

#### **Extragalactic Survey:**

Unbiased survey of 1/4 sky to ~6 mCrab VHE population study, duty cycle New, unknown sources; 1000 h



#### **Galactic Plane Survey:**

Survey of entire plane to ~2 mCrab Galactic source population: SNRs, PWNe, etc. PeVatron candidates, early view of GC, 1620 h





#### Galactic Centre Survey:

ID of the central source Spectrum, morphology of diffuse emission Deep DM search; base of the Fermi Bubbles Central exposure: 525 h, 10°x10° : 300 h



#### Large Magellanic Cloud Survey:

Face-on satellite galaxy with high SFR Extreme Gal. sources, diffuse emission (CRs) DM search; 340 h in six pointings

## KSP TIME BUDGET VERSUS OPEN TIME OF THE OBSERVATORY



► Available time per year, e.g. in the south: 1350 hours





### FERMI LEGACY II: DATA CHALLENGES











#### DATA CHALLENGE I – FERMI-LAT +IACT INPUT







#### CTA AS PART OF THE MULTI-MESSENGER VIEW OF THE HIGH-ENERGY UNIVERSE



#### LARGE(ISH) FIELD OF VIEW (10 DEGREES ACROSS), FAST RESPONSE







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## E.G. ALERTS AND TRIGGERS



Alerts and triggers to/from CTA for variable objects

- Crucial role of Fermi-LAT
- Including gravitational waves, neutrinos, and optical transient factories
- ► For GRBs CTA requires (MeV) triggers\*
  - ► Swift, Fermi GBM, SVOM, ?
- ➤ Triggers from CTA\*\* → broad astronomical community
  - Rate expected to be low but identified events likely to be extremely important





\*\*Alert generation in 1 minute

\*Serendipitous detections possible, e.g. in divergent mode, huge potential for local, lowluminosity events

## FOR MORE DETAILS ...

https://arxiv.org/pdf/1709.07997.pdf



Sep 2017

Istro-ph.1

arXiv:1709.0

cherenkov telescope array

## Science

with the **Cherenkov Telescope Array** 



### SUMMARY

- CTA in prototype stage.
  Construction will start once site issues are solved and the *threshold* scenario (250 M€) is reached
- Part of a broad suite of new observatories and tools that will address fundamental questions of the high-energy Universe.











