

CTA — A New Observatory for Very High Energy Gamma-Rays

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For the CTA Consortium http://www.cta-observatory.org



Cherenkov Telescopes

Gamma ray

Positro

Electron

Blue Cherenkov light beamed forward Illuminates ~10⁵ m² on the ground Short flash of few nanoseconds Intensity O(10 photons/m²) @ 1 TeV

Clue: imaging the cascade geometry → photon direction intensity → photon energy shape → cosmic ray rejection

Multi-telescope systems provide a 3D view of the cascade

The CTA Concept





- Arrays in northern and southern hemispheres for full sky coverage
- 4 large (~23 m) telescopes in the center (LSTs) Threshold of ~30 GeV
- ≥25 medium (9-12 m) telescopes (MSTs) covering ~1 km²
 Order of magnitude sensitivity improvement in 100 GeV–10 TeV range
- Small (~4 m) telescopes (SSTs) covering >3 km² in south >10 TeV observations of Galactic sources
- Construction begins in ~2015



CTA compared to Fermi – steady sources



Simulated Galactic Plane surveys



H.E.S.S.



CTA, for same exposure (~5 hours per position)



Expect ~1000 detected sources over the whole sky

Funk et al., Amer. Inst. Phys. Conf. Proc. 1085, 886 (2008)



Resolving complex sources







Fermi LAT >200 GeV background-subtracted counts map of Cen A Abdo et al. 2010, *Science* **328**, 725

Fermi LAT PSF at 10 GeV CTA PSF at 100 GeV (≥2 images) CTA PSF at 300 GeV (≥10 images) (68% containment)

Expect to detect hundreds of AGN

Doro et al., Astropart. Phys. 43, 189 (2008)

Dark matter searches with Fermi & CTA

10⁻²²

Fermi dwarf spheroidal galaxy (DSG) and **CTA Galactic Center** searches are complementary

Assuming b b-bar decay channel

LAT 2-year result from Ackermann et al. 2011, Phys. Rev. Lett. 107, 241302.



Fermi combined DSG analysis (10 DSGs), 2 years

Galactic Halo, 100 h, CTA array B (Ring Method)

Fornax Cluster, 100 h, CTA array B ($\theta_{max} = 1.0^{\circ}$)

Fermi combined DSG analysis, 10 years

Segue 1 DSG, 100 h, CTA array B



 10^{4}

A simulated GRB (E > 30 GeV)



CTA Simulation of GRB 080916C seen by GBM + LAT



from

Gamma-Ray Burst Science in the Era of Cherenkov Telescope Array (Astroparticle Physics special issue article) Susumu Inoue et al.



- Guaranteed science studying known high-energy sources
- Analogous to the advance from EGRET to Fermi-LAT
- Initial operations will potentially overlap with Fermi
- Proven technology combined with judicious innovation
- Will serve a large and diverse community
- Discovery potential of a leap in capability