



Status and First Results of the LHAASO Experiment

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Outline

- Introduction
- Status and first results
- Conclusions

LHAASO

Large High Altitude Air Shower Observatory

• Total budget: ¥1,200 M



LHAASO: Large High Altitude Air Shower Observatory

Major Scientific Goals

Origin of GCRs

- Searching for GCR sources by measuring SED with an unprecedented sensitivity of 1% I_{Crab} at 50 TeV
- Energy spectra for individual compositions with energy from 10 TeV to 1 EeV, where the spectrum knees are located
- Gamma ray astronomy
 - Searching for TeV γ sources, especially extended and transient ones, with an unprecedented survey sensitivity of 1% I_{Crab} at 3TeV.
- New physics frontier
 - dark matter, Lorentz invariance, new physics beyond LHC energy, etc





Hybrid Detection of EASs by LHAASO



LHAASO observables of EASs

	Ground-based	Air C/F Telescopes		
	EAS arrays	Cherenkov	Fluorescence	
Direction space-time		image (stereo)	image (stereo)	
Core	lateral distribution	stereo imaging	stereo imaging	
Energy	lateral distribution	Cerenkov light, geometry	longitudinal development	
Composition	lateral distribution, muons (π^{\pm}) , particles near the core (π^0)	image, Xmax	Xmax	

Measurement of EASs at High Altitude

Mt. Haizi (4410 m a.s.l., 29°21' 27.6" N, 100°08'19.6"
E), Sichuan, China



sky survey, extended, transient

		1				
		ARGO	AS+MD	HAWC	LHAASO	СТА
Area		6,500 m ²	50,000 m ²	22,500 m ²	1 km ²	10 km ²
σ_{θ} (deg)		0.2-0.5	0.2-0.5	0.1-0.5	0.1-0.5	0.05
BG rejection power			104	100	100/104	100
Duty Cycle		>90%	>90%	>90%	>90%	10%
FOV (sr)		2	2	2	2	0.015
Sonaitivity	@TeV	0.55		0.06	0.01	0.001
(c.u.)	@100TeV		0.25		0.01	0.3
Energy resolution		30%	30%	>50%	30%	15%

SED, morphology

Status and first results

Living Base (3750 m a.s.l.) 2016.08-2017.10





Site Preparation 2017-11

ers 🔳

THE FEEL



35KV transmission line powered on 2017-8

3800 m → 4410 m a.s.l. 29 km, 92 towers

Detector Deployment started in 2018-10



KM2A

- ED: 1850/5195 produced (200/month), 960 deployed, 229 in operation
- MD: 393/1171 constructed (100/month), 230 deployed, 86 in operation





WCDA

• 3 pools built, 1 in operation since 2019-4-26



gamma-like, nhit=581

20190705/024528/0.228384661: nTrig=0, θ=18.84±0.04°, φ=317.55±0.14°

hadron-like, nhit=586

20190704/024232/0.566287199: nTrig=0, θ=12.19±0.04°, φ=174.75±0.19°



2019-04-26 to 2019-07-14, 10¹¹ events



WCDA#1 Sky Map



WFCTA 6/18 telescopes deployed, 2 in operation



Conclusions

- Construction and detector deployment of the LHAASO experiment is going on smoothly.
- The first water pool has been in data taking since April, 2019. Preliminary results show that the detectors are working as expected.
- 1/4 of LHAASO will start data taking soon. By the end of 2019, 1/2 of LHAASO will be ready for operation.
- LHAASO will be completed by the end of 2020.

Welcome to LHAASO!







LHAASO talks @ICRC2019

Presenter	Title				
Huihai He	GAI1a: Status and First Results of the LHAASO Experiment				
Xiaojie Wang	GAI3a: Gamma Hadron separation using traditional single parameter method and multivariate algorithms with LHAASO-WCDA experiment				
Mingjun Chen	CRI3a: Status and First Result of LHAASO-WCDA				
Xiurong Li	CRI3d: Simulation and real data analysis of the LHAASO-WCDA dynamic range extension system				
Zhiyong You	CRI4h: The Cosmic Ray Spectrum of Light Component above 10TeV Measured by LHAASO Experiment				
Huicai Li	CRI7a: Comparison of measured and simulated data with early LHAASOWCDA test run data				
Zhen Cao	CRI14d: The Shower Energy Scale with Air and Water Cherenkov Techniques in LHAASO experiment				
Xinhua Ma	CRI14e: EAS Thermal Neutron Detector Array to Add into LHAASO				
Guangguang Xin	CRI15c: Study on the muon lateral distribution based on the first stage of LHAASO- KM2A				
Wei Gao	CRI16a: The Large-scale Anisotropy of Cosmic Rays Observation with the Partial LHAASO-KM2A Arrays				
Xiaojun Bi	DM1f: Perspective on dark matter annihilation limits from the LHAASO gamma-ray observation of dwarf Spheroidal galaxies				

LHAASO posters @ICRC2019

Time	Room	Board Number	Presenter	Title
		173	Ma, Xinhua	Effects of Thunderstorms Electric Field on Intensities of Positrons, Electrons and Photons at Daocheng
		172	Hou, Chao	Finalized design of LHAASO electromagnetic particle detector
		168	Guo, YingYing	The significance of the Water Cherenkov Detector Array (WCDA) to multi-TeV gamma rays sources
		230	Yu, Yanhong	Characterization of the photomultiplier tube for the LHAASO electromagnetic particle detectors
		235	Zhang, Xiaopeng	Batch Measurement of Attenuation Length of Wavelength-shifting Fibers for LHAASO Electromagnetic Detectors
		227	Yang, Mingjie	The performance of LED calibration system for Cherenkov telescope of LHAASO
July 25 th 26 th : 15:00- 16:30		231	Zeng, Zongkang	A charge calibration method for the LHAASO-WCDA dynamic range expansion system
		229	Yin, Liqiao	The MVA for pure proton and mixed H&He samples selection in hybrid measurement of cosmic ray showers with LHAASO experiment
		224	Wu, sha	The expectation of LHAASO sensitivity on the cosmic-ray electron
	Great Hall, 4th Floor	222	Wang, Yanjin	The energy calibration using the moon shadow of LHAASO WCDA detector
		195	Lv, Hongkui	Offline Calibration of Electromagnetic Particle Detectors in LHAASO
		193	Liu, Jinyan	The study on the LHAASO WCDA time calibration
		66	Liu, Jiali	The Study of TeV Gamma Ray Emission from Mrk421 with LHAASO-WCDA
		152	Chen,Songzhan	Detector Simulation of LHAASO-KM2A with Geant4
		151	Chen,Baomin	A study on the impact of LHAASO-WCDA PMT afterpulse
		196	Ma, Lingling	Pointing and Spot Size Measurements of LHAASO WFCTA Using Stars
		239	Zhu, Fengrong	Extinction Coefficient from Atmospheric Aerosols over LHAASO
		240	Zhu, Fengrong	The Performance of the Laser Systems in the Calibration System of LHAASO-WFCTA
		234	Zhang, Shoushan	Properties and Performance of SiPM based Cherenkov Telescope for LHAASO
		217	Ma, Xinhua	Cosmic ray mass composition analysis method to be used in the LHAASO-ENDA experiment
	Tripp Commons, 2nd Floor	66	Liu, Jiali	The Study of TeV Gamma Ray Emission from Mrk421 with LHAASO-WCDA
July 30 th 31 st : 15:00- 16:30	Great Hall, 4th Floor	234	Wang, Lingyu	Leak test for liners of muon detectors of LHAASO
	Tripp Commons	87	Zha, Min	A Real-Time Monitoring the TeV Blazars with LHAASO-WCDA Detector
	2nd Floor	88	Zhao, Shiping	On-site test system for LHAASO-KM2A muon detector