The High Altitude Water Cherenkov Observatory

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HEM 2014 - KICP Workshop - June 9, 2014

Outline

1. Motivation
2. Detector description
3. Status and results
4. Outlook

Introduction

- 2nd generation water Cherenkov
- Wide instantaneous field of view (2 sr)
- High duty cycle (> 90%)
- Large area (22,000 m^2)

HAWC Science

- Discover the **origin of cosmic rays** via **HAWC's observations of γ-rays up to 100 TeV** from discrete sources and the Galactic plane.
- Understand **particle acceleration** in astrophysical jets with **HAWC's** (wide field of view, high duty factor) **observations of transient sources**, such as gamma ray bursts and supermassive black holes.
- Explore **new TeV physics** via **HAWC's unbiased survey** of ½ the sky.

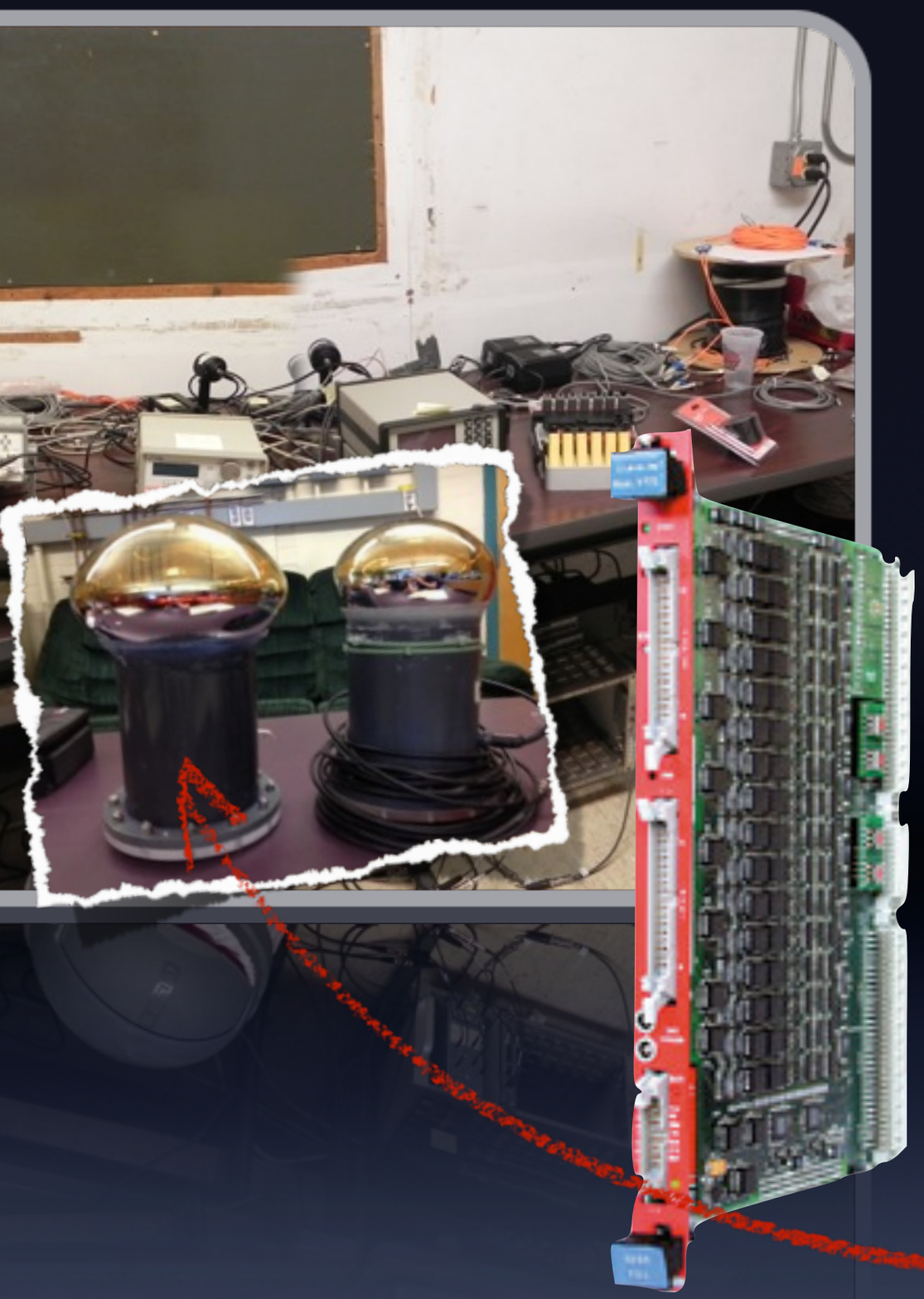
The HAWC Observatory

300 - 7 m x 5 m steel Water Cherenkov Detectors (a.k.a. *tanks*) with 4 PMTs at 4,100 m a.s.l. in Mexico

HAWC tanks

Auger tank

HAWC bladders



HAWC components

We will reuse from Milagro:

- 900 encapsulated PMTs
- Front-end electronics
- Water filtration system
- Technical expertise & experience

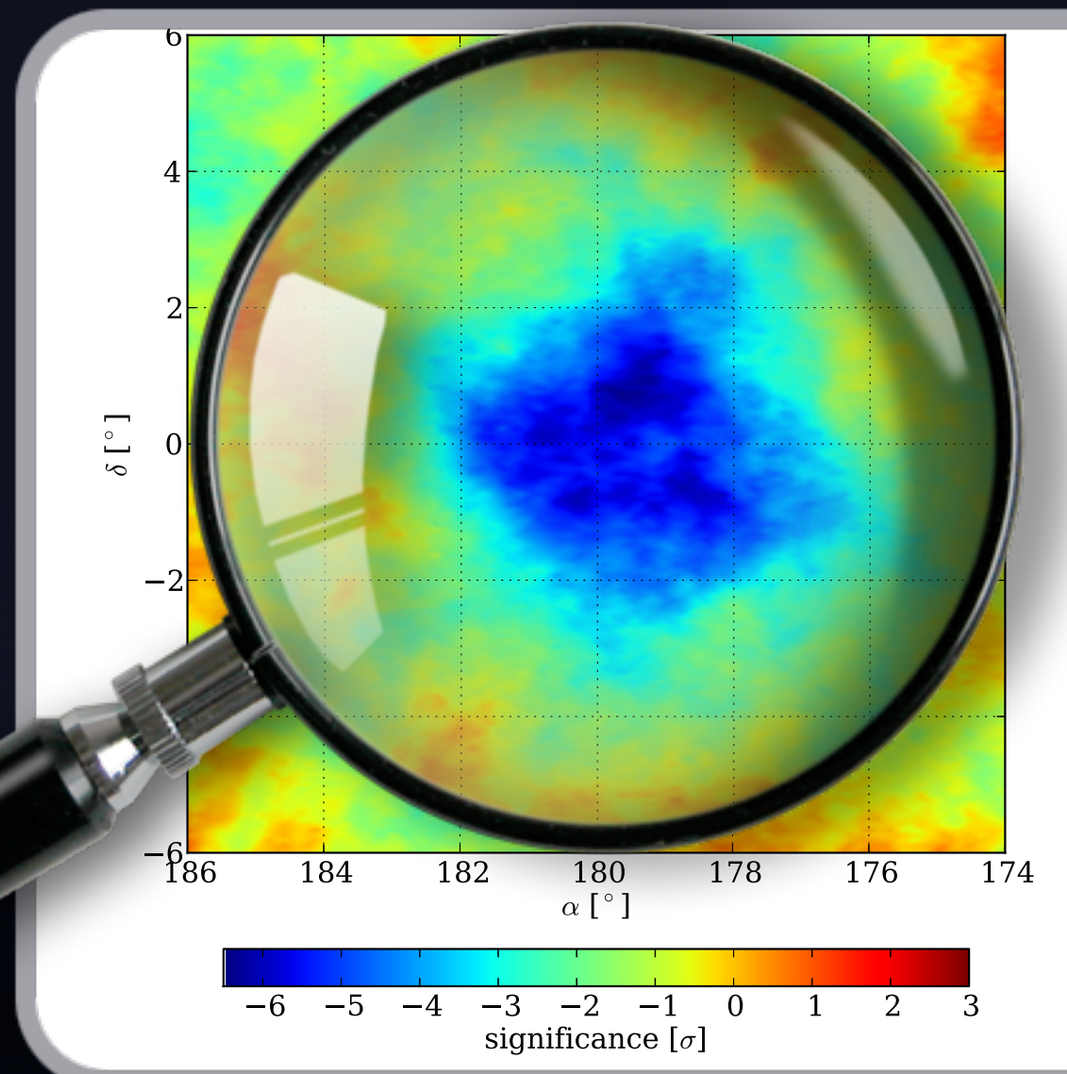
Off-the-shelf components:

- VME TDCs, trigger, scalers, HV
- 300 10” HE PMTs

HAWC Calibration

New dedicated **laser** system

- Timing calibration
- Charge calibration



HAWC site


UNEP
Jalapa
Veracruz
Tlaxcala
Tlaxcala
de Mexico (Mexico City)
Distrito Federal
Veracruz
HAWC Site
Puebla, PU, Mexico
Puebla
Cuernavaca

HAWC site

Status at the site

VAMOS: Six-tank array run between June 2011 - March 2012

Status at the site

February 2011

Status at the site

February 2012

Status at the site

September 2012

Status at the site

January 2013

Status at the site

May 2013

Status at the site

December 2013

Status at the site

March 2014

Status at the site

May 2014

HAWC-30, -77, -95, -111 Results

BBC

NEWS SCIENCE & ENVIRONMENT

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15 April 2013 Last updated at 01:22 ET

Hawc gamma-ray telescope captures its first image

By Jason Palmer
BBC News, Denver

México, Martes, 16 de abril de 2013 a las 09:36

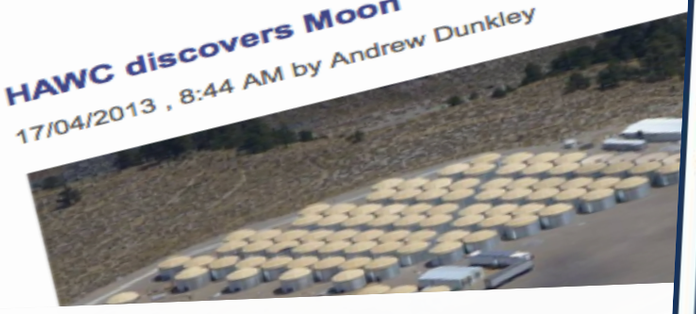
HAWC, el mejor detector de rayos gamma en el mundo, realiza sus primeras observaciones

Ubicado en las faldas del Volcán Sierra Negra en el Parque Nacional Pico de Orizaba, HAWC monitoreará las 24 horas del día fuentes celestes emisoras de rayos gamma

6:00am - 6:40am
6:55am - 7:45am

HAWC discovers Moon

17/04/2013 , 8:44 AM by Andrew Dunkley



Tendencias

30 ◦ Miércoles 17 de abril de 2013 ◦ jalisco.milenio.com

Integró la primera imagen de la sombra de la Luna

MILENIO

México estrena el mejor detector de rayos gamma

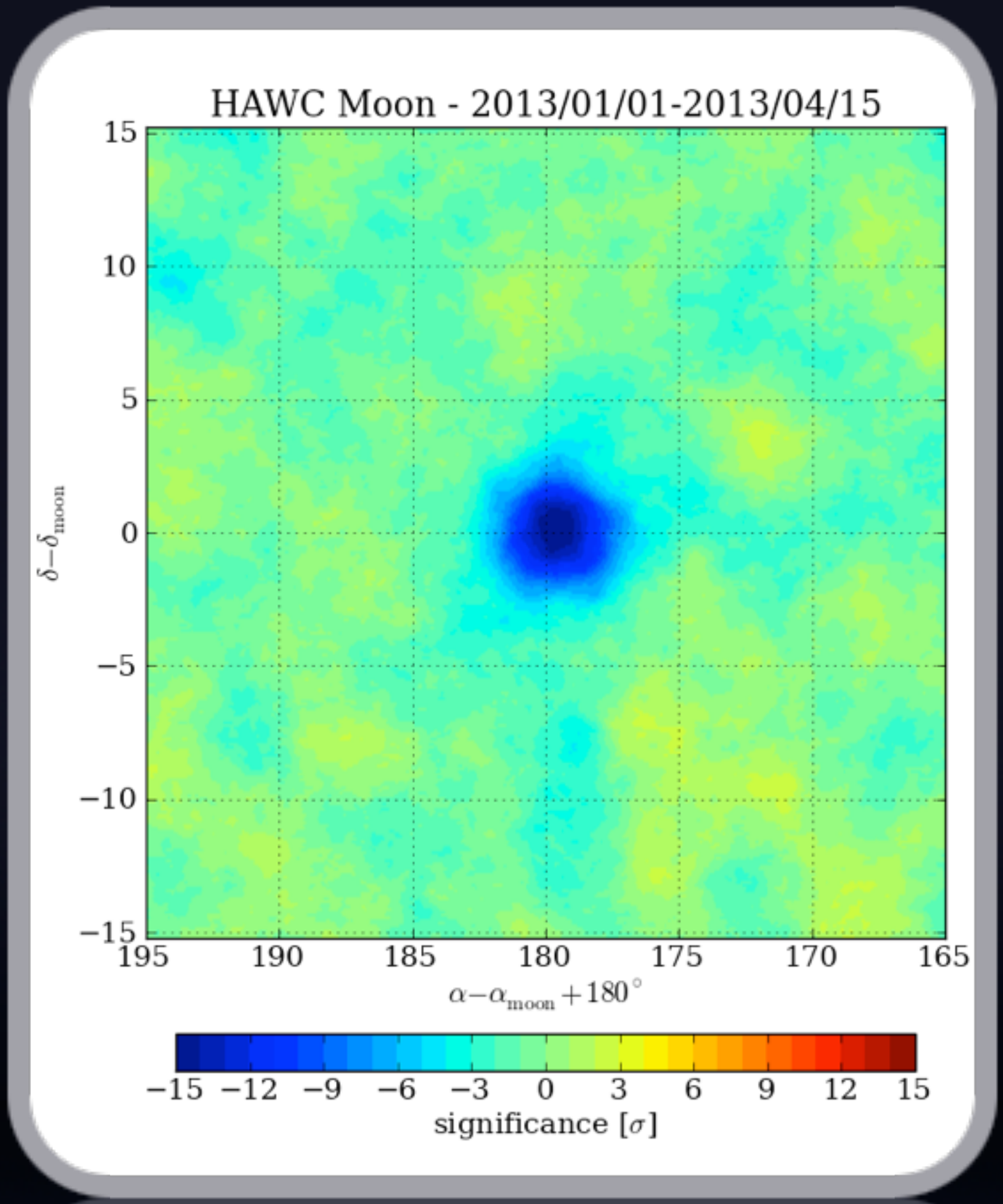
CIENCIA

Registran sombra de la luna en observatorio de rayos gamma

e-consulta Lunes 15 Abril 2013 - 19 : 16

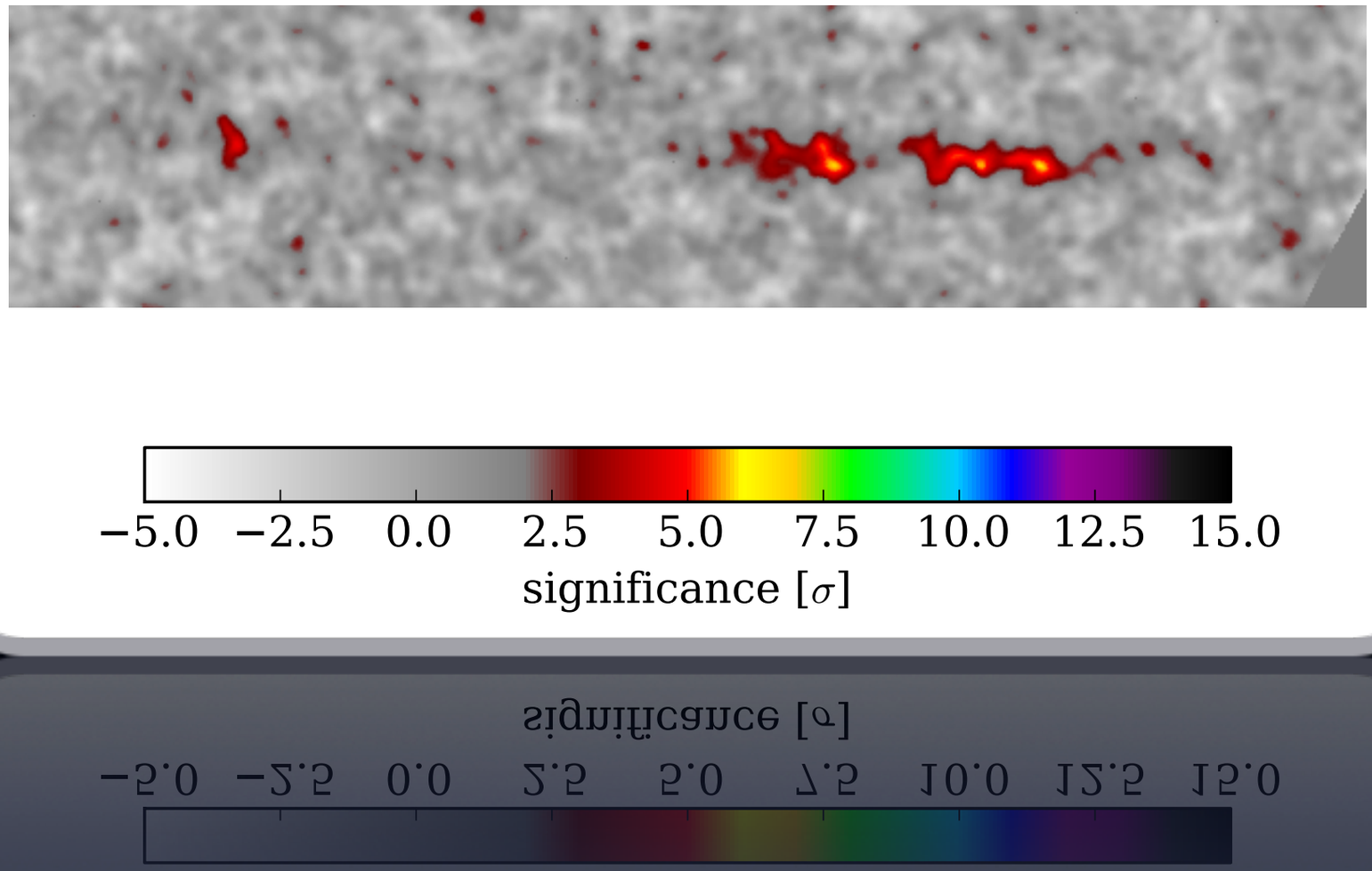
Preliminary Results

Moon Shadow



GALACTIC PHYSICS

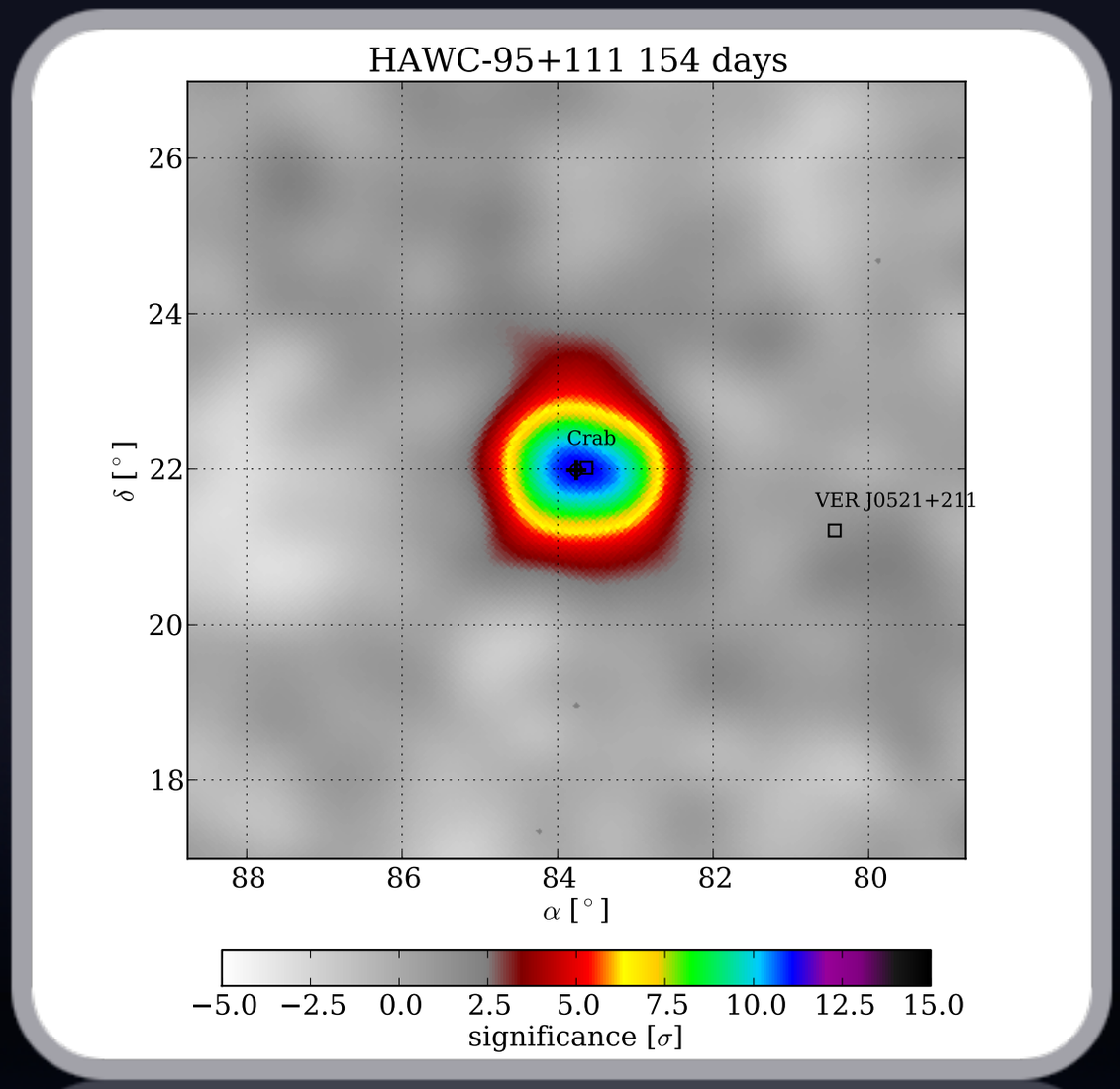
CYGNUS REGION
& The Inner Galaxy



Paper in preparation

GALACTIC PHYSICS

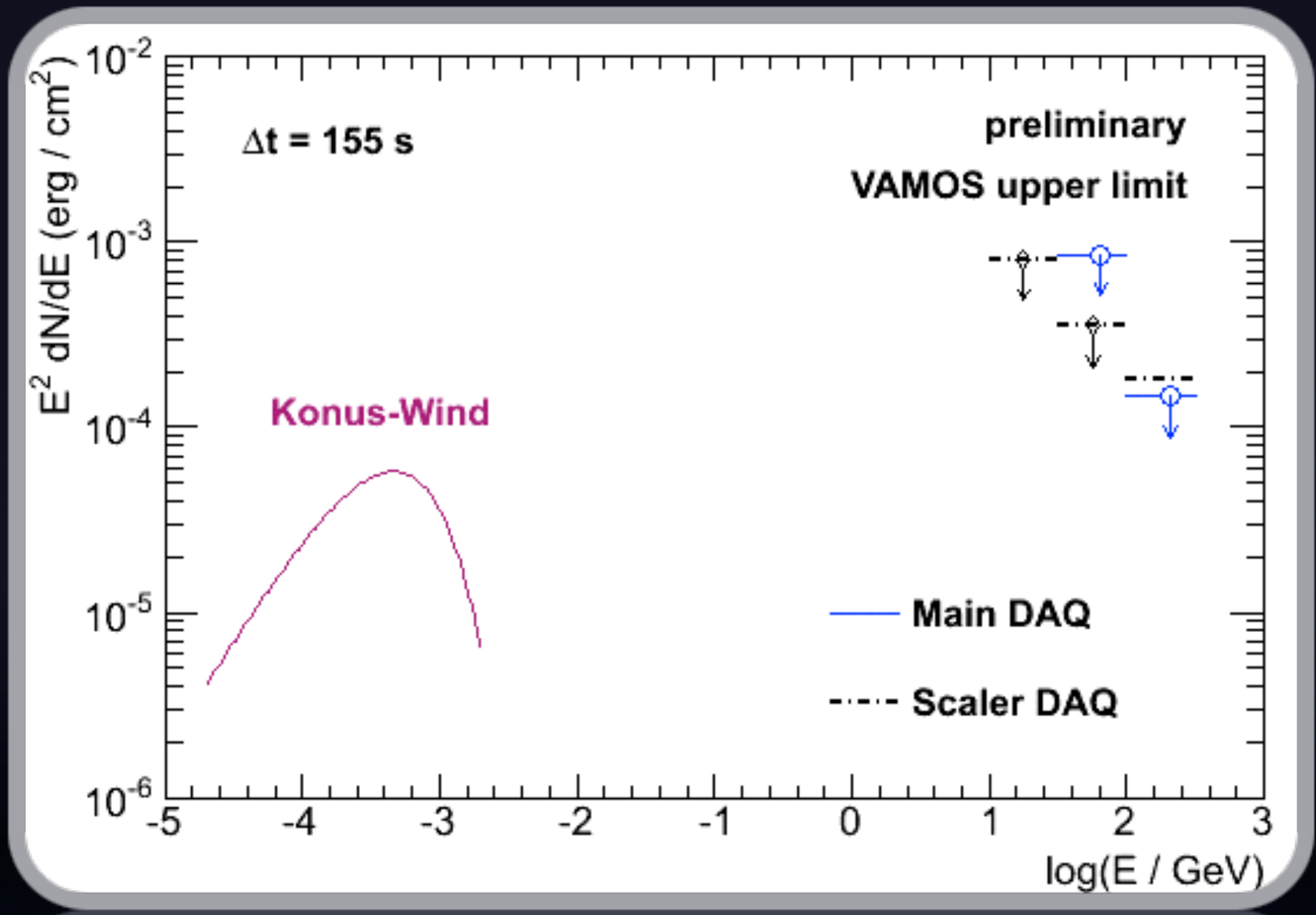
The CRAB



*Current **Crab** paper in preparation!*

EXTRAGALACTIC PHYSICS

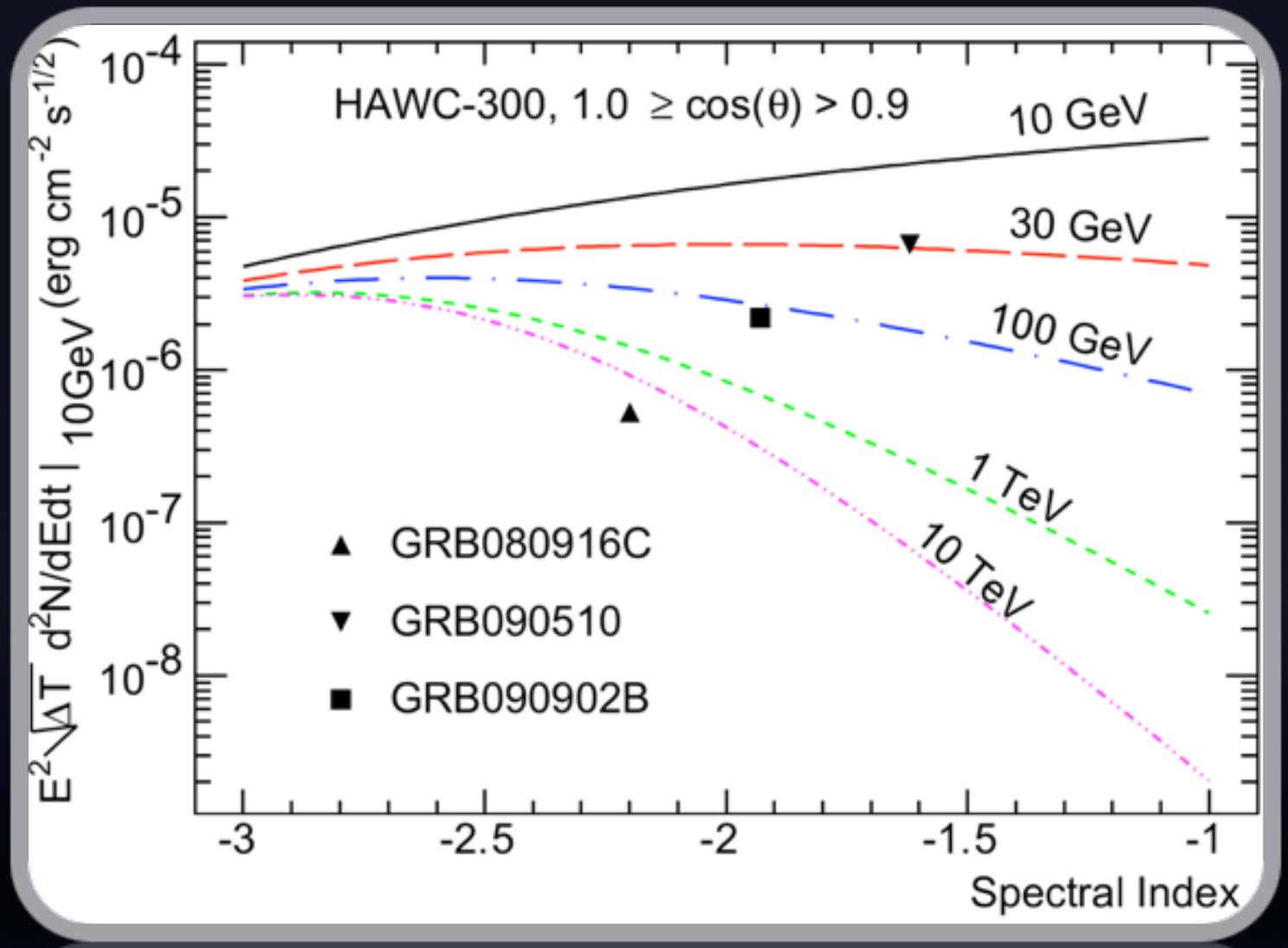
First GRB results



"Search for high energy **emission from GRBs** with the HAWC Observatory"

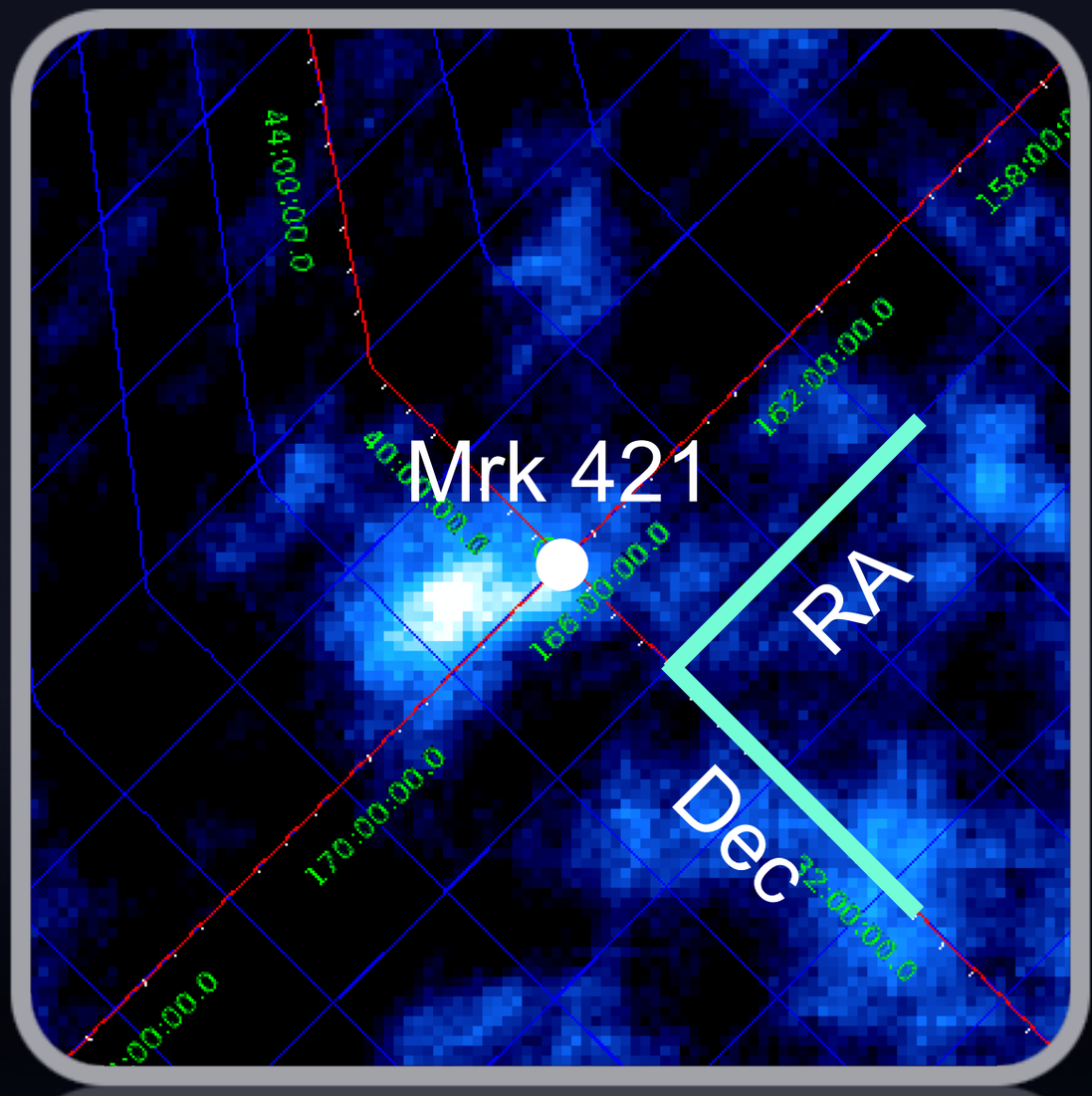
EXTRAGALACTIC PHYSICS

GRBs w/scalers



"Sensitivity of the HAWC Observatory to **GRBs** Using the **Scaler System**"

Mrk 421 flare

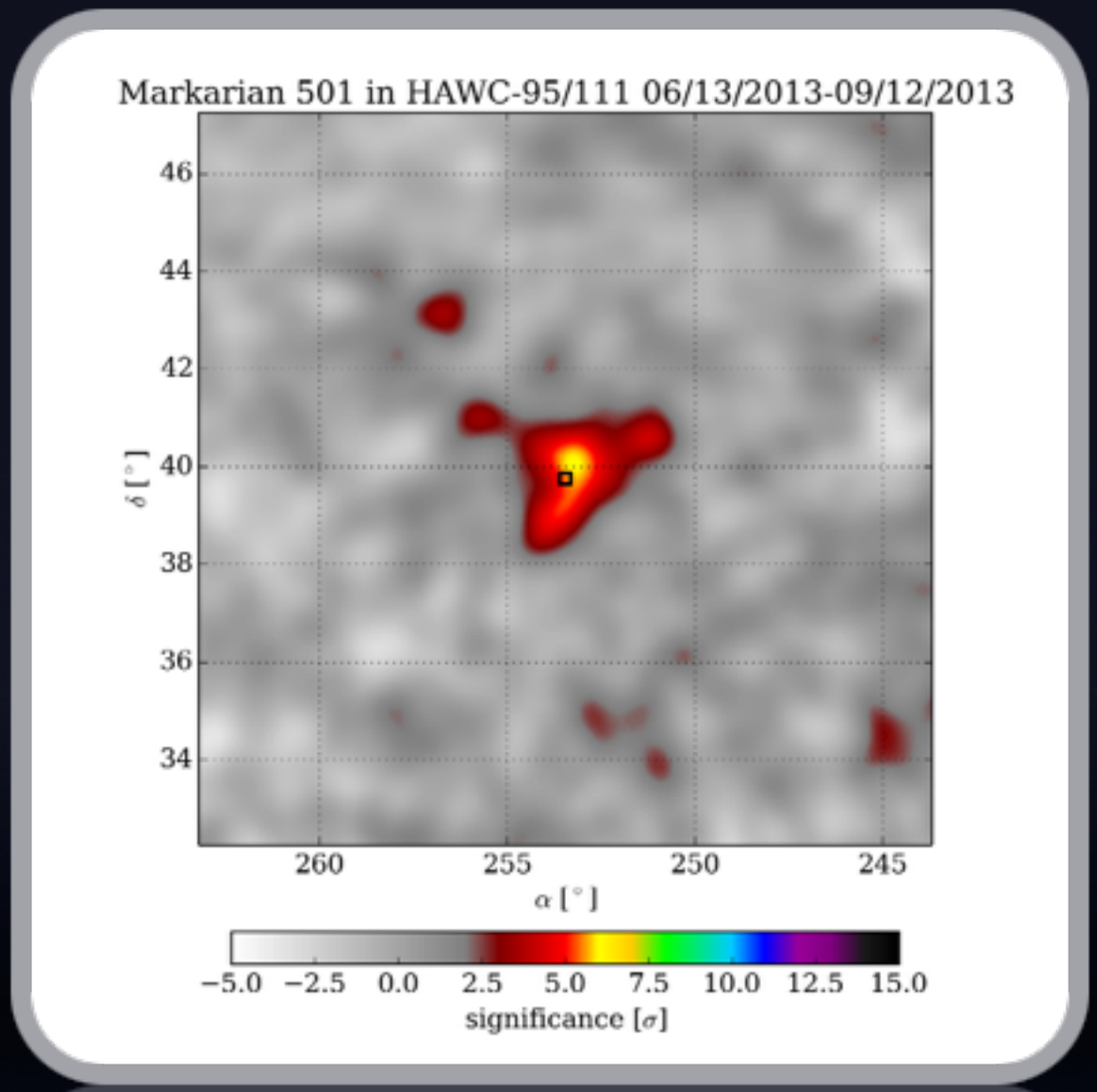


April 14 - 15

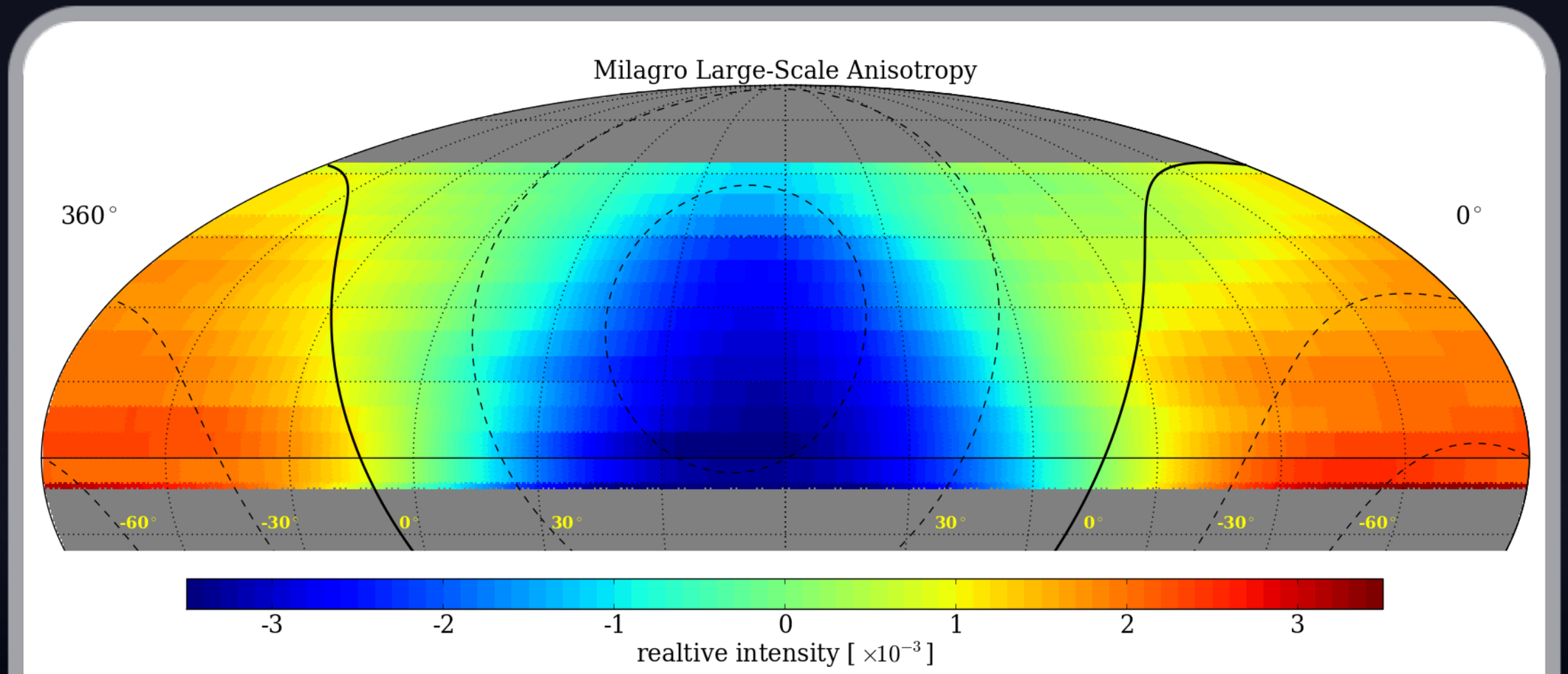
> 3.3 σ

EXTRAGALACTIC PHYSICS

Mrk 501

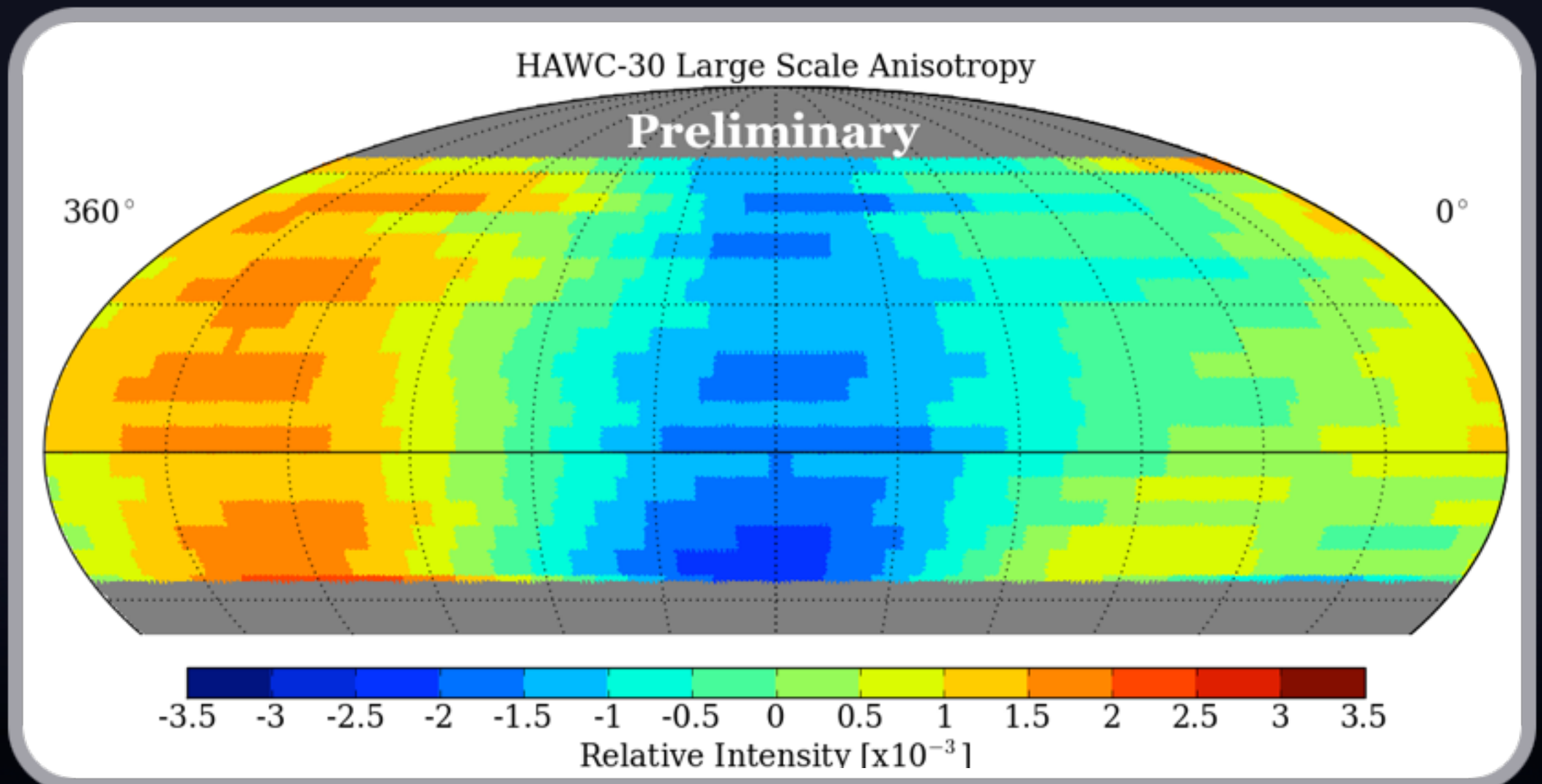


COSMIC RAY ANISOTROPY



COSMIC RAY PHYSICS

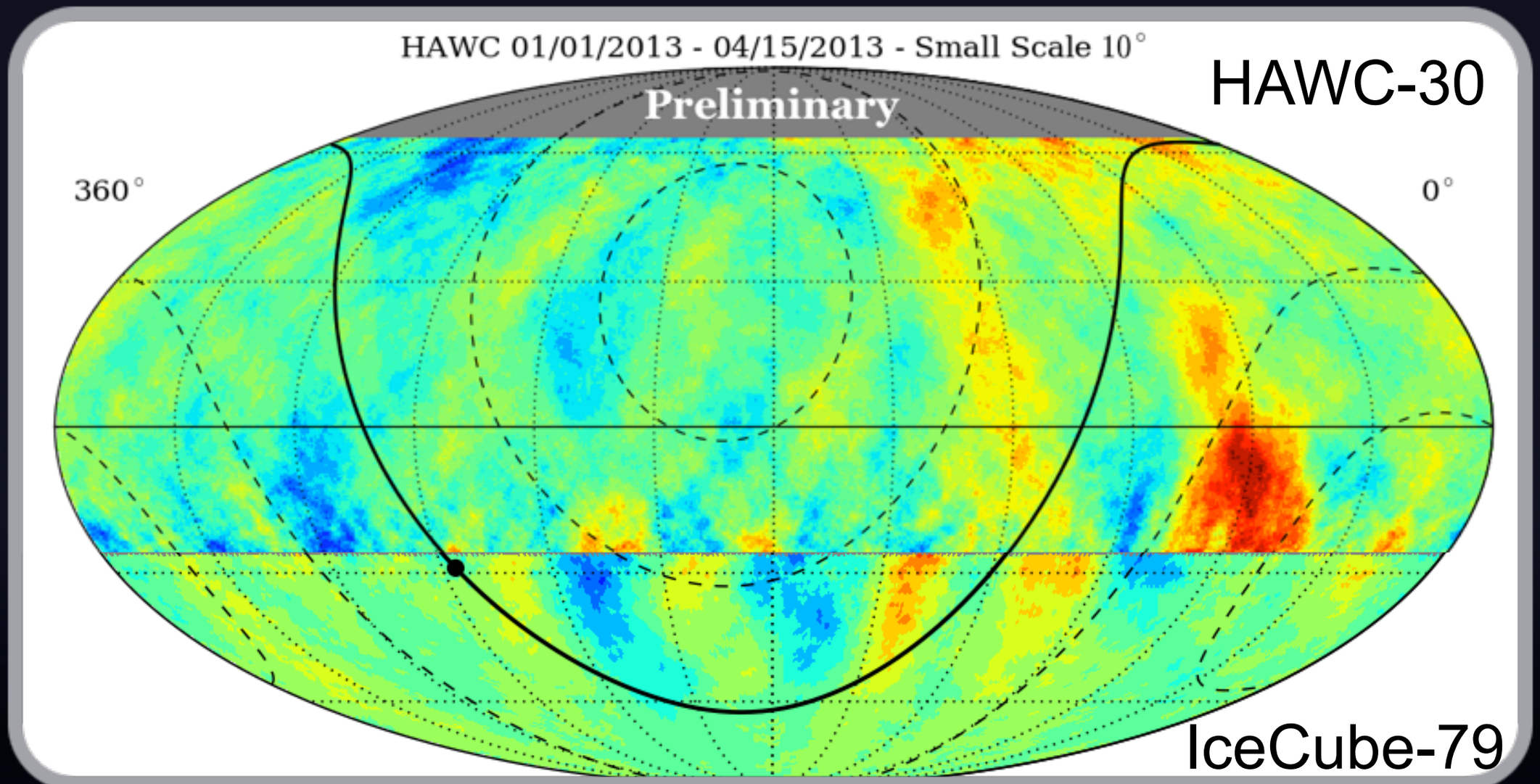
COSMIC RAY ANISOTROPY



"Observation of the **Anisotropy of Cosmic Rays** at the HAWC Observatory"

COSMIC RAY PHYSICS

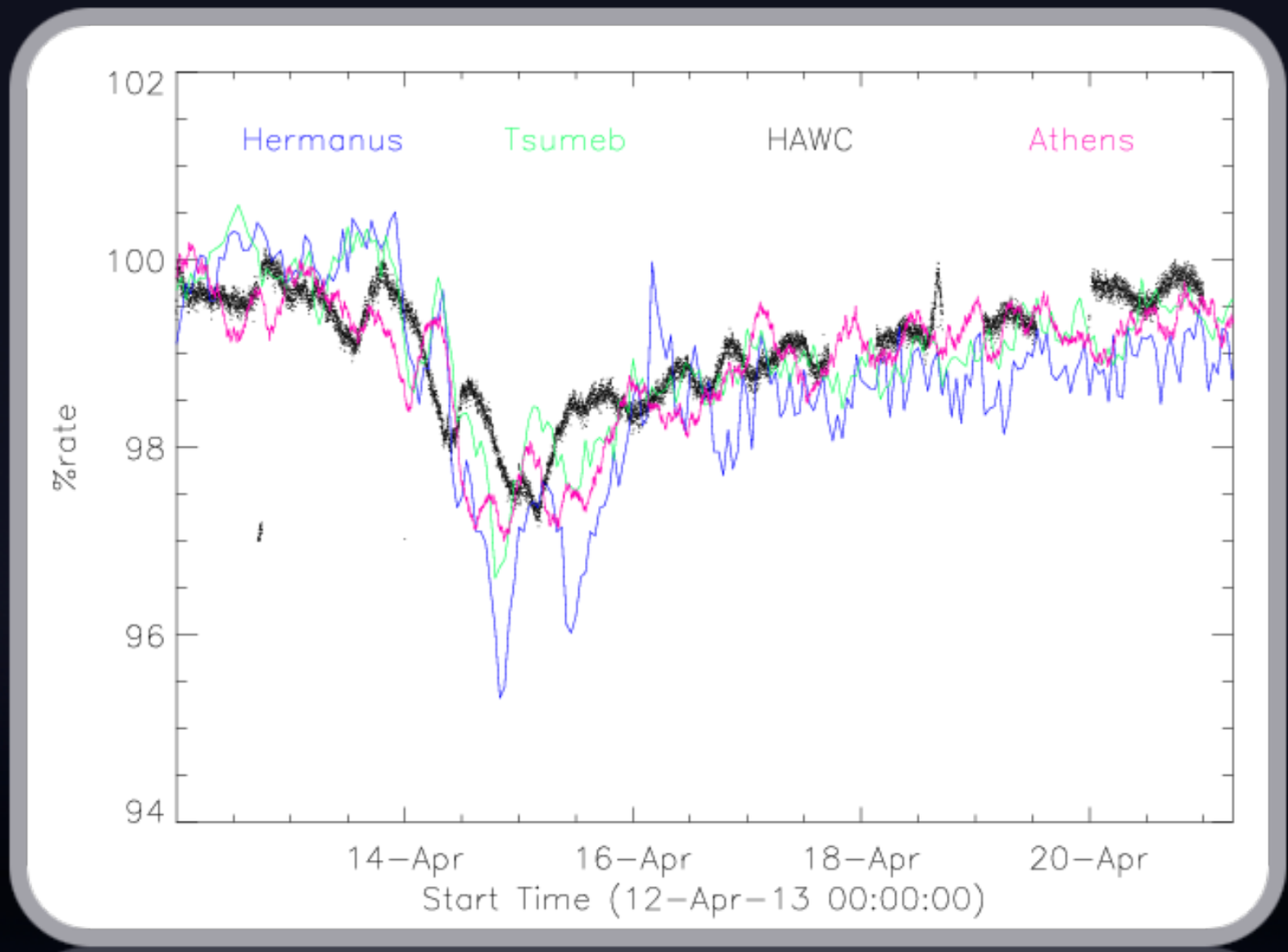
COSMIC RAY ANISOTROPY



"Observation of the **Anisotropy of Cosmic Rays** at the HAWC Observatory"

COSMIC RAY & SOLAR PHYSICS

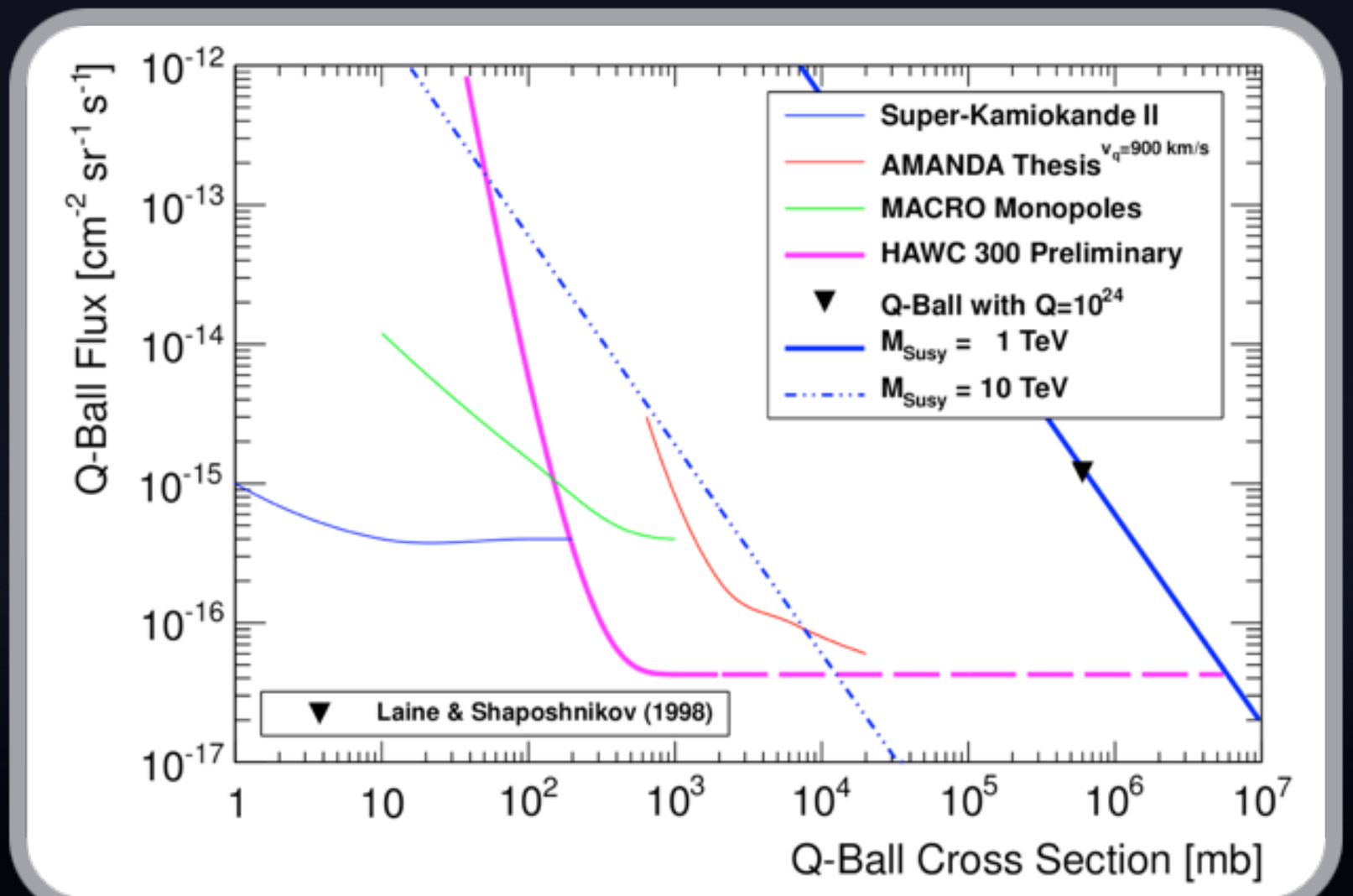
SOLAR EVENTS



"HAWC sensitivity to **Solar events**"

PARTICLE PHYSICS

Q-balls



"Searching for **Q-balls** with the High Altitude Water Cherenkov Observatory"

PARTICLE PHYSICS

- Limits to Lorentz Invariance Violation
- IGMF studies
- Sensitivity to PBH

Acknowledgements

HAWC Collaboration Meeting, February 25-27, 2014
Universidad Autónoma del Estado de Hidalgo
Pachuca, Hidalgo

Summary

- 2nd Generation WCD
- First results with HAWC-30, -77, -95, -111
- ***The future is bright!***

Coming soon!

Thank You!

High Altitude Water Cherenkov
Gamma-Ray Observatory