the High Altitude Water Cherenkov Observatory

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OUTLINE

INTRODUCTION & MOTIVATION

DESCRIPTION OF THE HAWC OBSERVATORY

LATEST (INTERESTING) RESULTS

OUTLOOK & CONCLUSIONS
GROUND ARRAYS

NASA's Fermi telescope resolves supernova remnants at GeV energies

Supernova Remnant G0.9+0.1

HESS J1745-290 (The Galactic Centre)
GROUND ARRAYS
HAWC is an array of 300 water Cherenkov tanks that record the particles created in gamma-ray and cosmic-ray showers. HAWC operates day and night, providing a large field of view for the observation of the highest energy gamma rays. HAWC is located at 4,100 m above sea level, covering an area of 20,000 m². Gamma rays select gamma rays from among a much more abundant background of cosmic rays. "Hot" spots concentrate around the core in gamma-ray showers, while "hot" spots are more dispersed in cosmic-ray showers.
**Small-Scale Cosmic Ray Anisotropy**

Small-scale (< 60°)
Large-scale removed (dipole, quadrupole, + octupole)
10° smoothing applied
86 billion events over 181 days


3 significant excesses
A – strongest, harder spectrum than bkg, at ~10 TeV consistent with Milagro
B – most extended
C – confirms Argo-YBJ observation
**REGION A**

- Preliminary spectral analysis

inclusive

bin 0 (lowest energy)
REGION A

- Preliminary spectral analysis

inclusive

bin 1 (∼ 3.2 TeV)
REGION A

- Preliminary spectral analysis

inclusive bin 2 (∼ 6 TeV)
REGION A

- Preliminary spectral analysis

Inclusive bin 3-6 (∼14 TeV)
\( \gamma \)-RAYS

- Sky map

HAWC-111 (283 d) + HAWC-250 (105 d)

PRELIMINARY
\gamma\text{-RAYS}

- The Crab
$\gamma$-RAYS

- Galactic plane
γ-RAYS

- Galactic plane

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Milagro Relative Sensitivity

Milagro
35 TeV - 8 years

HAWC-250
~TeV - 150 days

HAWC Relative Sensitivity

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HESS Galactic Plane Survey (2013)
MONITORING TeV sources

- Mrk 421
Geminga

Contributor to the positron excess?

- Milagro data
GEMINGA

- Milagro data
  Point source analysis

- HAWC data
  Point source analysis
GEMINGA

- Milagro data
  1 deg smearing

- HAWC data
  1 deg smearing
Geminga

Very preliminary

- Very extended
  3° top-hat smearing
- Harder than the Crab...
**Diffuse Emission**

- Photon-rich dataset above 10 TeV

large events
⇒ > 85% of the array
median $E \sim 10$ TeV

strong photon-like requirements
⇒ 1 in every $10^4$ events pass
25% efficiency for gammas
DIFFUSE EMISSION

- Preliminary limits
Indirect detection of DM

- Preliminary annihilation cross-section limits
CONCLUSION & OUTLOOK

- HAWC array completed
  Nearing design sensitivity
CONCLUSION & OUTLOOK

- **HAWC array completed**
  Nearing design sensitivity

- **Key science contributions**
  $\gamma$-rays, CRs, solar physics,
  particle physics,
  multi-messenger studies, ...
CONCLUSION & OUTLOOK

- HAWC array completed
  Nearing design sensitivity

- Key science contributions
  $\gamma$-rays, CRs, solar physics,
  particle physics, multi-messenger studies, ...

- Outrigger array funded
  Enhanced sensitivity above 10 TeV
Thank You Very Much!