

# Summary of the symposium UHECR2010

Dec.12, 2010, Nagoya C.C.

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# Spirit

- HiRes, Auger, TA, JEM/EUSO together with colleagues in collaborating fields.
- “Arguments to win, discussion to learn” by P.Sokolsky.
- Scientific arguments and discussion.

# What is the Problem #1?

- Yesterday      Spectrum (Energy)
- Today            Composition (Xmax)
- Tomorrow       Source ID (Anisotropy)

# Spectrum

- Flux suppression observed by HiRes, Auger and TA at  $\sim 10^{19.7}$  eV.
- In all methods; FD (mono, stereo) and SD (tank and scint) hybrid.
- In northern and southern sky.
- Threshold consistent within  $\sim 25\%$ , equiv. to energy scale uncertainty.

# Origin of Cutoff

- Consistent with GZK, but allows different interpretation depending composition.
- Unique origin in the north and south?

# Energy Scale

- AF yield; a series of exp. with better understanding and method. AIRFLY.
- World average; 337 line or whole.
- AF+telescope calib. by linac beam in situ.
- Cross calib. by optocopter and portable laser?
- Atmospheric monitoring.

# Composition( $X_{\max}$ )

- $X_{\max}$  and  $\Delta X_{\max}$  (distribution) from 3 exps.
- Different trigger/reconst., FD stereo & Hybrid.
- Different sky, north & south.
- Different philosophy,
  - \* “no” bias by restricted acceptance, Auger
  - \* bias “correction” by MC, HiRes and TA
- Different conclusion

# Yet,

*To be confirmed*

- Data ( $X_{\max}$  distribution at each energy bin) look similar and mutually consistent.
  - \* with or without acceptance (small, p/Fe dep.) bias.
- Opposite Interpretation
  - \* Transition from light(p) to heavy(Fe), Auger
  - \* Stays as light(p), HiRes and TA
- Average  $X_{\max}$ : Model (MC) expectation differs.
  - \* in definition and value.
- $\Delta X_{\max}$ : definition differs
  - \* RMS after resolution subtracted in quadrature, Auger
  - \*  $2\sigma$  truncated Gaussian fit inc. resolution, HiRes

*To be confirmed*



# We are scientifically vulnerable now.

## Next Steps

- No Royal Road (No over selling).
- Understand the method.
- “Understand the difference, data-data, model-model, data-model” by Y.Itow.
- Tests and Cross calibration among exps.
- Improve model and MC. LHCf, TOTEM & LE info.
- Wait for higher statistics.
- GZK neutrinos?
  
- Summary by B.Dawson.
- Summary of present understandings in the proceedings.

# Source and Anisotropy

- AGN correlation ( $z < 0.018$ , 60 EeV,  $3.1^0$ ) in the south, only significant ( $\sim 3 \sigma$ ) source association so far.
- Significant after Science(2007) publication?
- Cen-A association ( $18^0$ ).
- AGN corr. significant after removing Cen-A?
- No statistics in the north to invalidate the result in the south. Energy scale question.

# Source and Anisotropy -2

- Spectrum and composition “of Cen-A” very interesting.
- No (elite) source and excessively uniform sky.  
Is it OK?
- Better GMF knowledge.
- $X$ ,  $\gamma$ ,  $\nu$  (grav. wave) multi-particle sky surveys.

# UHECR2011

- Workshop type meeting with “experts” with clear subject and milestones.
- Discussion, work (and no arguments?)
- e.g. Energy and atmosphere? in 2011.
- In Karlsruhe, Chicago or in SLC?
- IAC members.

Thank you  
for your participation!