PMT Calibration School

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PMT Calibration School

Please take a lecture note!

PMT Calibration School

Saturday, April 26		
10:00	**12:30**	**Basics of PMT Calibration (K. Arisaka, Instructor)** ***ROOM MAITEN (BLUE)*** **Principle of PMT and its calibration (1hour)** **Absolute Calibration by NIST Standards (30min)** **Imperfect behavior of PMT (30min)**
12:30	**13:30**	**Visit to PMT test/potting facility at SDE-Fabrica** (Shuttle bus leaves the Conference center at 12:30)
15:00	**18:00**	**SD and FD PMT Calibration (K. Arisaka, Instructor)** ***ROOM CANELO (RED)*** **SD PMT Specs and Calibration (30min)** **SD PMT Test Facility and Results (30min, Barnhill)** **FD PMT Specs and Calibration (20min)** **FD Photon Yield and Systematic Errors (50min)**

SD Calibration Workshop

Sunday, April 27		
10:00	13:00	**SD Calibration Workshop (A. Tripathi organizer)** ***ROOM MAITEN (BLUE)*** **Local Station Calibration and Monitoring Update: Xavier (5min)** **Studies of Pedestal Induced Systematics and Electronics Noise: Gonzalo (20min)** **Report from Puebla: Humberto (20min)** **LED Flasher Measurements in Orsay Tank, and Result of Biological analysis of EA Tanks: Carla (25min)** **Water Level Monitoring Studies: Clementina (20min)** **Results of the muon data Analysis: Arun (30min)** **The Offline Calibration Database: Tom Paul (15min)** **Thoughts on SD Calibration in Pre-production: Xavier (20min)**

SD/FD Cross Calibration Workshop

Sunday, April 27		
14:30	18:00	FD/SD Energy Cross Calibration (K.Arisaka, organizer) *ROOM MAITEN (BLUE)* Absolute Energy by SD: AGASA/Auger-SD (1hour) Auger FD Dome Calibration (20min, Jeff Brack) Auger FD Laser Calibration (20min, Mike Roberts) Absolute Energy by FD: HiRes/Auger-FD (50min) How to Minimize Systematic Error in FD (30min) Strategy for SD/FD Energy Cross Calibration (30min) Discussion (All, 30min)

Homepage of PMT School

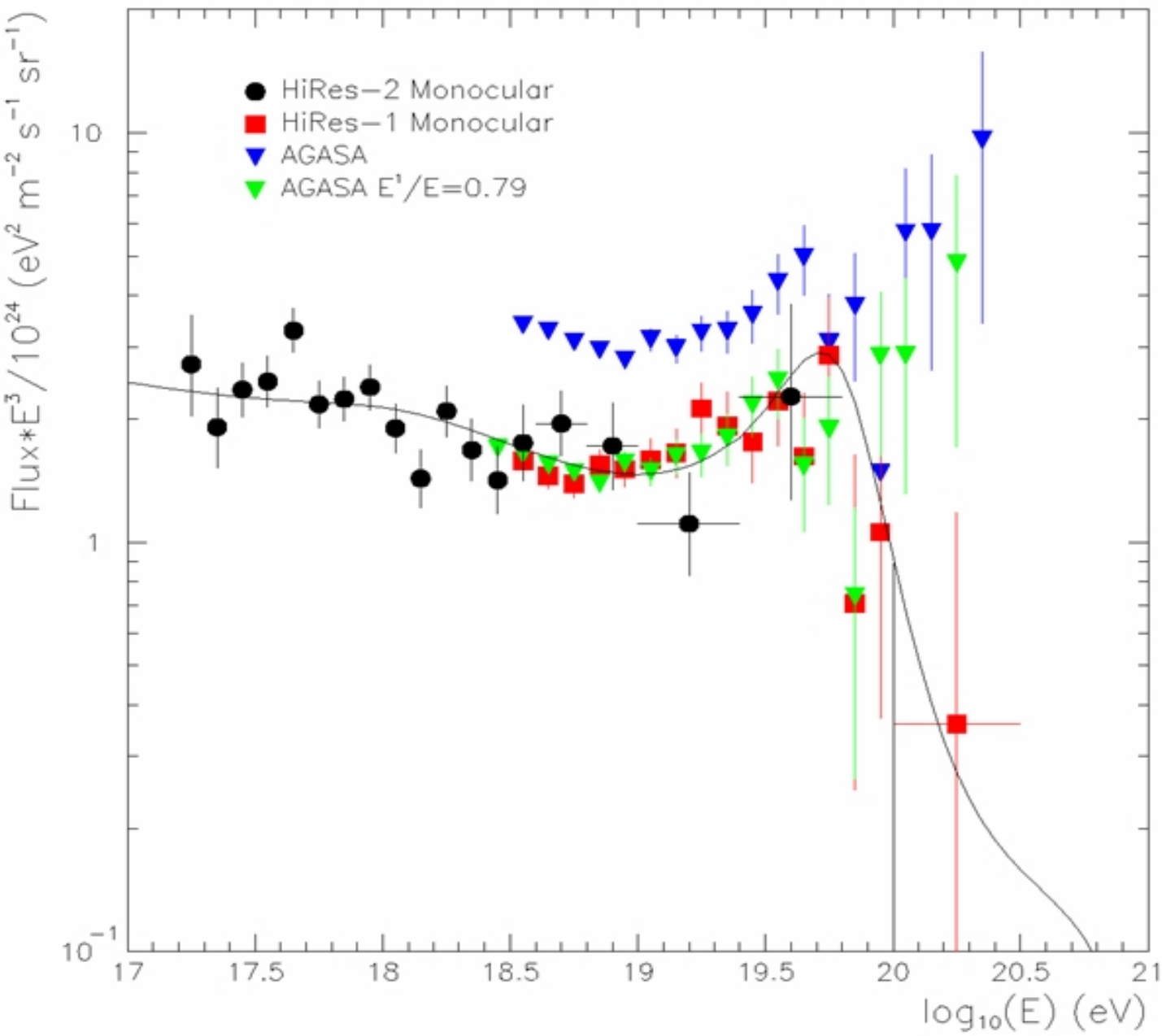
- Homepage is
  http://www.physics.ucla.edu/~arisaka/auger/pmt_school/
- All the presentations are available.
  - PPT files
  - PDF files
  - Combined PDF files (6 pages in 1 page)

Expected Attendees

- **Active workers at UCLA/UTN PMT test facility at Malargue.**
  - Local group.
  - Volunteers from outside.
- **Whoever interested in "absolute energy" of UHECR.**
  - Experts in SD and FD detector calibration.
  - Experts in SD and FD data analysis.

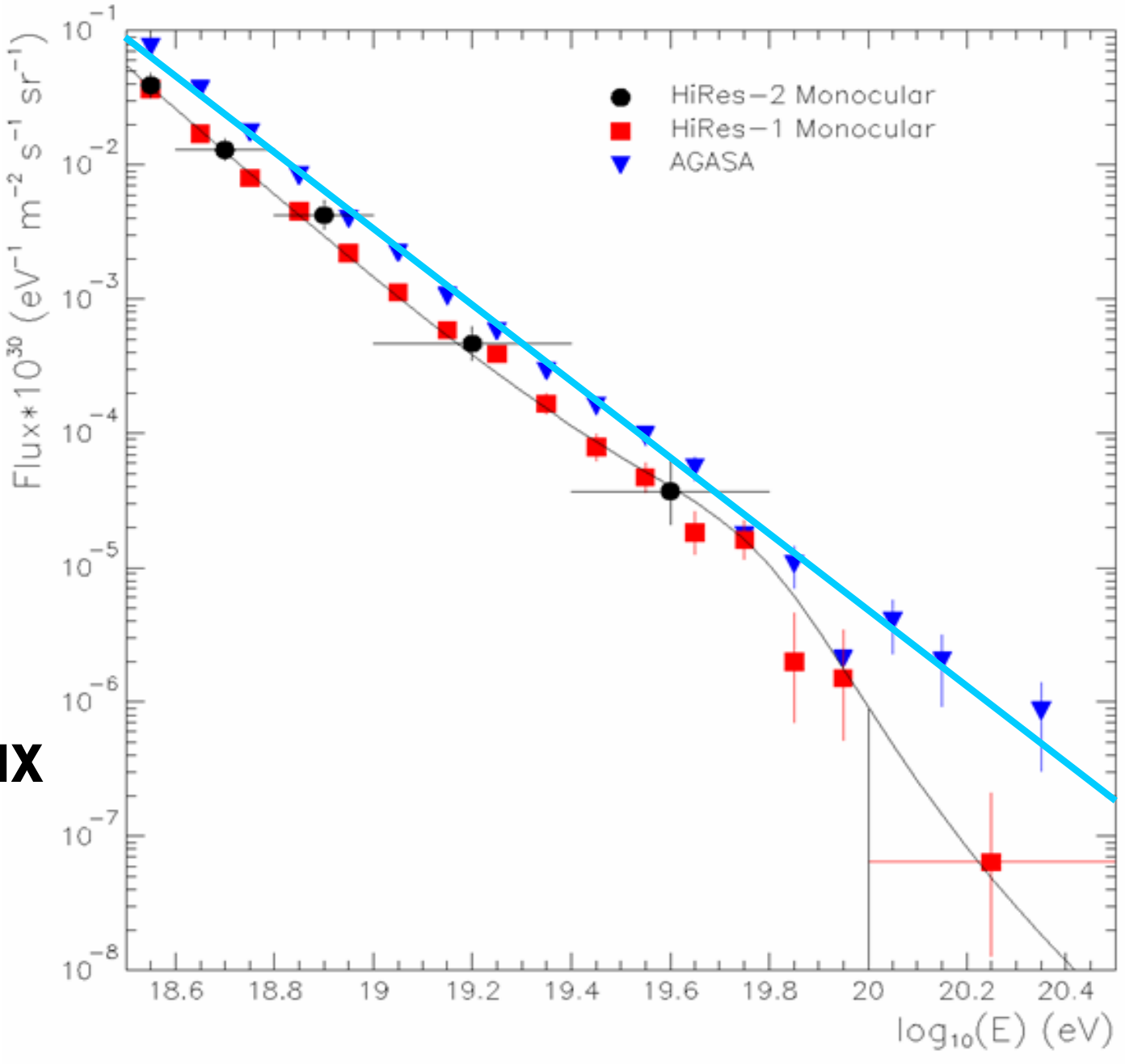
What is the Problem?

- AGASA sees a dozen of super GZK Events.
- But HiRes sees GZK cut-off?
- A factor of two difference in the Flux below GZK cutoff.



HiRes vs. AGASA

- Flux difference of the factor of two can be explain by energy difference of 20-30%.
- Is there any systematics error contributing to flux distortion above GZK cutoff?



What are we facing?

- Is the Pierre-Auger going to uncover their mistakes and fix them?

or

- Are we going to repeat the same mistakes?

- That is the question of ***systematics***, not ***statistics***.

Striking Fact

- If Hamamatsu miss-measured the Quantum Efficiency and/or Collection Efficiency of "one particular PMT" used by Kakimoto (say, it was 20% too low), it can explain the inconsistency between AGASA and HiRes.

- Moreover, Auger-FD would repeat the same, wrong spectrum of HiRes.

Why do we have to care PMTs?

- In FD, the absolute energy scale comes from
  - PMT calibration in photon yield study
  - PMT calibration in telescopes
- In both SD and FD, imperfect behavior of PMTs is the source of systematic errors
  - Stability
  - Non linearity
  - After pulse
  - ...

Goal of PMT School

- Understand Basic Principle of PMT.
- Become familiar with measuring various PMT parameters.
- Find out possible systematic errors in previous experiments.
- Try to minimize them in Pierre-Auger experiment.

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