

# “Theory Questions”

1. Questions associated to the Astrophysics of Cosmic Rays
2. Questions associated to the description of hadronic interactions at Ultra High Energy

# 1. Questions associated to the Astrophysics of Cosmic Rays

Interplay of - Spectrum  
- Composition  
- Angular distribution.

Properties of the Sources,  
(spatial distributions)  
Injection spectra  
Injection composition  
Properties of intergalactic medium.

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And my best wishes for the future work.  
I think the future of the field will depend  
To a significant extent to reaching an understanding of the physical meaning of the data. ]

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In the mean time a rich variety of astrophysical Scenarios are discussed with a variety of predictions

What are the astrophysical implications of a chemical composition of UHECR suggested by the AUGER data ?

An full understanding of the spectrum  
Requires a “global discussion”  
Of the spectrum from the knee energy to  
The “end of the spectrum”.

Do we have sufficient sensitivity to address these predictions , and observe the different phenomena/effects predicted in different scenarios ?

# Hadronic interactions.

How well are “minimum bias interactions” at LHC measured and understood.  
How safely can we extrapolate ?

How well can we predict  $\langle X_{\max}(E) \rangle$  (and its distribution) for protons and nuclei showers at UHE ?

Is it possible to identify the existence of new phenomena ?  
[Beyond QCD, ...  
Or beyond a “standard description of LHC]

[very exciting proposal of Glennys Farrar  
The data is already pushing us toward accepting new phenomena]

# New Data:

Interplay between:

## Statistics

(very large acceptance)

## Resolution

(quality of measurements)

Excellent idea to have this workshop at CERN !

Need to have a closer relation with the  
The “LHC community”.

Tuning of Montecarlo codes to describe  
Minimum bias and “underlying event” at LHC  
is an important effort for theorists and experimentalists.

The cosmic ray community has a lot to learn from these  
studies and efforts [and perhaps also something to contribute]

# Longitudinal profile

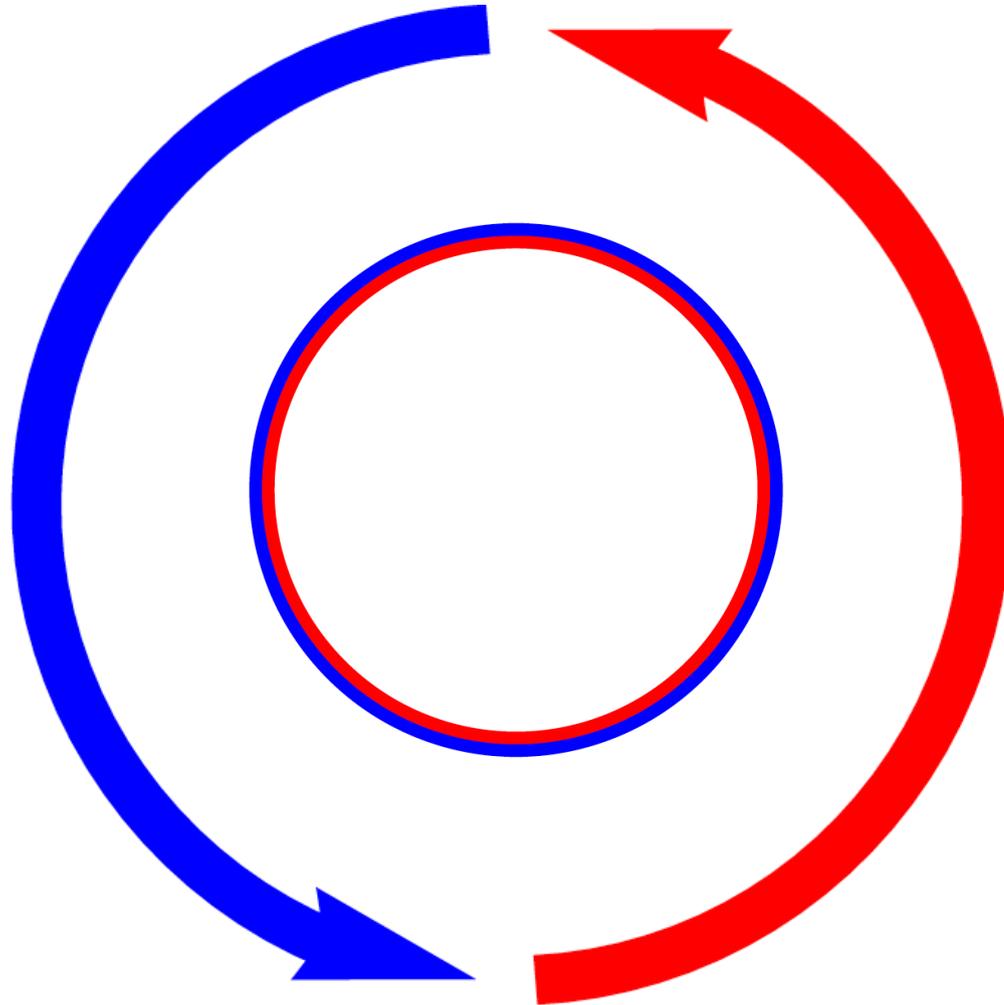
Xmax measurements  
(shape of shower measurement)

## Muon measurement at the ground.

Is it possible to develop a detection scheme that is realistically affordable ?

Is it possible to make sense of the results and extract useful information?

PARTICLE PHYSICS



COSMIC RAYS ASTROPHYSICS