



Laboratoire LEPRINCE-RINGUET  
Ecole polytechnique IN2P3/CNRS

# Séminaire

## High-definition muography, or how fundamental physics can help to see through a pyramid

Muography is an imaging technique making use of natural cosmic muons to probe the inside of objects. These muons originate from the interaction of primary cosmic rays with the Earth atmosphere. Their large energy spectrum allows them to penetrate from a few meters to several hundred meters of stones, and their interactions with matter provide hints of its density distribution. Depending on the size of the object this distribution can be obtained by measuring either the angular deviation of muons or the absorption/transmission factors in different directions. The main difficulty of muography is to cope with a modest muon flux, and therefore to build large area but precise and robust instruments. Following the R&D made on gaseous, Micromegas detectors for nuclear and particle physics, we have built at CEA/Irfu six high-resolution muography instruments over the last three years. Three of them were deployed around the Khufu's Pyramid in Egypt, within the ScanPyramids mission. In spite of extreme environmental conditions (temperature, dust, storms) the telescope showed good performance and stability. After the discovery of a first cavity in 2016 on the North-East edge of the Pyramid, they participated in 2017 to the discovery of the "ScanPyramids Big Void". This detection is the first ever of a deep structure of a pyramid from outside, and opens many more applications of HD muography in the coming years.

**David ATTIE  
& Sébastien  
PROCUREUR  
CEA/IRFU**

Salle conférence du  
LLR 05-2021

**Lundi 8 Janvier  
14h00**

[seminaires@llr.in2p3.fr](mailto:seminaires@llr.in2p3.fr)



Responsables séminaires

Sami Caroff  
Jean-Baptiste Sauvan