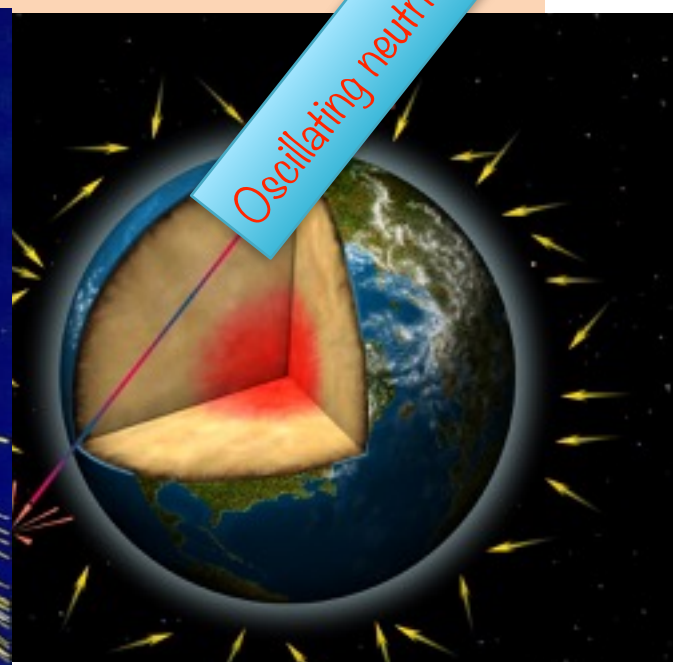


UNIVERSITE CADI AYYAD  
MARRAKECH



جامعة القاضي عياض  
مراكش

*Marrakech HEP & Astrophysics Laboratory*  
*LPHEA*



Mohamed Chabab,  
Cadi Ayyad Univ., Marrakech

Tangiers, October 27th, 2017



# SOME DATA ON UCA UNIVERSITY

## Data

- ◆ UCA : Public Institution
- ◆ Foundation in : 1978
- ◆ Colleges & Schools: 14
- ◆ Students :
  - 80 000 students
  - 478 foreigners
  - 45 nationalities
- ◆ Faculty: 1400
- ◆ Staffs: 850

## LOCATION



# High Energy & Astrophysics Lab



- ◆ 2 Research groups:

- ★ High Energy & Theory (EPHET)

- ★ Astrophysics & Astronomy (EA2)

- ◆ 12 Faculty members:

- + 9 Associates

- ◆ Graduate Studies: Training in HEP and Astrophysics.

- At present 26 Ph. D students + 50 Master students.

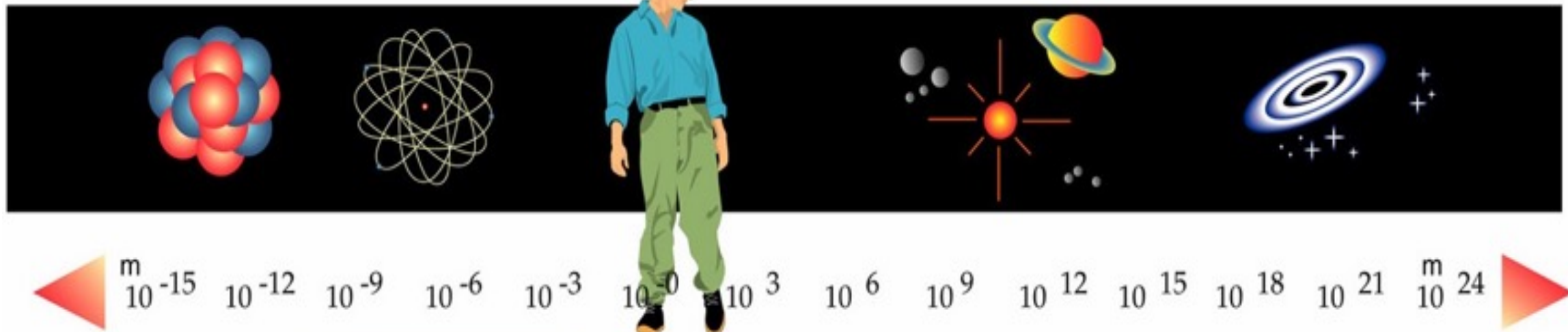
- ◆ Management of UCA Observatory (Oukaïmedan, 75 km from Mkech).





Particle physics looks at matter  
in its smallest dimensions.

Astrophysics looks at matter in its  
largest dimensions.



Microscopes  
Microscopes

Jumelles  
Binoculars

Telescopes optiques & radio  
Optical & radio telescopes

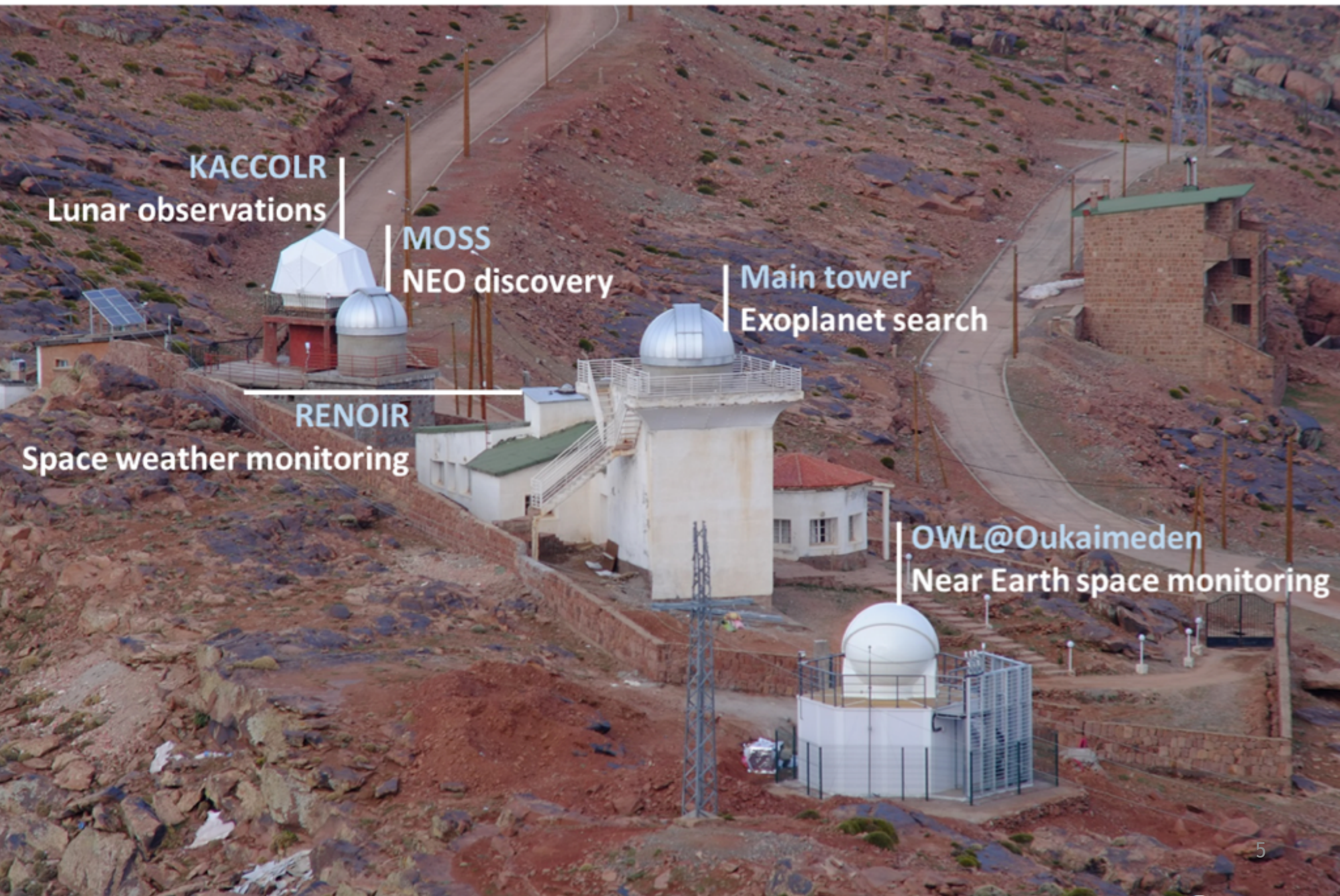
Accélérateurs  
et détecteurs  
Accelerators  
and detectors

L'oeil nu.  
Naked eye

**THE TWO FRONTIERS OF PHYSICS**



# *UCA Observatory @ Oukaïmeden*



KACCOLR  
Lunar observations

MOSS  
NEO discovery

Main tower  
Exoplanet search

RENOIR  
Space weather monitoring

OWL@Oukaïmeden  
Near Earth space monitoring



# *A&A Research topics*



*(Benkhaldoun, Bounhir, Benhida, Jabiri, Sefiani + 12 Ph. D students)*



# *Trappist North*



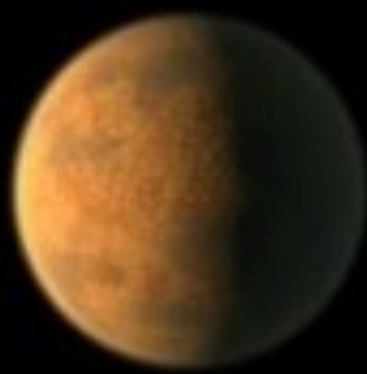
*(since October 2016...)*



# TRAPPIST-1 System



b



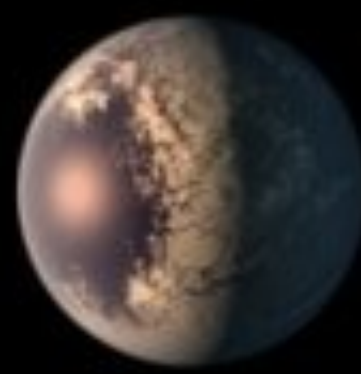
c



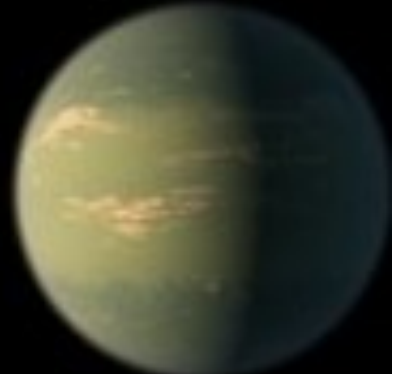
d



e



f

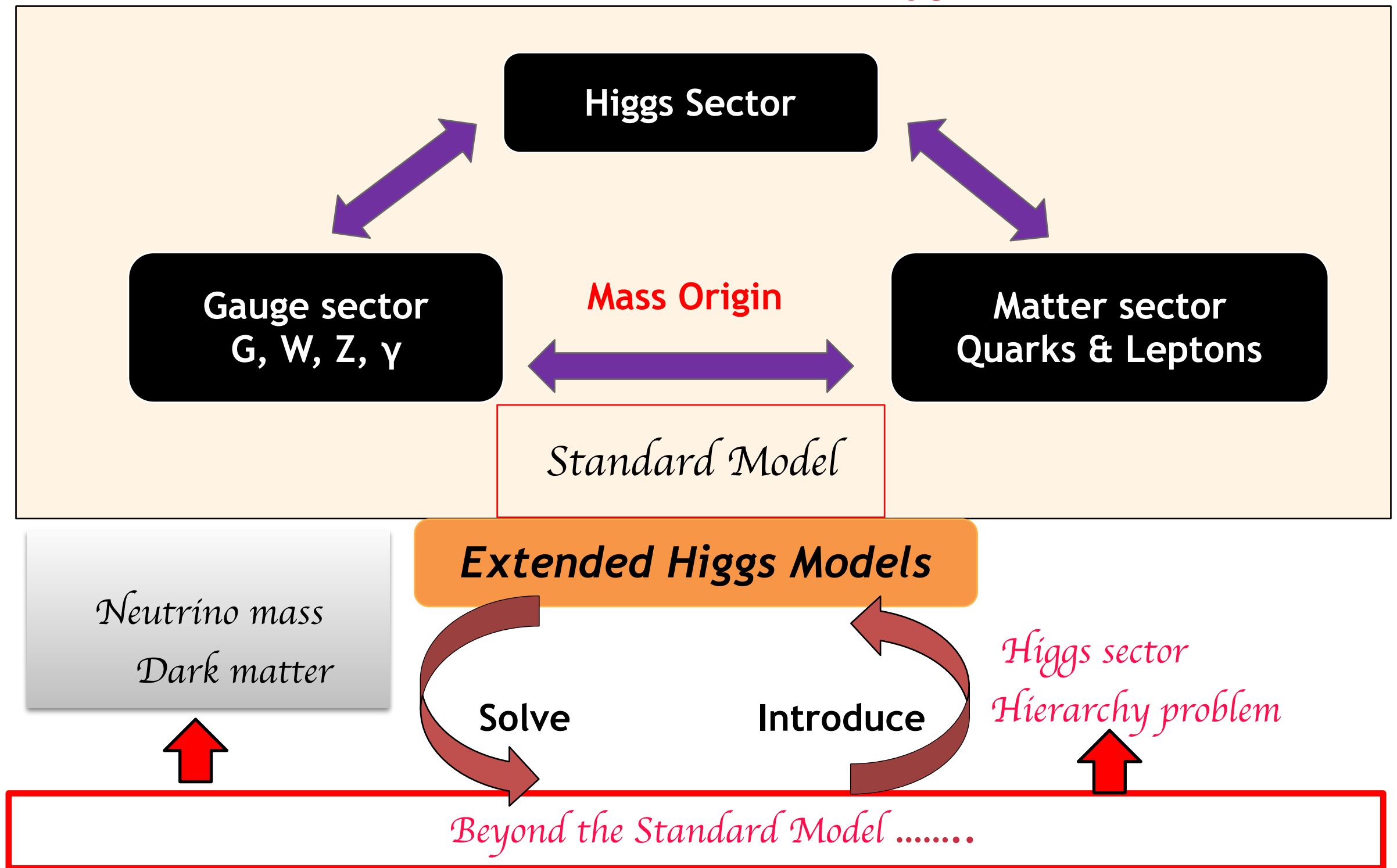


g

*(Z. Benkhaldoun & K. Berkaoui)*



# *LPHEA: HEP Phenomenology*





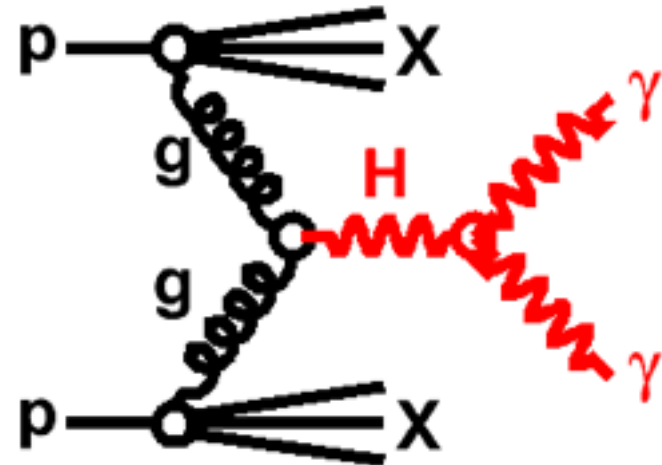


# *LPHEA: HEP Phenomenology*

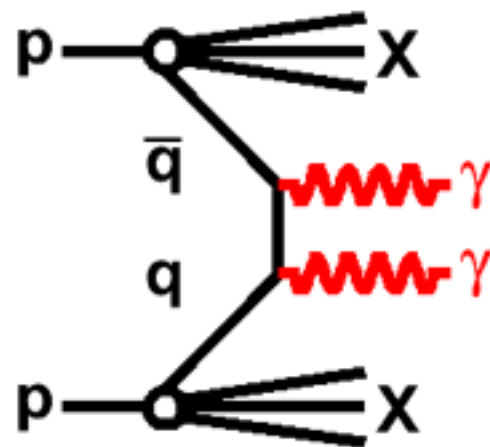
## ➤ Beyond Standard Model @ Colliders:

- Multi - Higgs Models : 2HDM, HTM, 2HDM+singlet, +Triplet,...
- MSSM, VLQ Models.

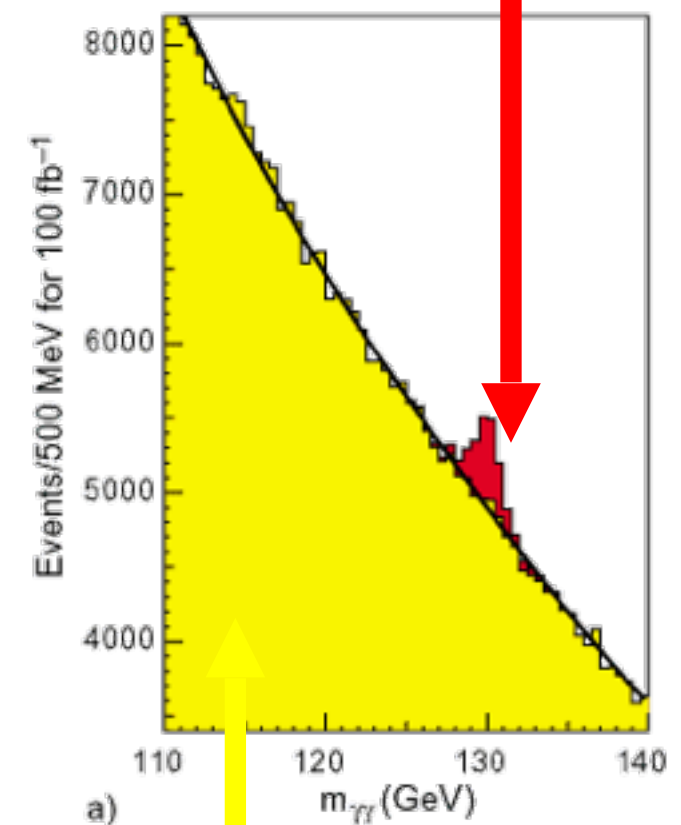
Higgs  $\rightarrow \gamma\gamma$



Background



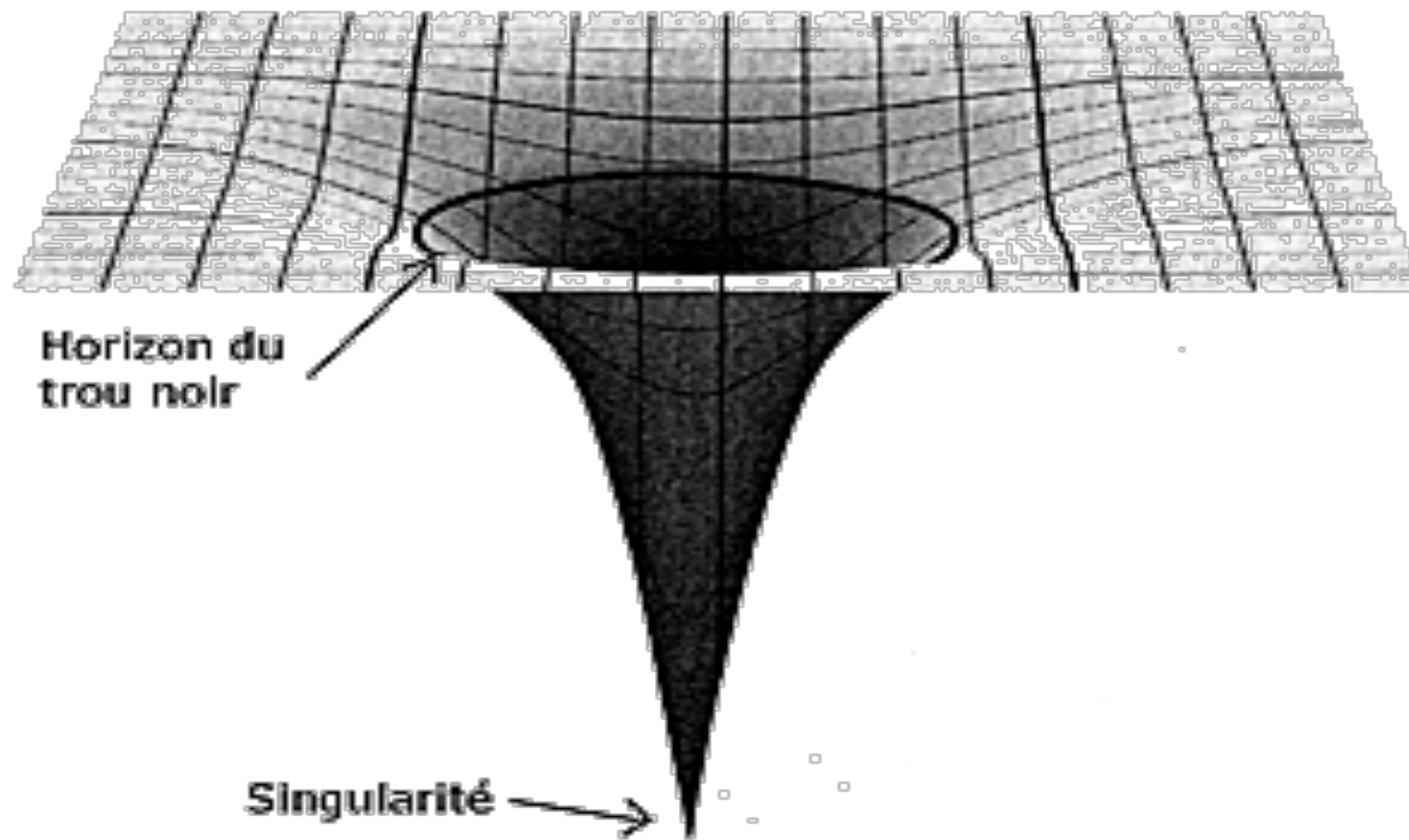
Simulation



(MC, Benbrik, Rahili, Semlali, Mouhcine, Rouchad)



# Hep - theory

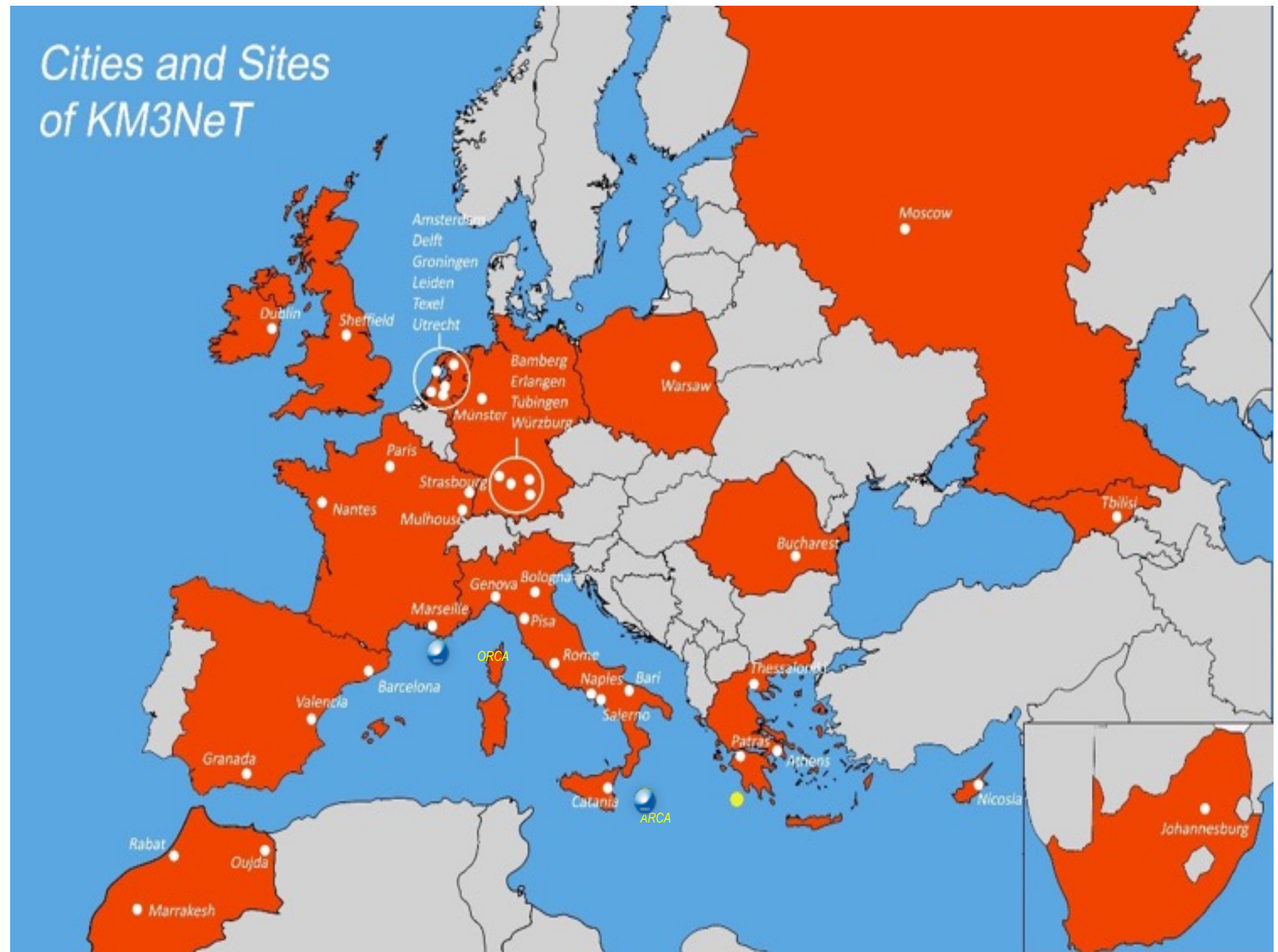


- Black holes Thermodynamics in General Relativity and Higher dimension Theories.
- Criticality and Phase transitions
- Quasi normal modes of BH: a tool to probe GW?



# KM3NeT Collaboration

- 13 Countries
- 51 Institutes
- >220 Scientists





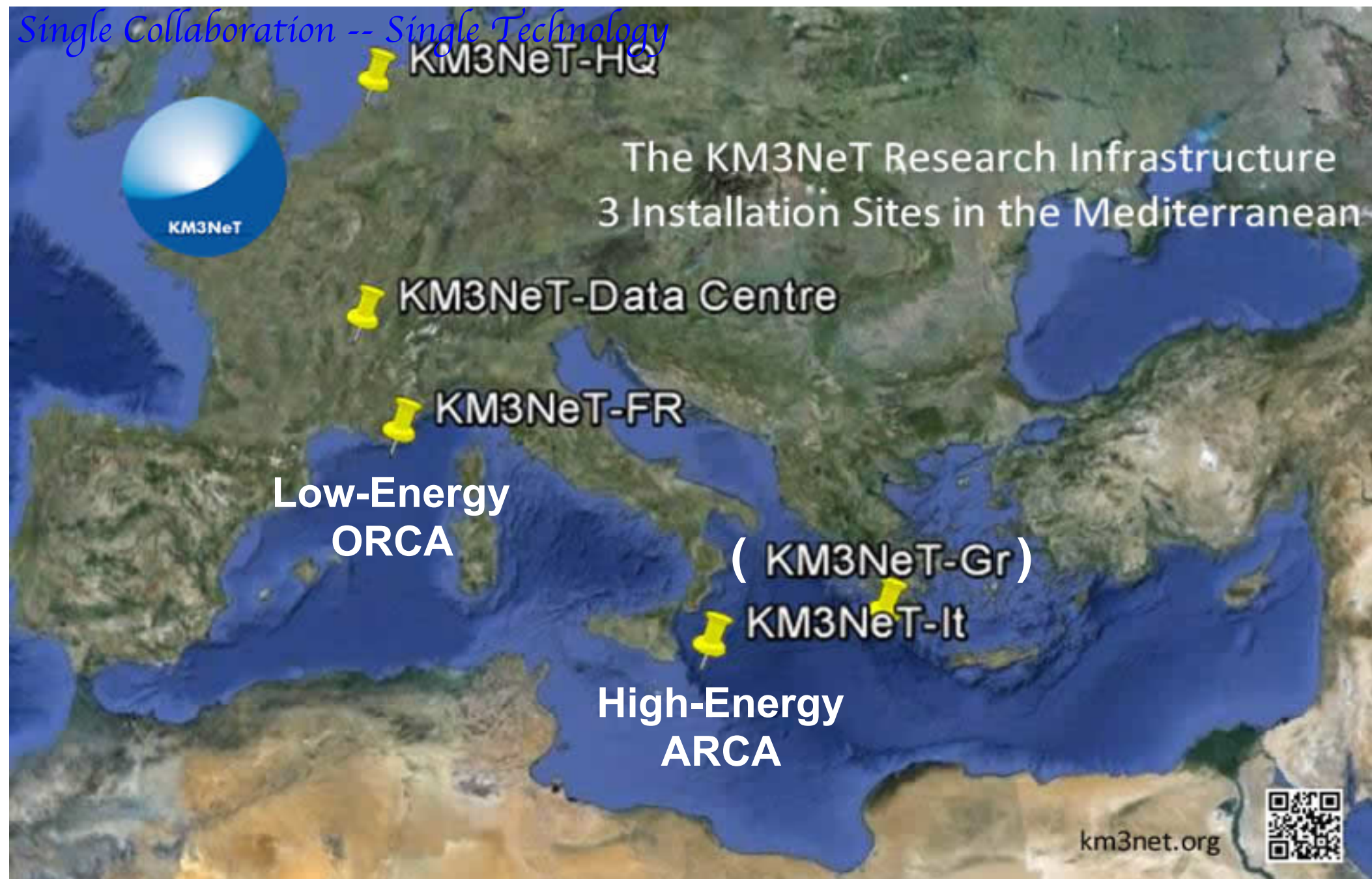
# KM3NeT: Next generation detectors<sup>13</sup>



*KM3NeT is a distributed research infrastructure with 2 main physics topics:*

- Low-Energy studies of atmospheric neutrinos*
- High-Energy search for cosmic neutrinos: Neutrino Astronomy Era*

*Single Collaboration -- Single Technology*



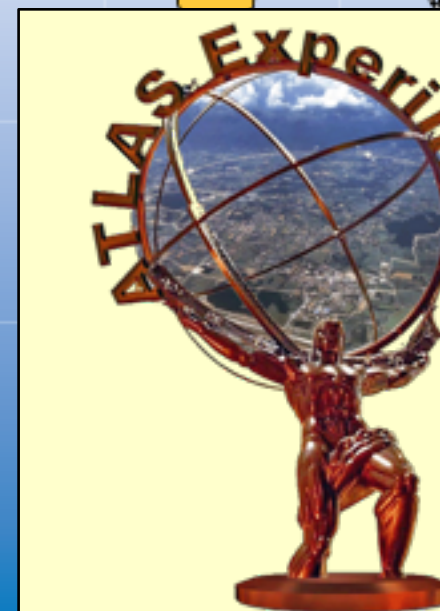


Argentina	Morocco
Armenia	Netherlands
Australia	Norway
Austria	Poland
Azerbaijan	Portugal
Belarus	Romania
Brazil	Russia
Canada	Serbia
Chile	Slovakia
China	Slovenia
Colombia	South Africa
Czech Republic	Spain
Denmark	Sweden
France	Switzerland
Georgia	Taiwan
Germany	Turkey
Greece	UK
Israel	USA
Italy	CERN
Japan	JINR

Morocco

# ATLAS Collaboration

(Goujdami & El Kacimi)



# *Nuclear & Mathematical Physics*

- *Development of new theoretical approaches within collective models: Particularly, improved geometrical model of Bohr-Mottelson.*
- *Aim: calculations of different collective properties of nuclei (Energy spectra, transition rates....)*



- *Study of nuclei properties far from the valley of stability by the method of Hartree-Fock-Bogoliubov.*
- *Analytical Solutions of many differential equations (Schrödinger, KG, Dirac,..) via powerful mathematical methods: Asymptotic iteration method or Nikiforov-Uvarov method.*

*(Oulne, MC, El Batoul, Lahbas, El Adri, Moumene)*

## Summary

- *LPHEA covers many physics research fields: ranging from nuclear and particle physics to astrophysics and astronomy.*
- *Our training program participates to the overall national efforts to prepare young generation of physicists.*
- *Marrakech group is also involved in vulgarisation of physics, particularly in particle and astrophysics via the annual Marrakech festival of astronomy.*



*Thank you*