

Conseil Scientifique de l'IN2P3 du 25-26 octobre 2018

→ Physique des événements rares : Matière noire et décroissance double beta sans neutrino V4 08/09/2018

Agenda :

Jeudi, 25 octobre 2018

Introduction :

10h00 – 10h10 : Bienvenue : Bertram Blank	10'
10h10 – 10h20 : Introduction du sujet : Alessandro Monfardini	10'
10h20 – 10h50 : La physique des événements rares : Marco Cirelli (LPTHE Paris)	20'+10'
10h50 – 11h10 : Contexte expérimental mondial DM : A. Tonazzo	15'+5'
11h10 – 11h30 : Contexte expérimental mondial NDBD : Y. Lemièrè	15'+5'

Dark Matter (DM)

- First hints already in the 1930^s (clusters of galaxies)
- In the 1970^s and 80^s rotation curves of spiral galaxies
- In the 90^s and 2000^s CMB experiments
- Gravitational lenses, galaxies formation at very high z etc.

« Needed » at all scales from local stars up to the Universe

TODAY'S SITUATION:

- **SOLID** ASTROPHYSICAL EVIDENCE FOR WEAKLY INTERACTING, COLD/MASSIVE, STABLE DARK MATTER
- **NO CONFIRMED « DIRECT » EVIDENCE YET**, i.e. AN UNAMBIGUOUS INTERACTION WITH ORDINARY MATTER (nor an unambiguous generation)

Neutrinoless Double Beta Decay (NDBD)

- If the neutrino has a mass and it is a Majorana fermion (hypothesis made in 1937) then the lepton number conservation can be violated in a « neutrinoless double beta decay »
- Hierarchy of neutrino masses, absolute scale and implications for « beyond standard model » theories

TODAY'S SITUATION:

- NEUTRINO OSCILLATIONS CONFIRMED THAT $m_\nu \neq 0$
- **NO OBSERVATION OF NDBD YET DESPITE THE IMPRESSIVE EXPERIMENTAL EFFORTS AND RESULTS**

$$\rightarrow t_{1/2}^{\text{NDBD}} > 10^{15} \cdot t^{\text{UNIVERSE}}$$

Neutrino coherent scattering (CE ν NS)

- A coherent interaction between neutrinos and all nucleons present in an atomic nucleus through the exchange of the Z boson
- Generally to “expand our knowledge of neutrino properties”
- Importance in compact astrophysical objects evolution and state

TODAY’S SITUATION:

- **EFFECT OBSERVED FOR THE FIRST TIME IN 2017**
- **NEED MORE QUANTITATIVE STUDY**

Why DM, NDBD and CE ν NS together ?

- Non-accelerators weak-interactions community
- **Common experimental techniques**
- **Working methods: maniacal care to backgrounds, patience, long-term approach ...**

IN2P3 labs (discussed in this CS)

Dark Matter

XENON1t (LAL, LPNHE, SUBATECH):
10.3 FTE (2018) and 10.1 (2017)

EDELWEISS (IPNL, CSNSM):
6.6 FTE (2019) and 8.8 FTE (2018)

DAMIC-M (CENBG, LSM, SUBATECH, LAL, IPNO, LPNHE):
24 persons (FTE not specified)

MIMAC (LPSC, CPPM):
4.8 FTE (2018)

DARKSIDE (APC, LPNHE):
3.5 physiciens (pas dans le rapport)

R2D2 and ANR NEWS (LPSC, LSM, SUBATECH):
1.2 FTE (2018)

IN2P3 labs (discussed in this CS)

NDBD

SUPERNEMO (CENBG, CPPM, LAL, LAPP, LPCC, LSM):

20 FTE (2018) and 16 FTE (2019)

CUPID (CSNSM, LAL, IPNL):

7.3 FTE (2018) ERC ongoing to partially fund the demonstrators

IN2P3 labs (discussed in this CS)

CEvNS

RICOCHET (IPNL, CSNSM):

3.7 FTE (2018) and 4.7 FTE (2019)

ERC accepted (IPNL)

**ENJOY THE REVIEWS
AND
PRESENTATIONS !!**