Scientific Council of IN2P3

October 6-7, 2025

Introduction to the Scientific Evaluation Session

Topic :

Search for neutrinoless double-beta decays

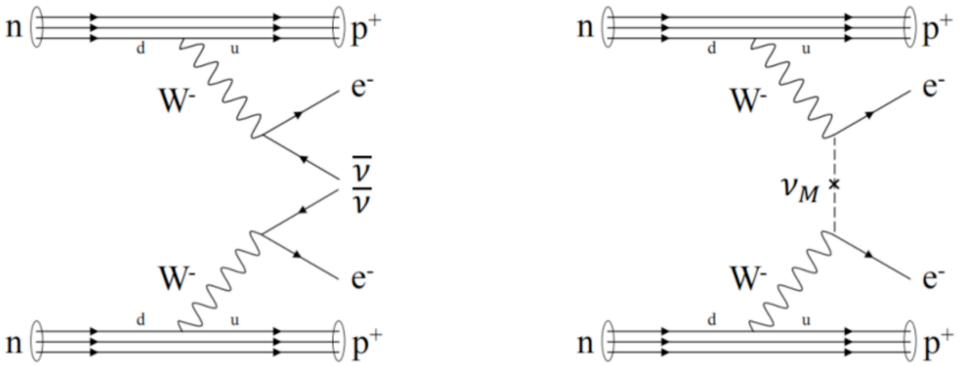
News from the Scientific Council of IN2P3

- Thank you to outgoing members for their contribution:
  - Nicolas Arbor, now scientific delegate for Nuclear Energy at IN2P3
  - James Bartlett, now French director of Centre Pierre Binetruy at UC Berkeley

  ➛ two new members will be nominated by IN2P3 director.

Search for 0νββ decays

- Scientific motivation:
  - Decay forbidden in SM: search for new physics
  - Fundamental nature of the neutrino: Dirac or Majorana?
  - Understanding the ν mass: generation, scale

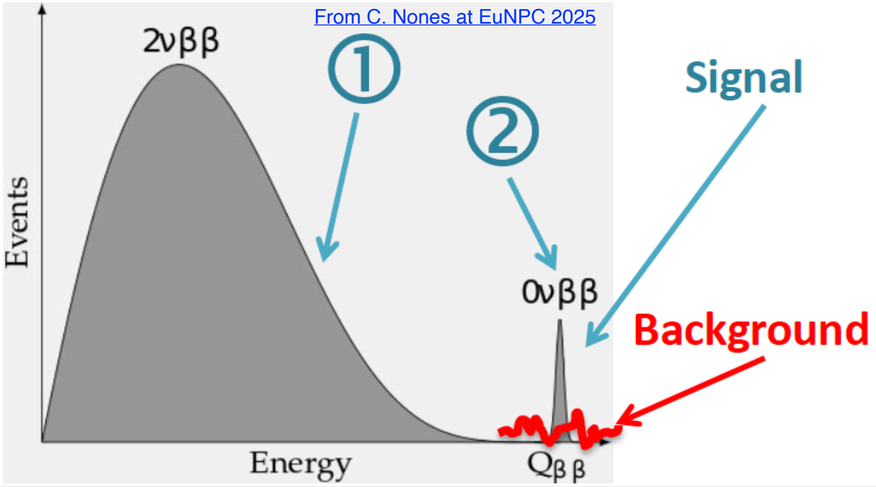


- Search strategy for the never observed 0νββ decay ②: **(A,Z) → (A,Z+2) + 2 e^- + no ν**
  - To be disentangled from already observed ①: (A,Z) → (A,Z+2) + 2 e^- + 2 ν
  - Experimental signature: $Q_{\beta\beta} = E_{e-} + E_{e+}$ ~ 2-3 MeV

    (depending on considered element)

  - Experimental challenging:

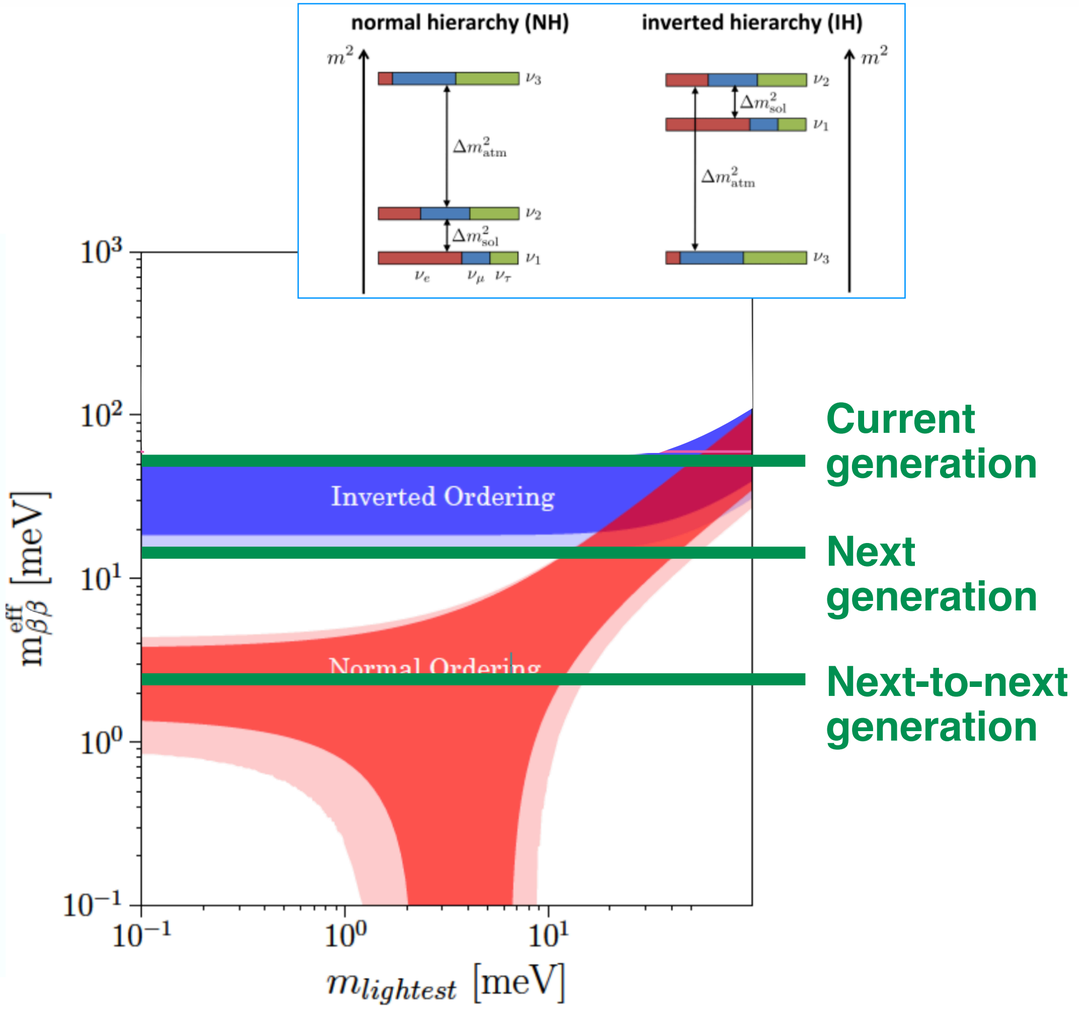
    - Isotope abundance, enrichment, ton-scale
    - High $Q_{\beta\beta}$
    - Purity
    - Energy resolution, tracking, …



Framework of the 0νββ-decay search

- Community entering a sensitive area
  - Sensitivity improving
  - Specifications increasingly challenging
- Many experiments, different optimisations
  - Different emitters
  - Different detection strategies
- Long term effort
  - New ideas for next-to-next experiments?
  - International collaborations

➢ What is the current status in France: involvement, maturity, competitiveness, collaboration, expected scientific return, …?



Search for 0νββ decays in France

- SuperNEMO: for information
  - 6.11 kg demonstrator of ^{82}Se isotope, separated from tracker-calorimeter detector
  - Detector assembly started in 2015, data taking April 2025 - end of 2026
  - @IN2P3: CPPM, IJCLab, LAPP, LPCC, LP2i
  - Reviewed by IN2P3-SC in 2005, 2011, 2018
- R2D2: for evaluation
  - Finalisation of the R&T started in 2017: high-pressure Xe gas cylindrical TPC
  - @IN2P3 labs: CPPM, LP2i, SUBATECH
  - Presented for information at IN2P3-SC 2018 session

Only at IN2P3

- CUPID: for evaluation
  - Scintillating bolometers based on Li_2MoO_4 crystals enriched in ^{100}Mo
  - Staged experiment: Stage-I data taking in 2030-2032
  - @IN2P3: IJCLab, IP2I, LP2i, and @Irfu
  - Reviewed by IN2P3-SC in 2018

Joint evaluation IN2P3- Irfu

Agenda

Open session: 6 Oct. until ~17:20

https://indico.in2p3.fr/event/36844/

Thank you for respecting the allocated time

Closed session: 6-7 Oct.

- 6 Oct. evening: place TBC
- 7 Oct.: In Salle Jean Zay (building K)

09:30 → 09:45	**Session introduction** **Speaker**: Isabelle Ripp-Baudot (IPHC, CNRS/IN2P3)	
09:45 → 10:00	**Session scoping** **Speaker**: Marcella Grasso (IN2P3)	15’ talk + 5’ Q&A
10:05 → 10:35	**The SuperNEMO experiment** **Speaker**: christine marquet	30’ talk + 20’ Q&A
10:55 → 11:15	Coffee break	
11:15 → 11:45	**The R2D2 project** **Speaker**: Anselmo Meregaglia (LP2I Bordeaux)	30’ talk + 30’ Q&A
12:15 → 13:30	Lunch break	
13:30 → 14:00	**Joint IN2P3-Irfu session scoping** **Speakers**: Marcella Grasso (IN2P3), Nathalie BESSON (Dapnia/SPP)	30’ talk + 5’ Q&A
14:05 → 14:35	**Search for neutrinoless double-beta decays** **Speaker**: Javier Menéndez (ICCUB/Barcelona University)	30’ talk + 15’ Q&A
14:50 → 15:20	Coffee break	
15:20 → 16:20	**The CUPID experiment** **Speakers**: Andrea Giuliani (CSNSM - CNRS/IN2P3), Benjamin Schmidt (CEA-Saclay), Dr Clauc Claudia Nones (CEA/IRFU/DPhP)	1h talk + 1h Q&A
17:20 → 17:25	End of the open session	

Invited experts

- **Patrick Decowski** (NIKHEF)
- **Esther Ferrer-Ribas** (Irfu)
- **Aldo Ianni** (LNGS)
- **Michel Sorel** (IFIC)

Many thanks for their useful contribution.

Next session of the CS-IN2P3

- **2-3 March 2026**

  Place to be confirmed

- **Topic:** ~~nuclear energy~~ ➛ **KM3Net**