Neutrinoless Double Beta Decay Search in XENON1T and XENONnT

Maxime PIERRE on behalf of the XENON collaboration

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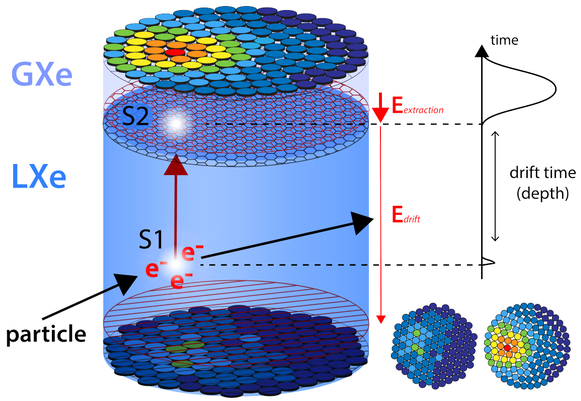
ONLINE ICRC 2021
THE ASTROPARTICLE PHYSICS CONFERENCE
Berlin | Germany
37th International Cosmic Ray Conference
12–23 July 2021

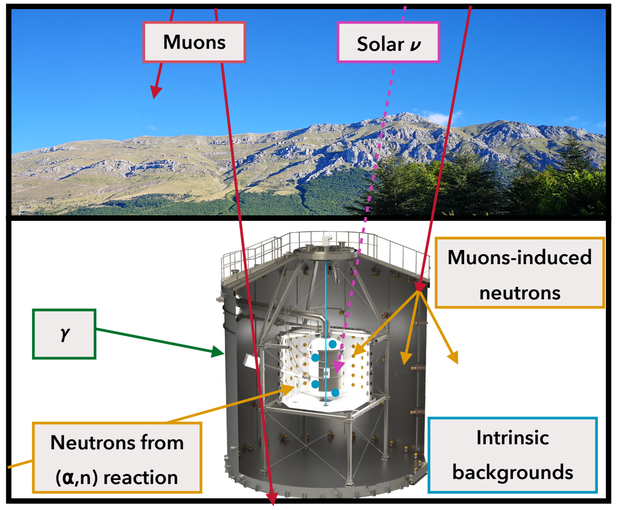
XENON

XENON Experiments

Dual-Phase Xe Time Projection Chamber:



Laboratori Nazionali del Gran Sasso



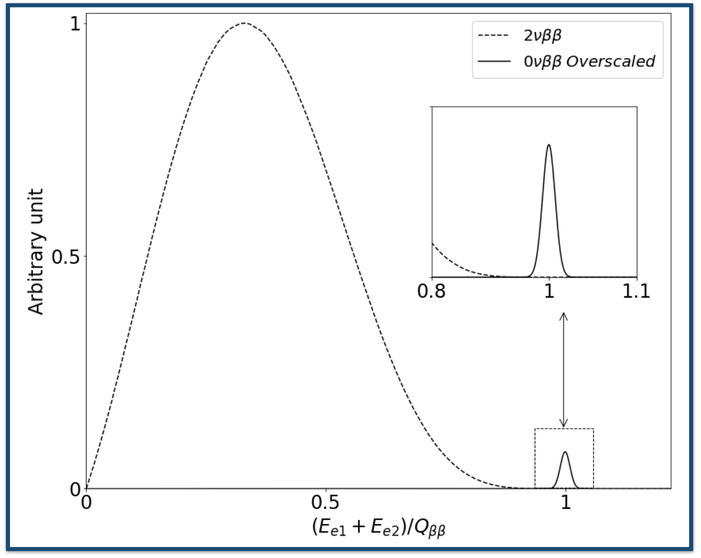
Main goal → WIMP dark matter candidate search
Current best-limit hold by XENON1T

Sensitive to other rare event searches → $0\nu\beta\beta$ decay

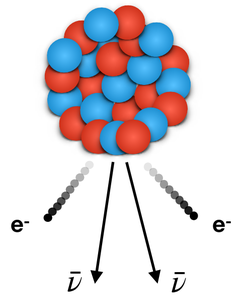
$0\nu\beta\beta$ decay

True Nature of Neutrino:

- Dirac or Majorana particle?
- Probe to answer this question → $0\nu\beta\beta$ decay
- Studied isotopes in XENON1T/nT:
  - ^{136}Xe, natural abundance: ∼8.9%
  - $Q_{\beta\beta}$ = 2457.83 ± 0.37 keV [1]

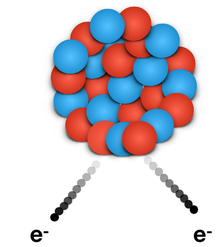


2νββ



- Rare process
- Observed in several isotopes
- Allowed in the Standard Model

0νββ



- Never observed so far
- Forbidden in the Standard Model
- Lepton number violation

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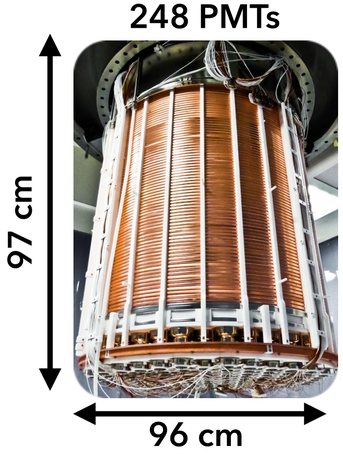
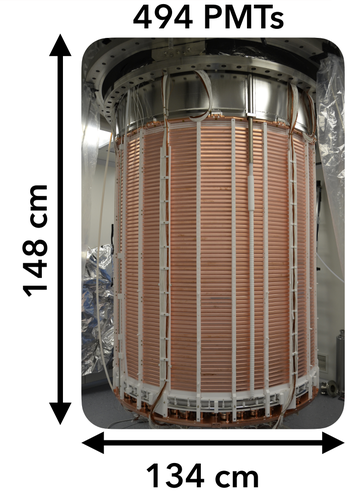
XENON1T: The Past

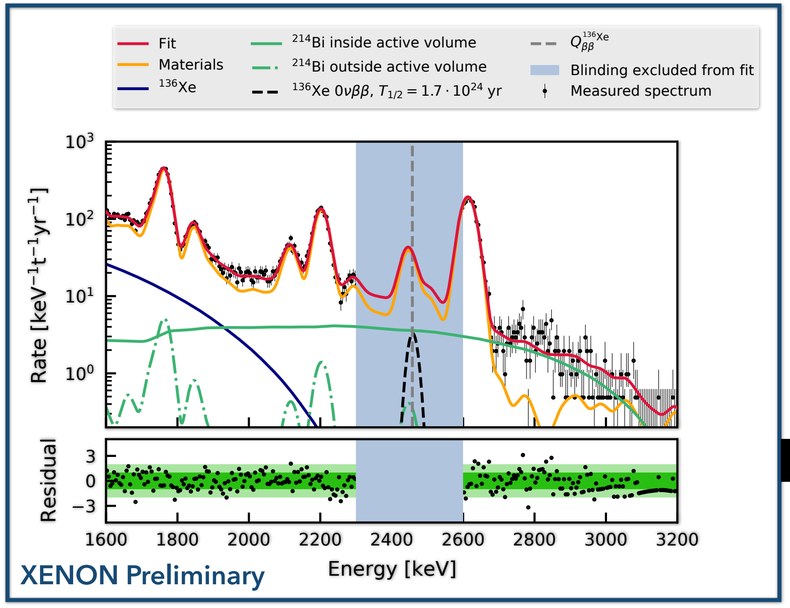


- Study of the detector response @ High energy
- Signal correction allowing an energy resolution @ $Q_{\beta\beta}$: ~0.8% (σ/μ)
- Blinded data analysis in the [2.3, 2.6] MeV ROI with a Livetime of 202.7 days.
  - **Expected sensitivity:** 1.7 x 10^{24} yr

XENONnT: The Present

- Improvements for $0\nu\beta\beta$ decay search wrt XENON1T:
  - Target mass increase (x3)
  - Background reduction (x1/10)
  - New dual-readout to avoid signal saturation
- Updated studies of the background models with inclusion of two internal backgrounds negligible in XENON1T → ^{137}Xe β-decay, ^{8}B solar neutrino





MC simulation studies

Internal & external background models

Signal model

Interested in this topic ?
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