LIP Dark Matter Group

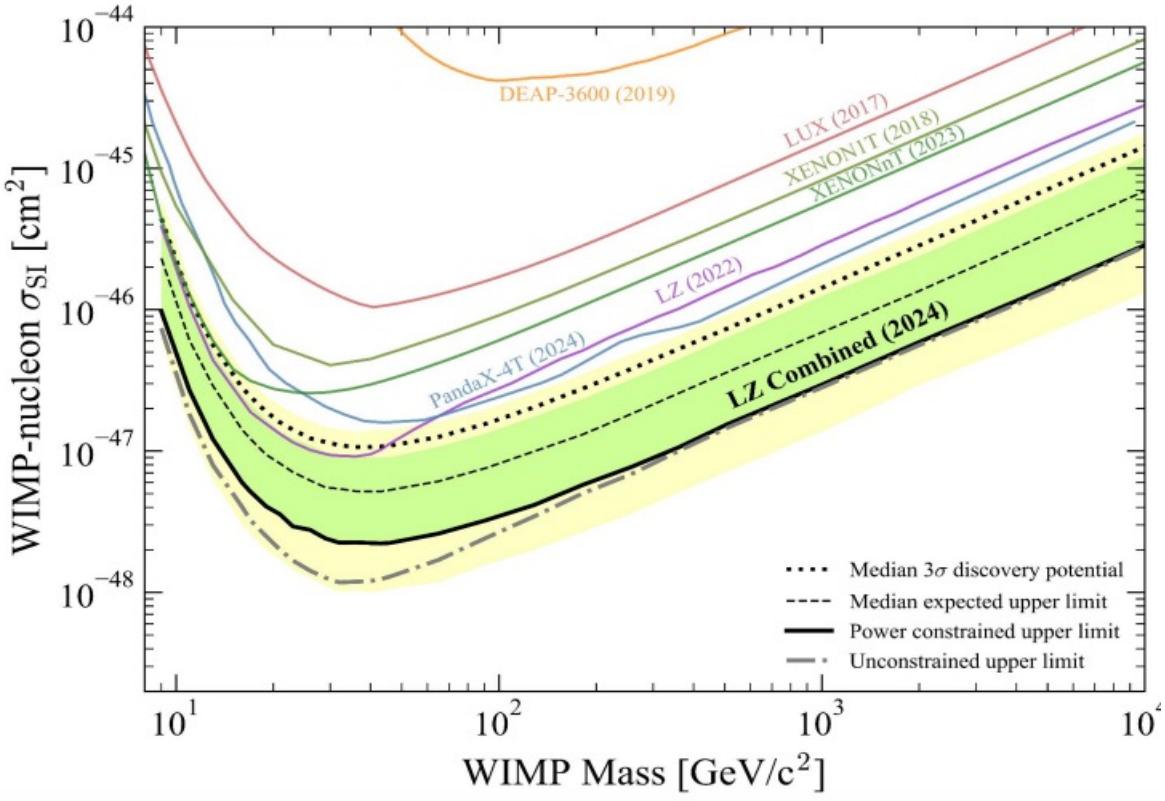
In 2024

- Isabel Lopes (PI)
- Alexandre Lindote (Researcher)
- Cláudio Silva (Researcher)
- Francisco Neves (Researcher)
- Paulo Brás (Researcher)
- Vladimir Solovov (Researcher)
- Guilherme Pereira (Researcher)

- Kai Jenkins (PhD student)
- Sandro Saltão (PhD student)
- Rui Ferreira (MSc student)

LIP Dark Matter Group @LZ (2024)

In 2024, **LZ released** a **new world-leading** WIMP search result



- total exposure of 4.2±0.1 tonne-years from 280 live days of LZ operation

- strongest SI exclusion limit: 2.1×10^{-48} cm^2 at a mass of 36 GeV/c^2

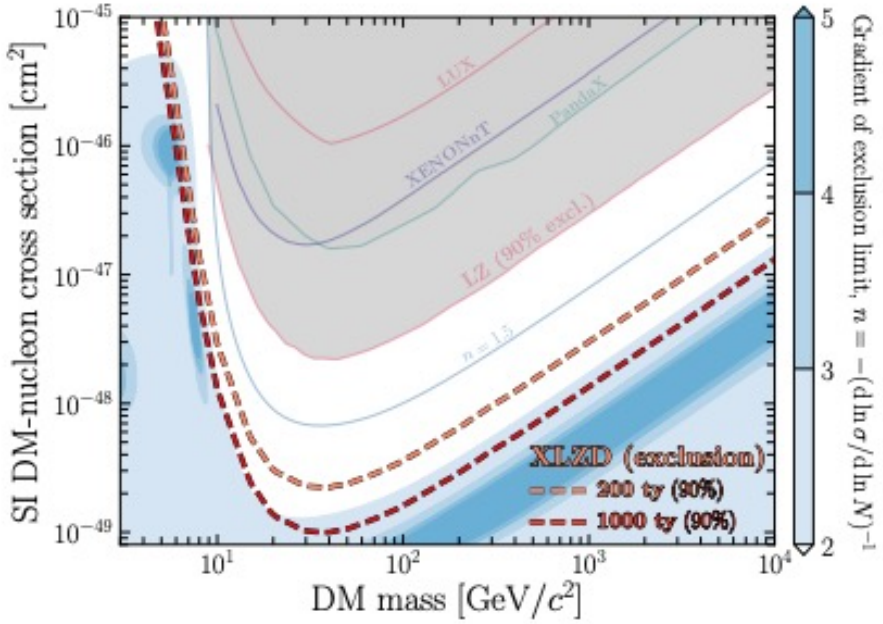
LIP main contributions include:

- Paulo Brás held the position of **LZ Data Analysis Coordinator** from 8/2022 to 12/2024
- Full responsibility for the recalibration of position reconstruction and spatial-dependent signal corrections.
- Development of data analysis tools for pulse identification and characterization, as well as position and energy reconstruction
- Underground Performance Monitor system (full responsibility)

LIP Dark Matter Group @ XLZD (2024)

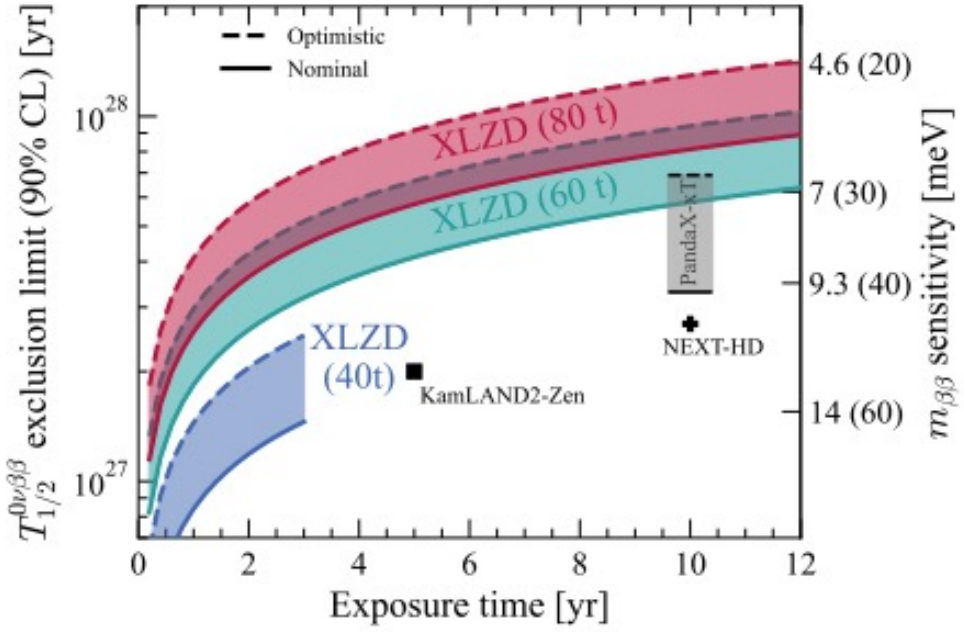
XLZD consortium **transitioned to an official collaboration** in 2024

Main goal: Build and exploit the next-generation xenon observatory **sensitive to dark matter and neutrino physics** based on a 60-80 t xenon dual phase TPC



Main XLZD achievement in 2024:

- Completed the XLZD Design Book, first publication on the experimental and technological strategy and the science reach of the experiment (**arXiv:2410.17137**).



Main LIP contributions:

- Led the first XLZD sensitivity study on the search of 0ν2β decay in ^{136}Xe (arXiv:2410.19016)
- Participated in XLZD Design Book
- Contributed to the site down select report

LIP Dark Matter Group in 2025

- **Participation in LZ experiment**
  - Focus on data analysis, in particular the data analysis in search of the $0\nu2\beta$ decay of Xe-136, which we lead.
  - **Paulo Brás is the LZ Deputy Physics Coordinator** since February 2025
- **XLZD Collaboration**
  - Present main focus on $0\nu2\beta$ decay of Xe-136 sensitivity study
  - Simulation of the high-energy external gamma-rays background
  - Development of a backgrounds control tool
  - Contribute to the design of the top light sensor array

Main challenges:

- To secure funding for the participation in LZ/XLZD
- To get FCT signing the MoU for XLZD (2025)
- To attract more PhD students!

SWOT analysis

Strengths	• A team with strong expertise on the various aspects involved in a direct detection of dark matter experiment • The group holds 4 key coordination positions in LZ & XLZD, including the **LZ Deputy Physics Coordinator** (P Brás)
Weaknesses	• We lost 2 researchers in 2024 (due to lack of funding). • Only 1 MSc and 2 PhD students.
Opportunities	• Extend our expertise; • Open the possibility of participating in cutting-edge projects • Attract students.
Threats	• **No funding since November 2024.** • We applied to a Grant at the PTDC 2023 Call in January 2024 but no response so far. This call favours applied projects...