



PPD Seminar

LZ Data Analysis Pipeline for the 4.2 Tonne-Year WIMP Search

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19 Nov 2025, 11:30

R61 CR03 (RAL)

Solving the true nature of dark matter is among the highest priorities in modern experimental physics. To date, there are myriad particle-like dark matter candidates predicted by various extensions of the Standard Model, but one class of candidates have received the most investment and attention by far: Weakly Interacting Massive Particles (WIMPs). Within the highly competitive landscape of WIMP search experiments, those using noble liquid time projection chambers (TPCs) have come to dominate the field. Here we focus on the LUX-ZEPLIN (LZ) experiment, which is a tonne-scale dual-phase xenon TPC hosted at the Sanford Underground Research Facility in Lead, South Dakota, USA. LZ's latest WIMP search results comprise data taken over 4 calendar years, culminating in a 4.2 tonne-year exposure. Discussed in this seminar is the LZ analysis pipeline, which includes the following components: (i) background mitigation and characterisation, (ii) noble liquid microphysics modelling, (iii) liquid xenon flow control and the radon-tagging technique, (iv) the neutron anti-coincidence veto system, (v) modelling of recombination enhancement in ^{124}Xe double electron capture, and (vi) statistical inference. These elements combined into a single analysis produced the current world-leading upper limits on both spin-independent and spin-dependent WIMP elastic scattering cross-sections in the mass range $\geq 9 \text{ GeV}/c^2$.

