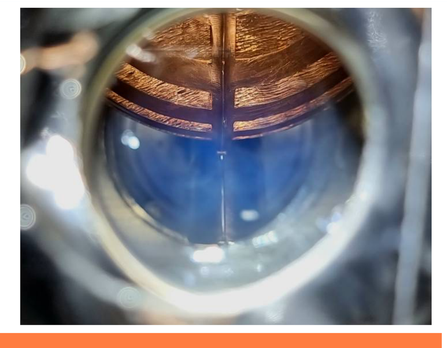
Xenoscope: a full-scale vertical demonstrator for the DARWIN observatory

Laura Baudis, Alexander Bismark, Yanina Biondi, Jose Cuenca García, Paloma Cimental, Michelle Galloway, Frédéric Girard, Ricardo Peres, Diego Ramírez García,Patricia Sanchez-Lucas, Kevin Thieme, Christian Wittweg

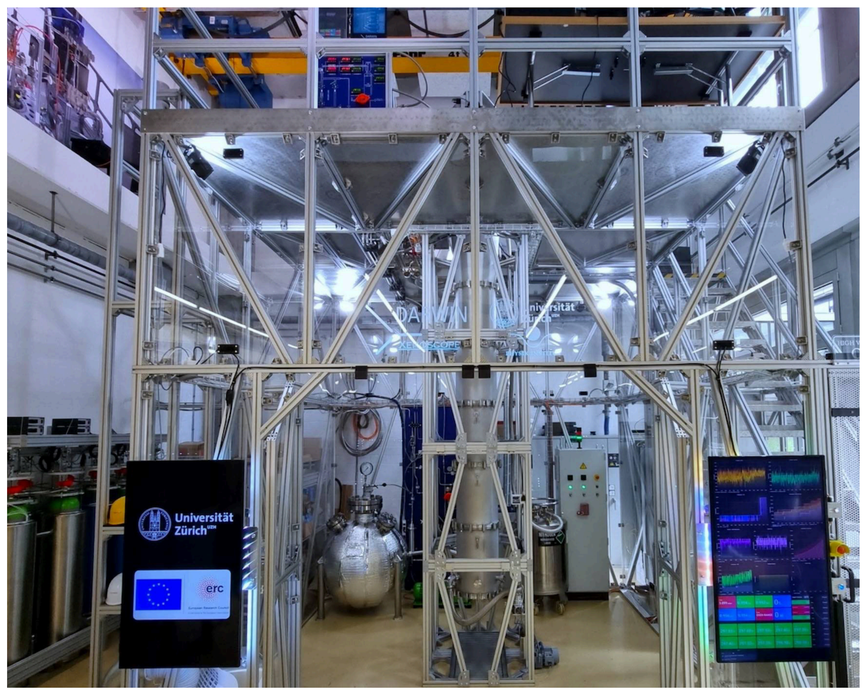
Department of Physics, University of Zurich, Switzerland

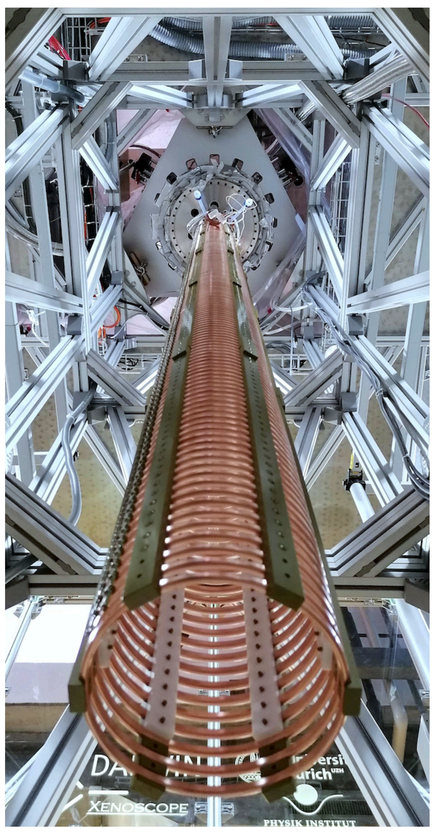
arXiv:2303.13963



The Xenoscope R&D platform at the University of Zurich

- The physics case for a large, xenon-based underground detector for dark matter and other rare event searches is compelling
- A dual-phase TPC offers good energy resolution, 3D position reconstruction and particle discrimination
- Xenoscope was built to address technological challenges related to the design and construction of a 50 t scale (and beyond) TPC
- The facility includes: gas handling & storage system, cryogenics & purification system and a slow control
- It currently houses a 2.6 m tall, two-phase TPC with a SiPM array in the gas phase, in a double-walled cryostat containing 400 kg of xenon

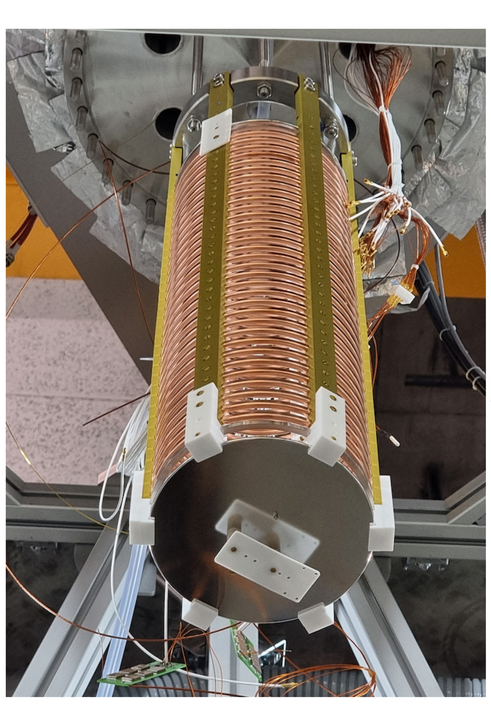


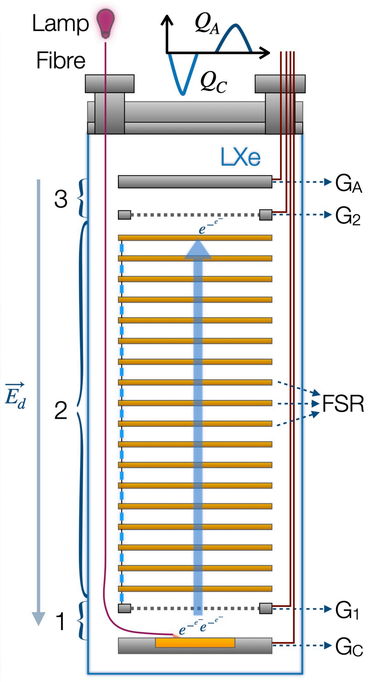


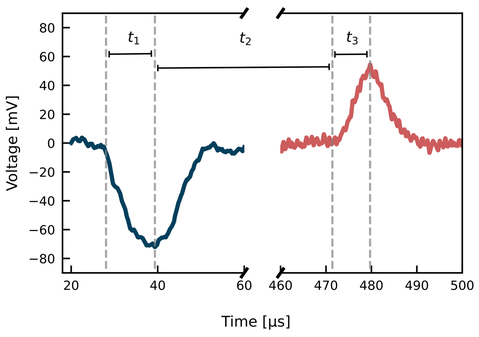
The Xenoscope facility (left) and the 2.6 m tall TPC (right) before its installation in the inner cryostat

Two phases: a xenon purity monitor and a 2.6 m tall dual-phase time projection chamber

- In a first phase, a 53 cm tall purity monitor was operated for 89 days, with a total of 343 kg of xenon in the cryostat
- The xenon recirculation flow was varied between 30 and 40 slpm, and the electron drift lifetime was measured for different flows, with a final value of (664±23) μs
- The drift velocity and the longitudinal diffusion coefficient were measured as a function of drift field (from 25-75 V/cm), and compared to NEST predictions, as well as to literature values

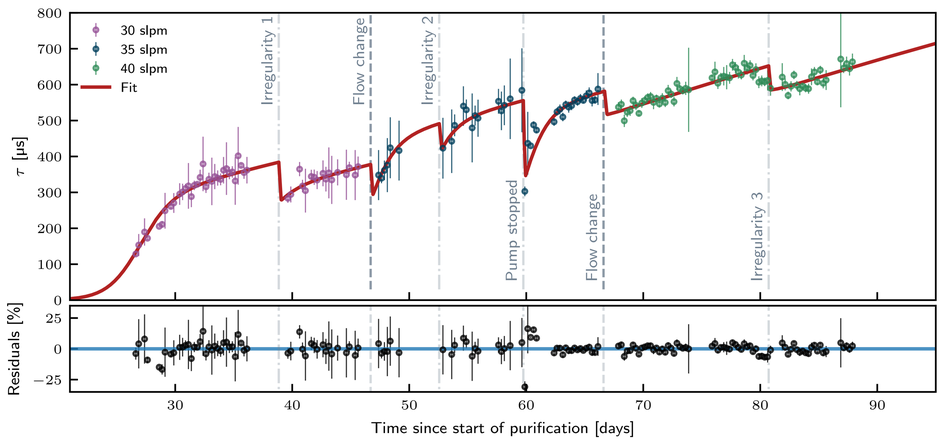




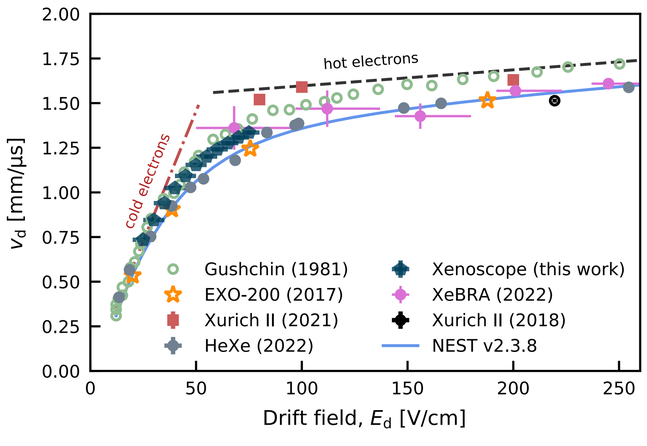


Picture (left) and schematic (centre) of the 53 cm tall purity monitor, with signal examples (right) acquired at the cathode and anode

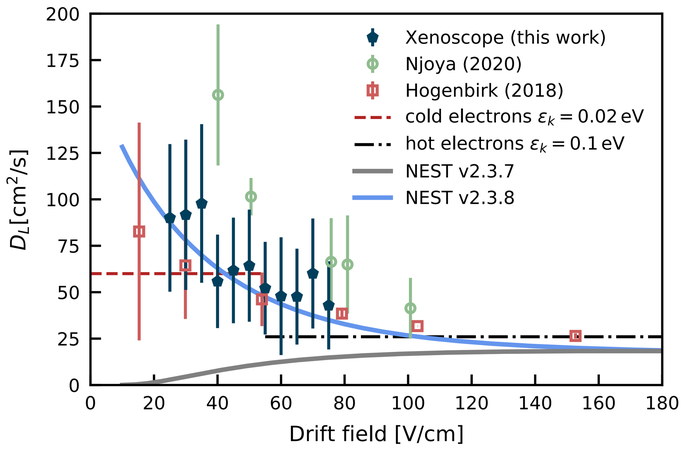
Electron drift lifetime for different xenon flows



Electron drift velocity as a function of field



Diffusion coefficient as a function of field



Links and Info https://www.physik.uzh.ch/en/groups/baudis/Research/Xenoscope.html

University of Zurich[UZH]

European Research Council
Established by the European Commission

DARWIN

L. Baudis et al., Design and construction of Xenoscope – a full-scale vertical demonstrator for the DARWIN observatory, JINST 16 (2021) P08052.