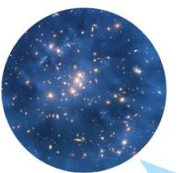
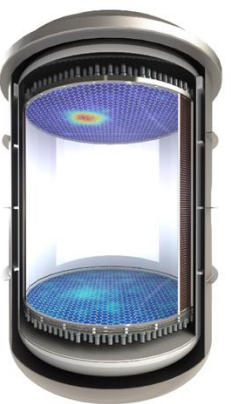


MOTION — Enabling Next-Generation XLZD Dark Matter Searches

Dark Matter

WIMPs
Sub-GeV
Inelastic
Axion-like particles
Planck mass
Dark photons



Neutrino nature

Neutrinoless double
beta decay
Neutrino magnetic
moment
Double electron
capture

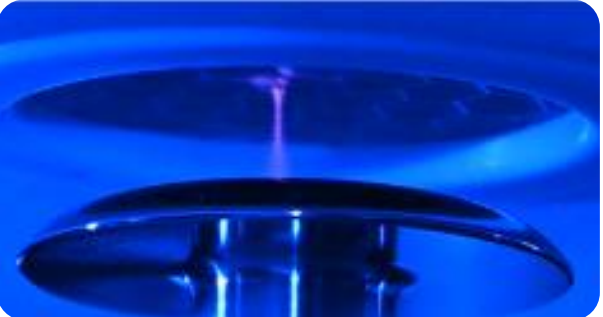
Supernovae

Early alert
Supernova neutrinos
Multi-messenger
astrophysics



Sun

pp neutrinos
Solar metallicity
⁷Be, ⁸B, hep



- ❖ Bulk LXe breakdown: ~1 MV/cm
- ❖ Observed breakdown: 70-150 kV/cm

Motion: a dedicated testbed

- ❖ Light
- ❖ Current/deposited energy
- ❖ Bubbling, arc discharge
- ❖ Electronegative purity
- ❖ Liquid level
- ❖ Pressure and temperature
- ❖ Electrical field simulations
- ❖ Custom HV feedthrough
- ❖ Electrode surface studies



Welcome to
Poster 28

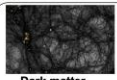




MOTION — Enabling Next-Generation XLZD Dark Matter Searches
Keyu Ding*, Yanina Biondi, Alexander Jansen, Michael Schrank, Tom Sonius

MOTION is a Time Projection Chamber (TPC) with 70 kg of liquid xenon (LXe), serving as a testing platform for breakdown studies and high-voltage (HV) delivery of around -200 kV in LXe for next-generation dark matter detectors

What is XLZD?



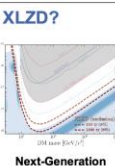
Dark matter



Supernova



TPC



Electric field (kV/cm) vs. distance (cm)

Next-Generation Observatory for Rare Events: A Joint Effort of LZ, XENONnT, DARWIN, and nEXO

What is breakdown in LXe TPC?



Breakdown

Bulk LXe breakdown: ~1 MV/cm
Observed breakdown: 70-150 kV/cm
Limits detector performance
Affected by purity, stressed surface, pressure

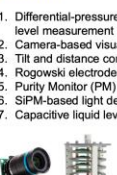
MOTION: Dedicated test platform



Light
SIPM

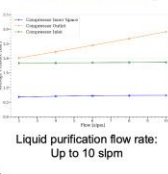


Current/deposited energy
Anode current readout



Bubbling, arc discharge
Camera

Stable commissioning



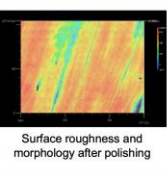
Liquid purification flow rate: Up to 10 slpm

Electrode field simulations



Various shapes, angles and distances
Custom HV feedthrough
Low radioactivity, ultra-HV

Electrode surface studies



Surface roughness and morphology after polishing

Carbon nanotubes (CNT) PM



Small footprint

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