Dark Matter
LZ + R&D

IC-HEP Open Day
5th Jan 2022
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Mass Scale of Dark Matter

10^{-22} \text{ eV} \quad \text{QCD axion classic window} \quad 10^4 \text{ - } 10^5 \text{ eV} \quad \text{WDM limit} \quad \text{GeV} \quad \text{unitarity limit} \quad 100 \text{ TeV} \quad M_{\text{pl}} \quad 10 M_{\odot}

``Ultralight'' DM
non-thermal bosonic fields

``Light'' DM
dark sectors
sterile neutrino can be thermal

WIMP

Composite DM
(Q-balls, nuggets, etc)

Primordial black holes

Direct Detection & LXe Time Projection Chambers
100x more sensitive than predecessor (LUX 250kg)

*white plastic material; PTFE (Teflon), chosen to reflect Xe scintillation light
ER (BG-like) vs. NR (WIMP-like)

Ionisation vs. Excitation vs. Heat

Time

Photons

S1, S2

Electrons

Incoming Particle
Assembled in Clean Room
Being commissioned at 4850ft UG in SURF SD
World leading results expected in 2022
Operating in UK-wide R&D effort IC has many contributions to:

- Target doping (could lower mass range sensitivity)
  - Xenia at IC: LXe detector (only one in the UK)

- Development of new SiPM photodetector array (potential next step for LXe TPCs)
  - Fully operational testing setup at IC

- Migdal experiment; first measurement of expected low-energy physics (lower mass range sensitivity)
  - Built by IC & RAL operated in ISIS n-beam

All providing first hand, state of the art Lab experience and direct access to data.