THE UNIVERSITY of EDINBURGH
School of Physics & Astronomy

Summary of our First Cross-Institute Dark Matter Meeting

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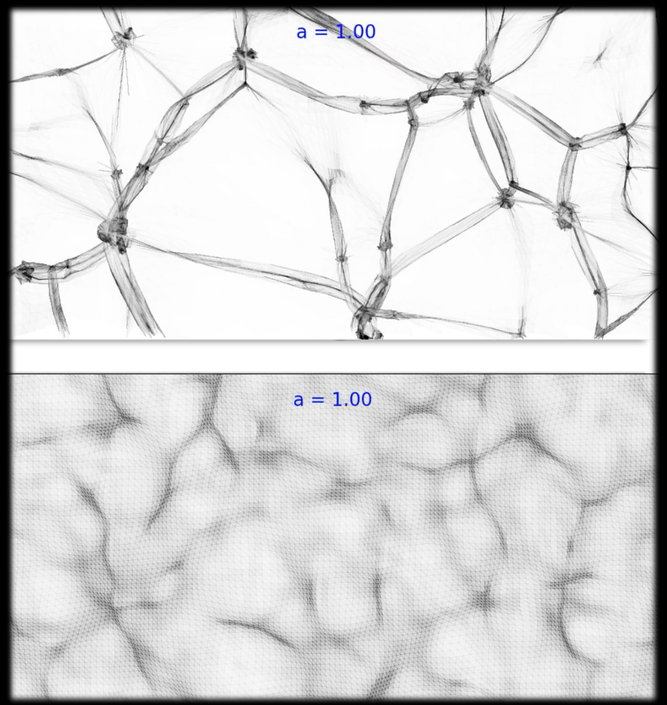
Cross-Institute DM Meeting - 5th September

- Thank you to Michael Petersen and Celine Boehm who helped me organise and find speakers!
- The meeting was well attended by both up-the-hill and down-the-hill, with around 35 attendees total
- Each “area’ (astro, PPE and PPT) summarised their ongoing research related to Dark Matter.
- The broad plan is to make this semi-regular. We will have another one in December(?) with longer, more detailed talks on specific pieces of research.

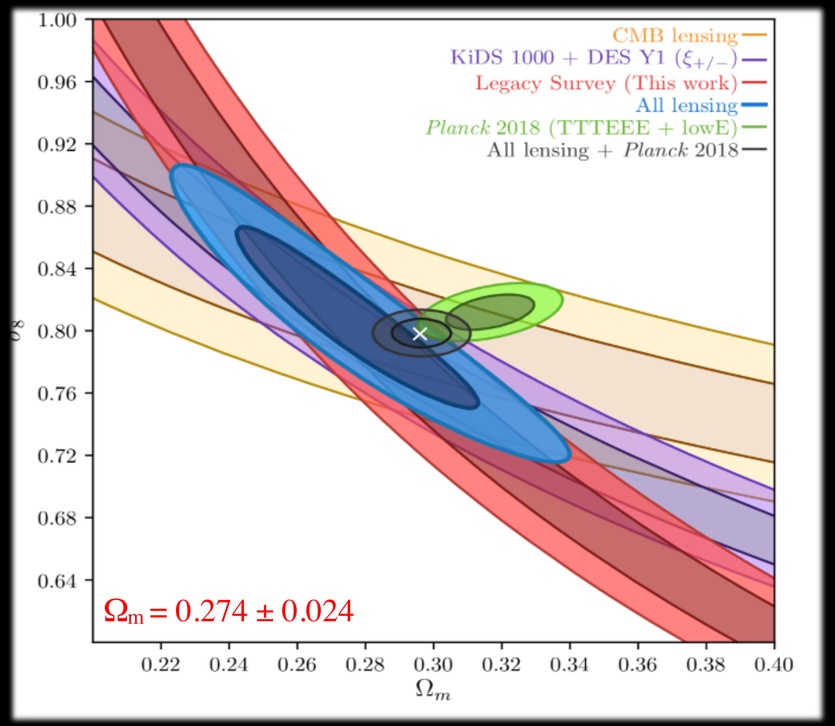
A Snapshot of Dark Matter Research at the IfA:

Michael Petersen + many others!

- Cosmology
- Cosmological Simulations
- Near-field Observations and dynamical modeling
- Astrophysical dark matter candidates



Modelling the cosmic web with (top) and without (bottom) DM

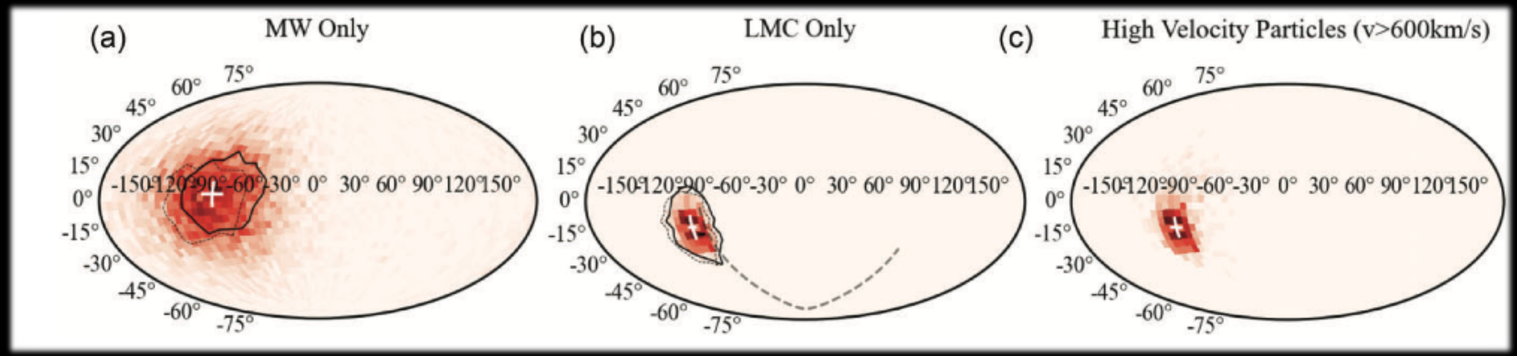


CMB Lensing Tomography

Also of possible interest:

- High redshift baryonic observations
- More cosmological simulations

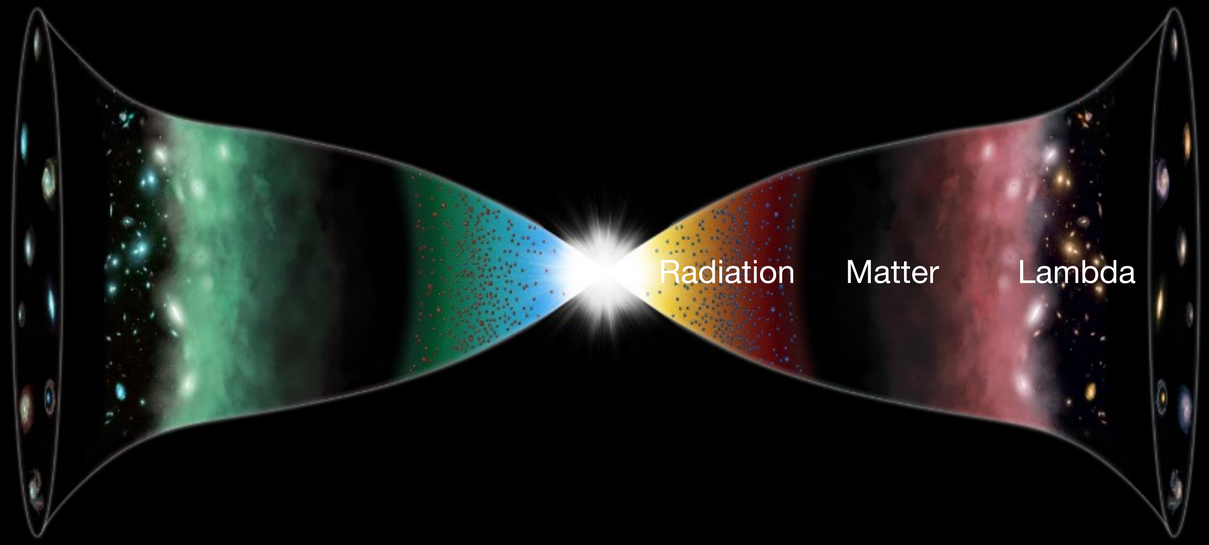
Response of the Milky Way halo to the DMC and implications for Direct Detection



A Snapshot of Dark Matter Research in PPT:

A Stable Right-Handed Neutrino as the Dark Matter

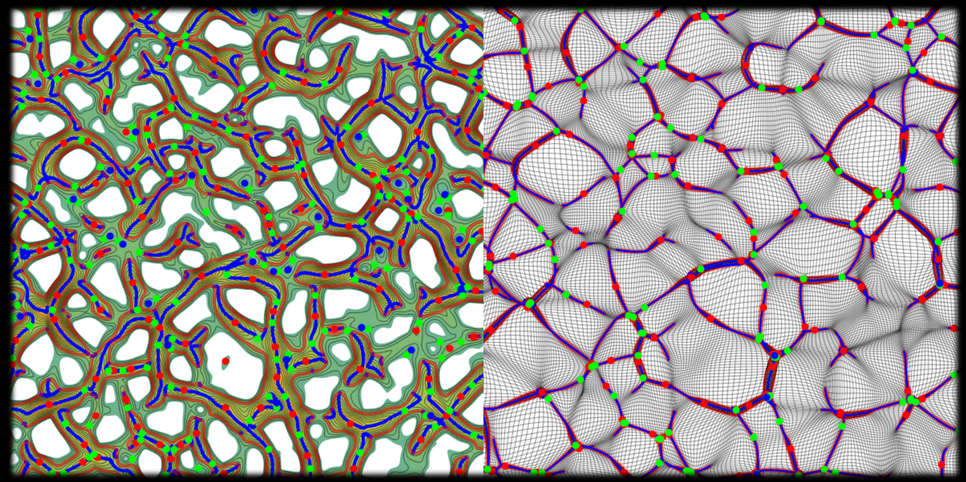
Latham Boyle, Kieran Finn & Neil Turok,
Phys. Rev. Lett. 121 (2018) 251301; *Annals of Physics* 438 (2022) 168767



ν_R field equation is regular at the bang: select CPT-symmetric vacuum state
predict density of stable ν_R's in the "out" regions

if one ν_R is stable, its density matches Ω_{DM} if its mass $M \approx 5 \times 10^8$ GeV

Caustic Skeleton & Cosmic Web

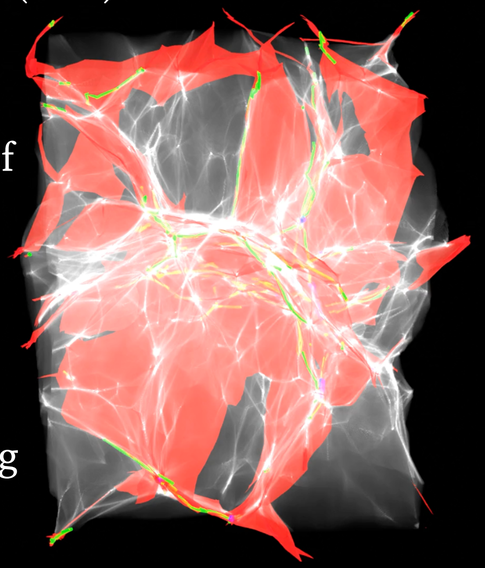


Job Feldebrugge et al
JCAP 05 (2018) 027, *JCAP* 02 (2023) 058

Caustic skeleton: a new geometric toolkit that defines the different elements of the cosmic web in terms of their unique formation histories.

We can use caustics to explore how dark matter shapes our universe.

This could improve our understanding of dark matter and may yield new probes for cosmology.

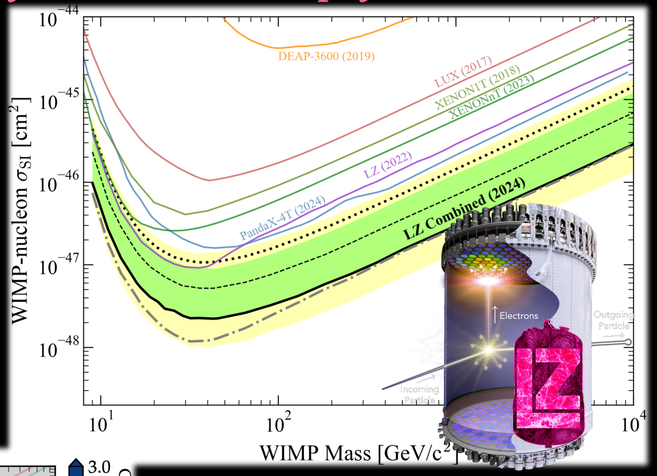


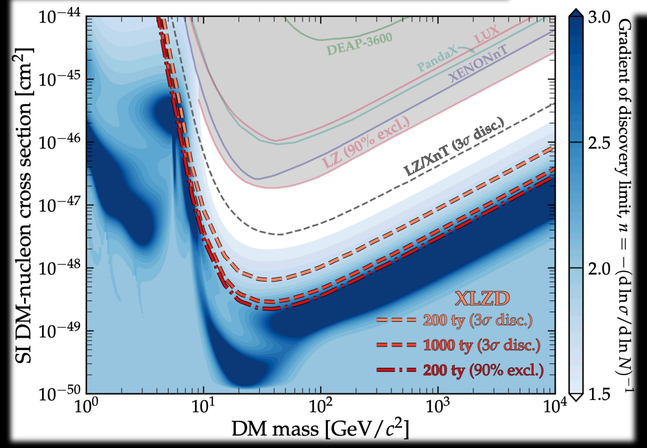
A Snapshot of Dark Matter Research in PPE:

Liquid Xenon *Sally Shaw, Alex Murphy*

World-leading LZ experiment located in Lead, South Dakota. New constraints on WIMP DM above **2.2x10^{-48} cm^2**

Edinburgh lead on neutron backgrounds/veto detectors and low energy electron recoil signal such as axions, ALPs, hidden photons...





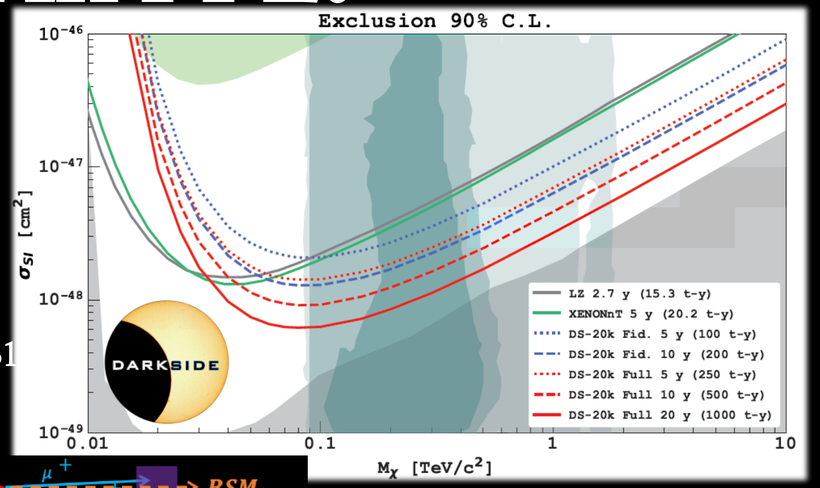
XLZD - merger of XENON, LZ, DARWIN:
60-80T of LXe - ultimate probe of WIMPs to neutrino floor and sensitive to neutrino physics
Potentially to be hosted in UK at Boulby Underground Laboratory!

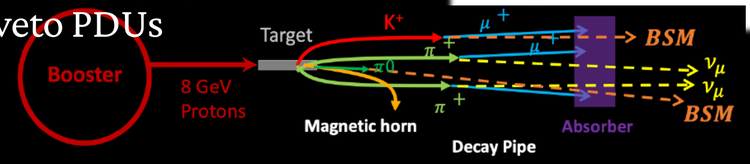
Andrzej Szelc

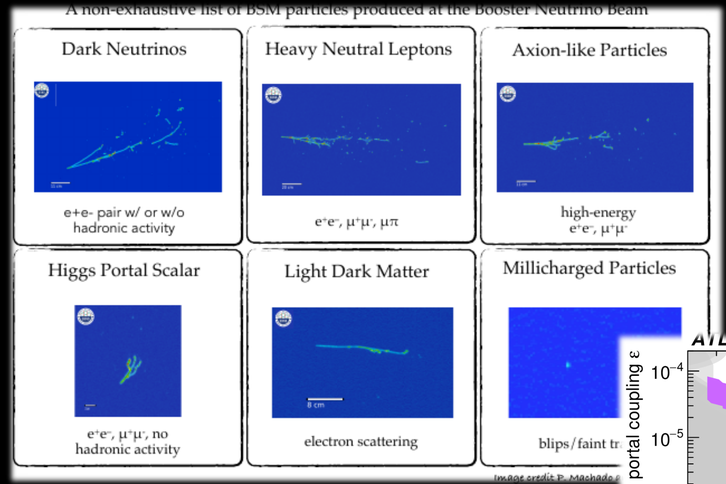
Darkside-20K under construction at Gran Sasso National Lab in Italy.

Expected to run 2026 - 2031

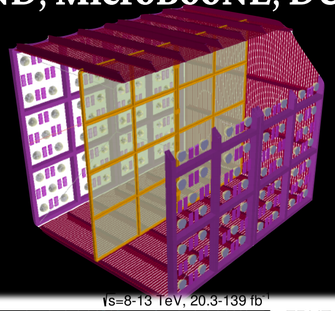
Edinburgh group testing veto PDUs





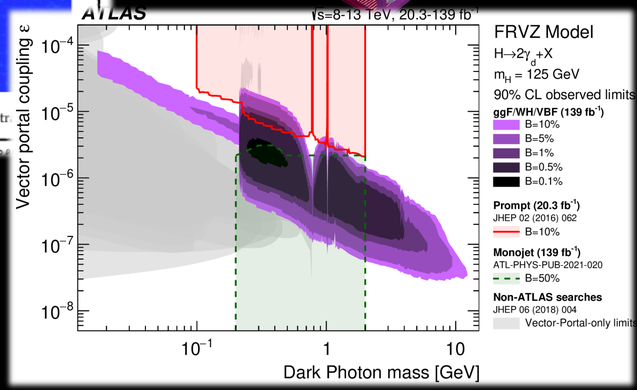


Accelerator neutrino experiments with sensitivity to DM candidates:
SBND, MicroBooNE, DUNE



Collider Searches

Dark Photon searches at ATLAS: search for dark sector particles using displaced lepton jets in Higgs decays



Dark Matter Day

Every year on Halloween! Next year we hope to do something much bigger aimed at the general public.

More help with outreach is ALWAYS welcome...

This year, I'm giving a general interest seminar, and we will have two inflatable planetarium shows in the Nucleus beforehand courtesy of ROE(details/booking to be circulated shortly)!

DARK MATTER DAY

everyone loves a mystery

ARE YOU AFRAID OF THE DARK?

The Subterranean Search for Dark Matter

DARK MATTER DAY

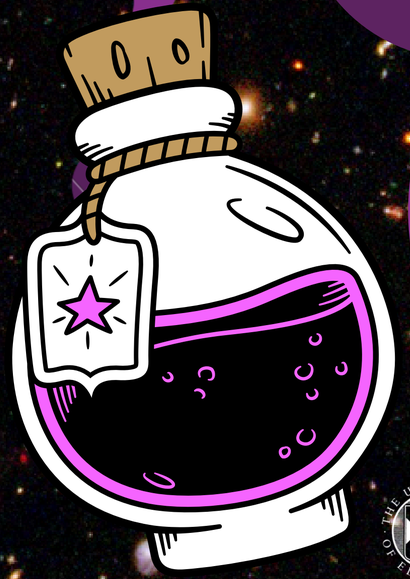
Alder Lecture Theatre, Nucleus Building

Speaker: Dr. Sally Shaw

31st October 2024

17:00

From 16:30



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DARK MATTER DAY