

2022/07/19 - Snowmass Community Summer Study

Dark Matter Complementarity

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Dark matter complementarity in Snowmass

Input also from Suchita Kulkarni,
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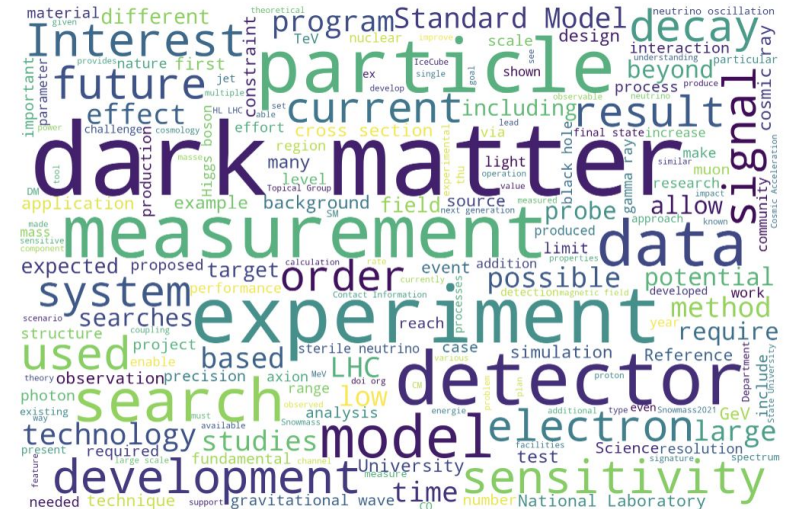
- How should we think about different searches for dark matter?
- We are in an **exploratory phase** where new ideas can be implemented on short timescales, operating alongside longer-term projects (eg HL-LHC, FCC, Gen-3 direct detection)
→ Key point for DM discoveries and characterization: **work together!**
- Snowmass efforts towards a discussion of dark matter complementarity ↔ **cross-frontier**
 - a. This work **builds** from the work ongoing towards the whitepapers in the **individual TGs**
 - b. The complementarity whitepaper does not duplicate this work, but rather refers to it and contextualizes it

<https://gordonwatts.github.io/snowmass-loi-words>

Word Clouds

Word clouds are made by looking at the word frequency in the LOI's. The more frequent the word, the larger the font-size in the word cloud.

All LOI's



Snowmass complementarity effort: whitepaper goals

We are planning to produce a **whitepaper** and its **executive summary** that can be included in Frontier reports

Whitepaper goals:

- (a) lay out the scope of dark matter scenarios/models/DM-related signatures being addressed within Snowmass, across all frontiers → draw from TG reports
- (b) highlight what is needed from each frontier to discover DM in the next decade
- (c) articulate the value of having multiple complementary approaches to DM discovery/searches (including not just the "complementary discovery coverage" message but also "learning more about DM when multiple complementary probes overlap").



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Snowmass complementarity effort: goals for today

Gather material from talks and panel discussion to be **summarized in whitepaper**

Common talk requirements for all speakers (except for Theory, more general):

- DM@Frontier/Topical Group summary
- Complementarity scenarios
- Answer the question: “how can your Frontier help discover DM in synergy with other Frontiers”

Panel discussion (panel leader: A. Steinhebel) will discuss selected points [from this google doc](#) - you can add yours

Optimistically, have a rapid turnaround so that summaries can be included in final Snowmass reports → need a few committed authors and editors

do you want to join us? Email me (caterina.doglioni AT hep.lu.se) to be added to the Slack channels!



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Backup slides (pre-Snowmass-pause)

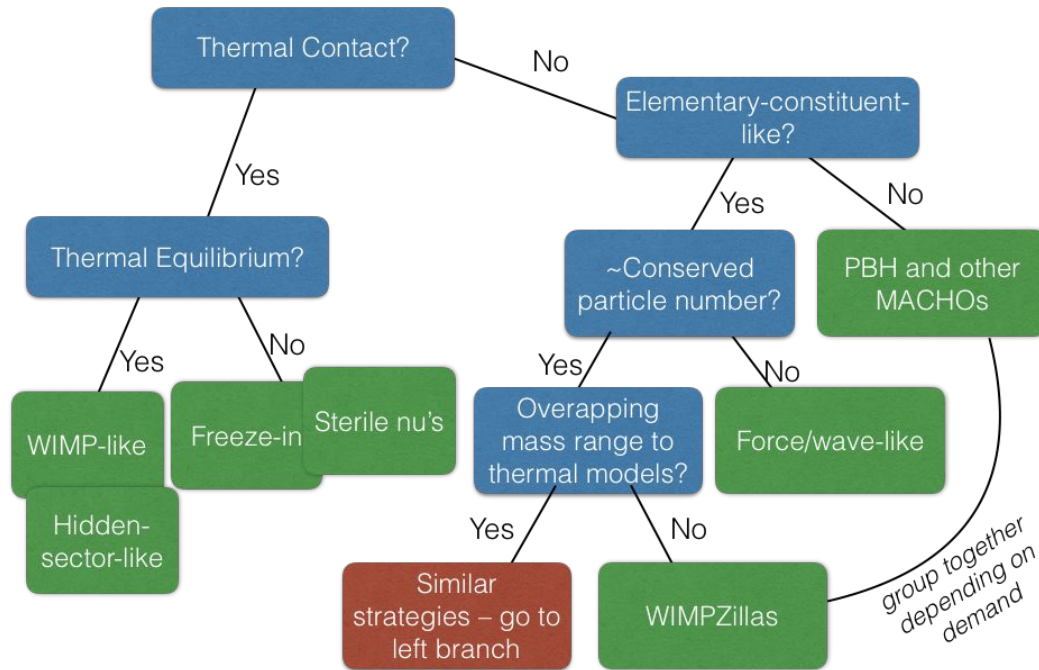
Themes discussed before - by model/flowchart

1. Thermal WIMP DM
 - a. Including TeV scale particles even if non-thermal
2. Light hidden sector DM
 - a. Including thermal, much lighter than WIMP DM
 - b. Including hidden sectors with very light mediators (could also fit in 4)
 - c. Self-interaction / warm DM / primordial couplings to proton constraints (CF3)
3. Sterile neutrino
4. Wave-like DM, axions and hidden photons (as DM and as mediator)
 - a. (Maybe this should be split up)
5. Very heavy DM (both particles and macroscopic objects)
6. DM with gravitational interactions only
7. DM that we don't yet know about / for which we don't have a theory
8. Development of the big picture - how to connect the themes

Full set of notes:

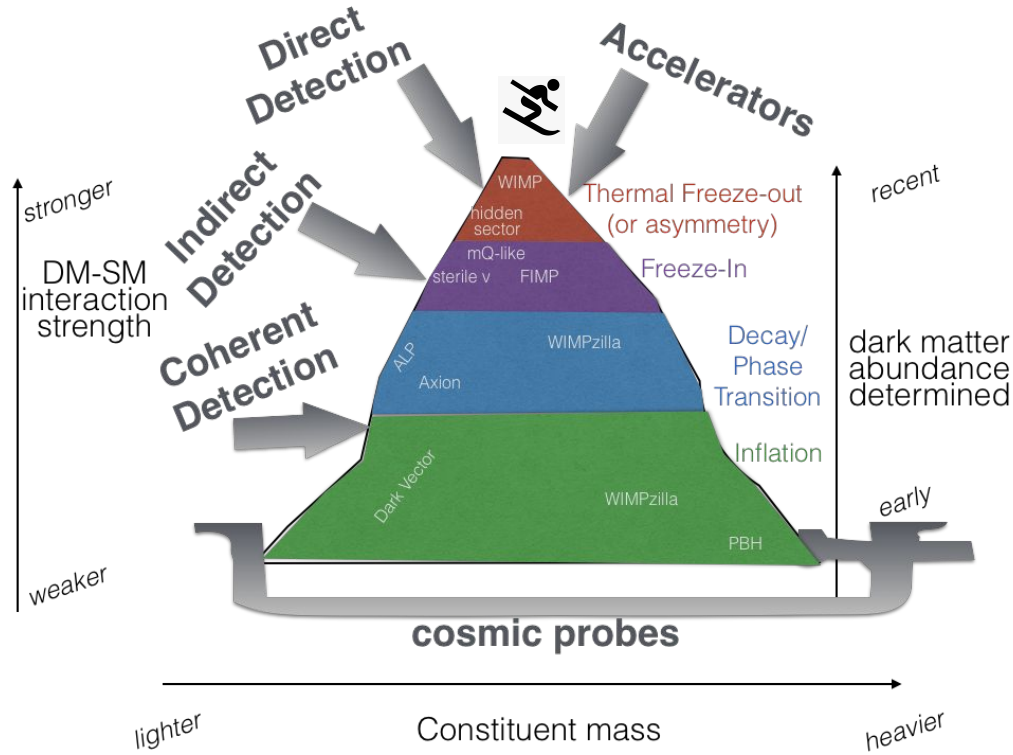
https://docs.google.com/document/d/1uyVZLuoYvdy3oAiPoYIJ-jwYdiUje7d1Y_4A9VjNaY/edit#

Dark matter flowchart [N. Toro, A. Berlin, N. Blinov]



Big picture pictures

Dark matter mountain [N. Toro]



Dark matter Aspen landscape [S. Gardner]



← MASS