

Goals for this session

Refine the Charge

- Add (or subtract) Main Bullet Points
- Refine existing Bullet Points
- Begin to form Outline & Main Questions

Form Working Groups

- What Structure should we use. Default: follow Charge Structure
- Begin to collect Working Group Leaders

Discuss Work Plan

- Work toward a defined goal for March Meeting
- How do we make progress?
- How do we communicate

1. Review the motivation for *(next generation?)* direct searches for WIMP particle dark matter.

Is Gen2 and Gen3 too political?

Should we provide our own consistent definition of 2nd and 3rd generation under charge 3?

Given standard assumptions of spin-independent or spin-dependent coupling, what do recent experimental constraints imply about the possible nature of the WIMP?
How do these conclusions change for non-standard assumptions?

Direct searches

Astrophysical & Cosmological (with CF2)

Accelerator Limits (with CF4, Energy Frontier)

Precision Experiments (with Intensity Frontier)

Is this the right set of
“experimental constraints”?

What are the likely regions of WIMP-nucleon cross sections?

What WIMP masses are implied by these models?

Do the planned next-generation direct searches cover these likely regions?

What other physics might be explored with such searches (Axions, LIPS,...)

in conjunction with CF3

1. Review the motivation for direct searches for WIMP particle dark matter.

This should also address Jim Siegrist's questions:

- Do we need to reach the irreducible neutrino floor?
- Is our enthusiasm for WIMP searches modulated by LHC results? Should it be?
- What about other dark matter candidates and methods?
- What does the decision tree for this area look like? What are key results and outcomes?
- What would be the impact of an LHC or indirect detection discovery?

2) Summarize the state of direct searches for dark matter.

Direct dark matter searches are performed with a wide range of different technologies. Describe the technology classes being used today, and create an up-to-date summary of current limits and detection claims.

SuperCDMS, CoGeNT, COUPP, CRESST, DAMA, DAMIC, Darkside, DEAP-3600, DMIce, DMTPC, DRIFT, Edelweiss, LUX, MiniCLEAN, PANDA-X, Picasso, WARP, XENON, XMASS, ZEPLIN.

We want representation from all experiments. Is this a complete list?
Only ones with US participation? How will we include DAMA, for example?

We do not plan to discuss “future” experiments here.

DISCUSSION: Can the community itself create a Roadmap for the Future? Is that our Job? Or P5? Or the Agencies?

2) A. Summarize the state of direct searches for dark matter.

Direct dark matter searches are performed with a wide range of different technologies. Describe the technology classes being used today, and create an up-to-date summary of current limits and detection claims.

B. Summarize the strengths and **weaknesses of experimental direct detection technologies ← More politically charged, but also more substantive. Can we do it?**

Are there Technology-specific Underground Real Estate constraints:

e.g. Size of experiment, Depth Requirements

What is the intrinsic background rejection achieved by each technology, and what are the prospects for improvement?

What are the background levels that have been achieved by each technology, and what are the realistic prospects for the next generation?

How does the "background-free" fiducial volume scale with increasing target mass?

What WIMP sensitivity has been achieved thus far, and what are the realistic projections for the next generation? ← how can we do this before we determine figures of merit?

See charge 3

3) Identify optimal criteria by which second generation proposals for direct dark matter search experiments can be evaluated in terms of sensitivity and discovery potential

Related Questions:

- A. What would it take to convince the community that WIMP dark matter has been discovered? How many confirmations, and of what type, are required? What targets should be set for WIMP-nucleon cross-section sensitivity as a function of WIMP mass in the next generation?
- B. If WIMPs are discovered in the next generation, what further information is provided by the subsequent experiments? How well could the WIMP mass be determined by direct searches? What precision is required in the WIMP-nucleon cross section to constrain models? How much information would be gained from annual or daily modulation experiments? What angular resolution is required from directional detection experiments to do "WIMP astronomy"?

4) Explore methods to communicate direct searches results to the community.

- Improvements to existing community tool box
(e.g. DMTools, incorporating (3) in a standardized format, etc.)
- Expansion of existing observables to maximize the physics yield.
- Better ties to the larger HEP community

5) Identify new opportunities for direct searches for dark matter.

Describe experiments proposed for the future, including scaled-up versions of existing technologies, and new technologies.

What kinds of technologies have been identified for targeted searches for WIMPs that have low mass or non-standard interactions?

Are WIMP models that might best be explored with new technologies?

6) Identify infrastructure common to direct dark matter searches and explore funding strategies to deliver it at a lower cost.

- Compilation of screening facilities available worldwide, listed by type and sensitivity to major radioactive contaminants. *(with Capabilities)*
- Compilation of Underground Real Estate presently available worldwide, and outlook for the space available and potentially available over the next decade for next generation experiments. *(with Capabilities)*
- Simulation tools (code, files, physics lists) and establishing links with developers from FLUKA, GEANT4, MCNPX, Sources, MUSUN, etc etc. *(with AARM)*
- Common R&D Structures *(with Instrumentation)*

Working Groups

CF1 Science case for WIMP dark matter

Review of Direct Searches

- 1. Noble Liquids*
- 2. Cryogenic (TES, Bolometric) solid state*
- 3. Threshold Detectors*
- 4. Scintillating Crystal*
- 5. Gaseous Detectors*
- 6. New technologies*

Develop criteria and figures of merit

Communicating direct search results

Future Experiments & New Opportunities

Enabling Infrastructure

(Identify Instrumentation Liason and Capabilities Liason)

- 1. Underground facilities*
- 2. Low Background assay & storage*
- 3. Instrumentation and R&D*
- 4. Software (Simulation, site-specific files, DM tools, other?)*

Schedule – A suggestion

- Need to form these groups in the next month.
- If structure is good, we will send out requests for members – Self selection
But also
- Collaborations should discuss it among themselves and designate reps
- Working groups responsible for calling their own meetings
- Monthly Teleconf of group leaders to discuss progress
- At the First Teleconf each group should be able to provide
 1. complete list of group members
 2. an outline of what they hope to accomplish by March