

# 108. Accelerator Probes of Light Dark Matter (keV-GeV)

SnowMass2021

<https://indico.fnal.gov/event/44870/sessions/16307/#20201006>

< Tue 06/10 >

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11:00	<b>Overview on light dark matter cosmology (15' + 5')</b> Zoom 5 Nikita Blinov et al.	11:30 - 11:50
12:00	<b>RF6 Light dark matter studies at high intensities (15' + 5')</b> Zoom 5 Gordan Krnjaic	11:50 - 12:10
	<b>NF03 Light dark matter at accelerator neutrino facilities (15' + 5)</b> Zoom 5 Wooyoung Jang	12:10 - 12:30
13:00	<b>EF10 Light dark matter at high energies (15' + 5')</b> Zoom 5 Suchita Kulkarni	13:00 - 13:20
	<b>Discussion (10')</b> Zoom 5	13:20 - 13:30

## Conveners

108. Accelerator Probes of Light Dark Matter (keV-GeV)

**Jaehoon Yu** (University of Texas at Arlington) **NF03**

Liantao Wang (University of Chicago)

Jodi Cooley (SMU)

Caterina Doglioni (Lund University)

**Alexandre Sousa** (University of Cincinnati) **NF02**

Brian Batell (University of Pittsburgh)

Joshua Ruderman (New York University)

- ▶ Provide overview of the complementary activities on low-mass dark matter (LDM) across NF, RF, and EF, and discover, create, and promote new joint activities.
- ▶ Target outcome was to identify discussion points and ideas to continue developing together throughout the Snowmass process and beyond
  - ◉ Work towards one LDM white paper across all frontiers

See also CPM sessions #72, #97, #127, #136, #173 for complementary discussion

# Questions to Address



- ▶ **How do we best promote inter-experimental efforts to identify and combine complementary measurements to maximize sensitivity to discovery?**
  - ⦿ Across accelerator experiments (Meson factories, Neutrino experiments, Beam dumps, Missing Energy/Momentum, LHC,...)
  - ⦿ Accelerators vs. cosmic probes (direct detection, cosmic ray, neutrino telescopes, CMB, ...)
  
- ▶ **What simulation tools are required for near-future accelerator searches?**
  - ⦿ Dedicated tools (*e.g.*, BdNMC for LDM generation at fixed-target expts.), Multi-purpose generators (*e.g.*, Pythia, Madgraph5\_amc@NLO), hybrid tools (DM module in GENIE)
  - ⦿ Joint theory/experiment effort (*e.g.* model-specific production/scattering/decay, simulation of neutrino beam line, ...)
  - ⦿ Interpretations for a variety of LDM models (*e.g.*, building model catalog for Madgraph5, ...)
  
- ▶ **In the event of a light dark matter discovery (!!!):**
  - ⦿ What experiments are needed and what are the prospects for measuring the properties (masses, couplings) of DM particles and mediators?
  - ⦿ How do we evolve the present program to make precision measurements of DM properties?
    - ➔ Pursue new ideas to minimize neutrino backgrounds for DM searches at acc. expts

# Practical Work and Action Items

- ▶ **Continue developing a standardized set of physical limits for sensitivity plots and promote their use across relevant experiments**
  - ◉ *e.g.*, DM relic densities, minimal portal models, thermal targets in vector portal models, ...
  - ◉ Broader discussion on light dark /dark sector benchmarks is underway during Snowmass 2021
  
- ▶ **When feasible, encourage experiments to produce well-documented and comprehensive data releases:**
  - ◉ Essential step to enable effective inter-experimental efforts
  - ◉ Would allow quicker and accurate interpretation of experimental results within the very diverse landscape of DM theoretical models by the community.
  
- ▶ **Survey existing generator tools, identify where improvements / additions needed, merge tools if appropriate, create new tools, ...**
  
- ▶ **Theory/pheno/experiment studies of discovery scenarios :**
  - ◉ What experiments/measurements are needed? Experimental agenda, possible timelines, ...
  - ◉ Highlight complementarity of different experiments, bolster LDM science case!
  - ◉ See also DOE Basic Research Needs Dark Matter Small Projects New Initiatives Report [https://science.osti.gov/-/media/hep/pdf/Reports/Dark\\_Matter\\_New\\_Initiatives\\_rpt.pdf](https://science.osti.gov/-/media/hep/pdf/Reports/Dark_Matter_New_Initiatives_rpt.pdf)