

# RF6: Dark Sector Studies at High Intensities

<https://snowmass21.org/rare/dark>

Topic Conveners: Stefania Gori, Mike Williams

Sub-topics/sub-conveners:

1. Theory of dark sectors (Brian Batell, Philip Schuster)
2. Dark sectors at electron-positron colliders (Chris Hearty)
3. Dark sectors at fixed target / beam dump experiments (electron, positron, proton, and muon beams) (Gordan Krnjaic, Phil Harris, Natalia Toro)
4. Dark sectors at kaon factories (Babette Dobrich, Jure Zupan)
5. Low-mass dark sectors at energy-frontier facilities (cross-group with EF09 - BSM: More general explorations / EF10 - BSM: Dark Matter at colliders) (Phil Ilten)
6. Dark sectors at neutrino experiments (cross-group with NF03 - Neutrino physics - BSM) (Pilar Coloma, Lisa Koerner)
7. Other experimental opportunities

## What is a Dark Sector?

- Set of new particles which do not experience the known forces.
- Weakly coupled to visible sector through a mediator or “portal”.

## Why Dark Sectors?

- Dark matter may reside in the dark sector. Simple (thermal) and novel cosmologies are possible.
- Dark sectors may play a role in addressing other puzzles, e.g., neutrino masses, matter-antimatter asymmetry, naturalness, ...
- Experimental anomalies often interpreted in context of dark sectors.

## Why high intensities?

- High intensities allow probes of weak portal couplings.
- Past/existing high intensity experiments already provide leading constraints.
- Great potential to discover dark sectors and discern their structure with new searches and experiments in the coming years.

# RF6 Dark Sector Theory Meetings

Day 1, Friday, December 4, 8:00am - 12:00pm US/Pacific

Day 2, Wednesday, December 9, 8:00am - 12:00pm US/Pacific

## Goals of the meetings:

- Highlight and discuss recent developments in dark sector theory:
  - Novel dark sector cosmologies
  - New models that address outstanding problems in particle physics
  - Dark sector explanations of experimental anomalies,
- Identify targets that can be explored at current and near-future experiments:
  - Many targets already exist: minimal portal models (e.g. , dark photon, Higgs portal scalars, heavy neutral leptons, dark matter thermal targets, ...
  - What scenarios are we missing or need further theoretical/phenomenological exploration?

# RF6 Town Hall / White Paper Discussions

Monday, December 7, 2pm US/Pacific

RF6 is planning to have 3 white papers around 3 big ideas + a white paper on experiments/facilities. The 3 big ideas are:

- 1. Detect dark matter particle production*
- 2. Explore the structure of the dark sector*
- 3. New Flavors and Rich Structures in Dark Sectors*

Details can be found here (please add your comments!)

<https://docs.google.com/document/d/1iD2ZZvVoLv3x-RaLtHCo8KGK--2MvSxcn8vrkxtRbWWM/edit>

We will have a town hall meeting to discuss the organization. It will take place on Monday, December 7 at 2pm Pacific: <https://mit.zoom.us/j/94815474591>

We are looking for volunteers to contribute to the white papers. If interested, please fill out the google form at

[https://docs.google.com/forms/d/e/1FAIpQLSc7LhtUoGNmsb4hmcI\\_dJD-X8H70K7NTspowjzEHpDBQxYnDQ/viewform?usp=sf\\_link](https://docs.google.com/forms/d/e/1FAIpQLSc7LhtUoGNmsb4hmcI_dJD-X8H70K7NTspowjzEHpDBQxYnDQ/viewform?usp=sf_link)