



Cosmic Frontier: Wave-Like Dark Matter

Joerg Jaeckel

University of Heidelberg

Gray Rybka

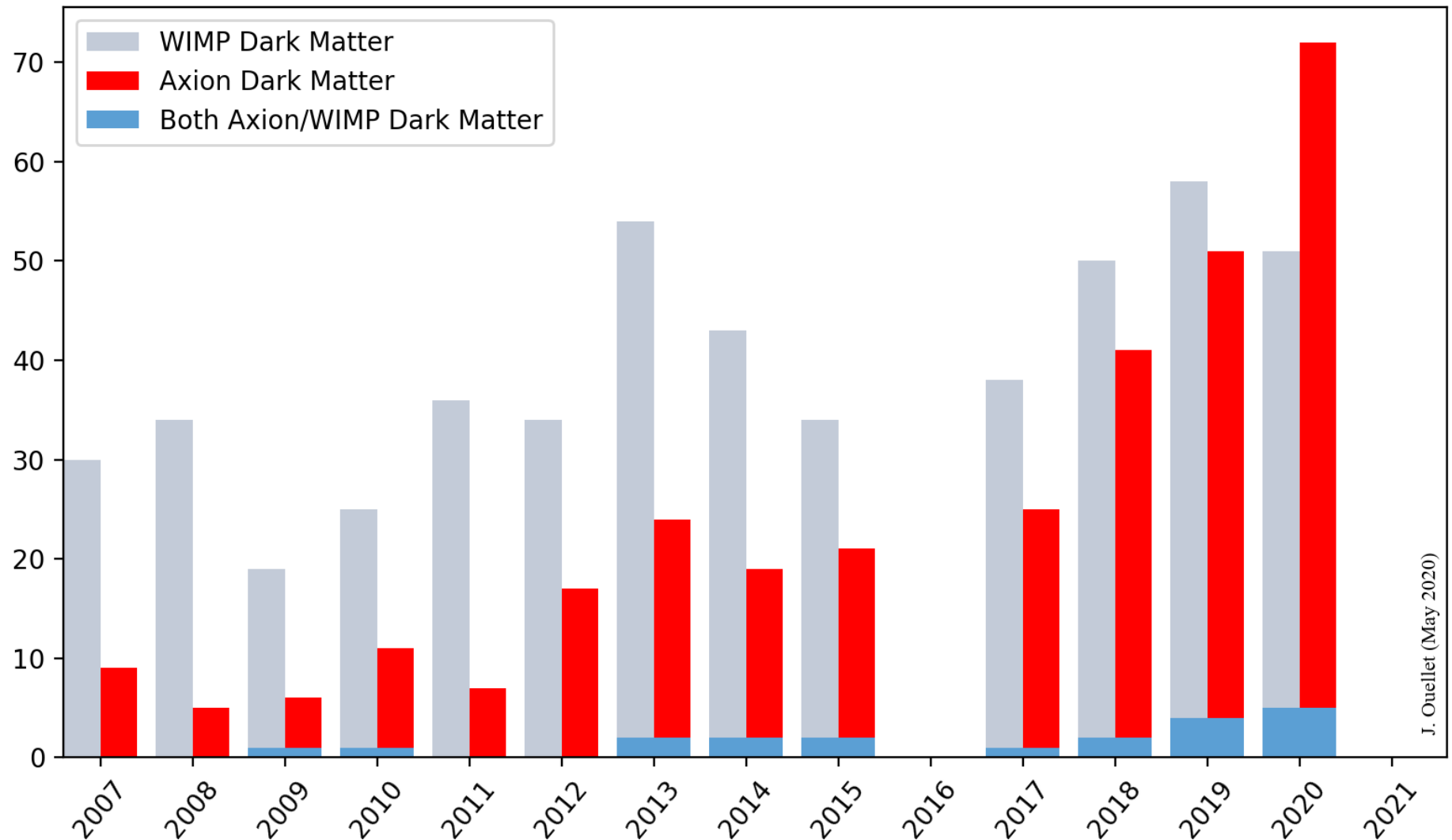
University of Washington

Lindley Winslow

Massachusetts Institute of Technology

Wave-like Dark Matter, especially Axions, is a growing community!

APS April Meeting Abstracts



J. Ouellet (May 2020)

From: Dr. Jon Ouellet (MIT)

* Note hard to get all the key words for WIMPs, but the trend of axions is exciting!

This has been fueled by:

- Better understanding of cosmology
- New ideas
- New technology (cryogenics, quantum sensors, magnets, lasers)

It is a good time to come together as a community and develop a vision for the coming decade.

What is Snowmass?

Organized by the American Physical Society's (APS) Division of Particles and Fields (DPF), it is a roughly decadal review of particle physics and an exercise intended to define the most important questions and the most promising ways to address them. Snowmass aims to include the whole community both in the U.S. and abroad to develop this vision.

Snowmass 2021 Wiki: <https://snowmass21.org/>

Townhall: <https://indico.fnal.gov/event/23601/>

Master Indico Site: <https://indico.fnal.gov/category/1098/>

What is the Cosmic Frontier (CF)?

Snowmass roughly maps onto the programs at DOE so the Snowmass Cosmic Frontier maps to DOE's Cosmic Frontier. From DOE:

"[Cosmic Frontier](#) researchers seek to understand the nature of the overwhelming majority of the contents of the universe by searching for evidence of mysterious dark matter and dark energy."

DOE Cosmic Frontier:

<https://science.osti.gov/hep/Research/Cosmic-Frontier/Experiments>

What is CF2?

We are Wave-like Dark Matter.

- [CF1. Dark Matter: Particle-like](#)
- [CF2. Dark Matter: Wave-like](#)
- [CF3. Dark Matter: Cosmic Probes](#)
- [CF4. Dark Energy and Cosmic Acceleration: The Modern Universe](#)
- [CF5. Dark Energy and Cosmic Acceleration: Cosmic Dawn and Before](#)
- [CF6. Dark Energy and Cosmic Acceleration: Complementarity of Probes and New Facilities](#)
- [CF7. Cosmic Probes of Fundamental Physics](#)

Snowmass Cosmic Frontier:

[**https://snowmass21.org/cosmic/start**](https://snowmass21.org/cosmic/start)

Snowmass Timeline

- **Today**, register an input here:
 - <https://forms.gle/k2j81xRRaQGAKnds5>
- **August 31st**, deadline for letters of interest (2 pages):
 - <https://snowmass21.org/loi>
- **November 4th**, Snowmass Planning Meeting (Fermilab)
- **July 11, 2021**, Snowmass Summer Study (Seattle)
- **July 31, 2021**, deadline for white papers:
 - <https://snowmass21.org/submissions/start>
- **December 2021**, Final Snowmass Report

Letters of Interest

- These will guide how we organize future meetings.
- Up to 2 pages excluding the author list and references
- Request from CF2: indicate what models you are pursuing and the expected sensitivity for described phases.

We request that you use either the Latex or Google Doc template provided.

<https://snowmass21.org/cosmic/start%23submissions>

There will be overlaps!

CF1 vs. CF2 - We set a boundary at roughly 1 eV.

CF3 v.s CF2 - We will take all astrophysical studies that are not mapping gravitational interactions. For instance we take:

- Stellar cooling
- Supernova
- Gamma-Rays

LAB



Outer space

When in doubt, submit to multiple groups!

CF2

Axion direct detection experiments;
solar axion helioscope experiments; ...

CF3

Ultra-light axions (fuzzy dark matter); ultra-ultra-light axions (dark energy);

CF2/CF3

Stellar cooling; supernova signatures; axion signatures in gamma-ray spectra; neutron star constraints; ...

From the CF3 Meeting: <https://indico.fnal.gov/event/43925/>

Overlaps Outside CF

Instrumentation Frontier IF1: Quantum sensors

Accelerator Frontier AF5: Accelerators for Rare Processes, see Magnets, Cavities

Energy Frontier EF9: BSM

Energy Frontier EF10: Dark Matter

Rare Processes and Precision RF3: Small Experiments, see EDM

Rare Processes and Precision RF6: Dark Sector Studies at High Intensities

Others.....

Example Efforts:

ADMX

HAYSTAC

CASPEr

ABRACADABRA/DM Radio

MAGIS

IAXO

.....



Submit LOIs to get on this list!

Discussion

- Boundaries seem reasonable?
- Are we missing any broad category of efforts?

Community Input: <https://forms.gle/k2j81xRRaQGAKnds5>

- What is our vision for the next decade?
- What is the best way to build our community?
- Next community meetings?

How to Stay in Touch?

- Slack - There is an active Snowmass community. Be sure to add #cf02-dark_matter_wave and #dark_matter
- Email list - SNOWMASS-CF-02-DM-WAVE@FNAL.GOV

More details on the Cosmic Frontier Wiki:
<https://snowmass21.org/cosmic/start>

Feel free to signup for all topics that interest you beyond CF2!