

# **CF2: Wave Dark Matter**

**Community Strategy Discussion**

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# Thoughts from the Conveners:

**What should the community strategy be and how does that translate into white papers?**

- The white papers are input to our summary and ultimately this will be input into the P5 deliberations.
- P5 in the past has been given 3 funding scenarios and prioritized within those scenarios.
- The next P5 is going to be tough because of DUNE and LHC costs.
- Cosmic Frontier will need to finish construction and commissioning on LZ, SuperCDMS, LSST and ramp-up CMB-S4
- CF2 is going to need to provide a very cost-effective and coherent program!!!

# Proposed Strategy

- 2 or 3 community white papers, very directed at getting the P5 recommendations we want.
- whole community signs them, signaling that this is what we want.
- present a very clean program on the order of \$50M.
- call out theory support and R&D.

# Notes from the Process so Far:

## What has emerged from the community talks/LOIs?

- ADMX-EFR and DMRadio have money to develop formal projects, data taking hopefully starting around 2025.
- CASPEr, ALPHA (Plasmon Haloscope), ARIADNE are running demonstrators and would be ready for a new BRN process in the middle of the decade.
- Modest investment in Baby IAXO x-ray optics would allow US leadership in the IAXO high mass axion program.
- Many other exciting opportunities that need more theory and R&D to understand their motivation and feasibility.
- Synergies with CMB, Gravitational Waves and other astrophysical studies.

# Three Pillars of Wave Dark Matter

These need better titles

- QCD Axion and ALPs
- Open Horizon: Scalar and Vector Wave Dark Matter
- Synergies of Wave-like Dark Matter

# QCD Axion and ALPs

## Recommendations

- The established DMNI program should go forward. DMRadio and ADMX-EFR should progress to DOE projects.
- A modest investment in the design of x-ray optics for Baby IAXO would make use of key US expertise and allow the US program to cover the full axion parameters space.
- Demonstrator scale experiments for alternative couplings and frequency ranges should proceed including CASPEr, ARIADNE and ALPHA. A new BRN DMNI process should evaluate the next generation of projects once the current DMNI process is complete.
- A design study for a future combined axion facility including magnet, cryogenics and quantum sensor needs should take place and it should outline the needed R&D.
- Support theory work to better understand new experimental signatures in these experiments and better understand constraints across the mass range.

# Open Horizon: Scalar and Vector Dark Matter

- Support theoretical work to understand experimental consequences of emerging theories and understand the interaction of these candidates in the proposed detectors.
- Support R&D and early stage demonstrators especially in emergent technologies to determine the feasibility of the proposed experimental designs.

# Synergies of Wave Dark Matter

- Support theoretical work to understand the interplay of wave dark matter phenomenology with astrophysical and cosmological signals including those in CMB, gravitational waves and other astrophysical environments.



# Next Steps

## Meetings, White Papers, Summaries

- We would like to gather volunteers for the Axion and New Horizons community white papers.
- We need to figure out if we are writing the synergies paper or if a similar CF3 paper is going forward. Volunteers from CF2 are welcome here too.
- Whitepapers complete by March so more meetings before the holidays and lots of writing in January.