Report from topical groups

Cross frontier: NF/CF/RF/UF/IF

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CF1: Dark Matter: Particle-Like

This group covers dark matter in the regime where it appears in experiments as individual quanta, rather than coherently via wave phenomena. Techniques to search for such particles include directly through its interaction with detector materials, indirectly from products of its annihilation, and via production at accelerators (primarily covered in other frontiers).

- ➢ Distinguished from CF2 (Dark Matter: Wave-like) by focus on higher mass range (roughly ~1 eV and above)
- ➢ Distinguished from CF3 (Dark Matter: Cosmic Probes) by focus on particle signals of DM: CF1 covers (among other topics) classic indirect-detection searches for the particle products of DM annihilation/decay, but CF3 contains a broader range of astrophysical/cosmological probes

CF1 Activities to date

- Series of nine CF1 meetings through August and September - mostly stepping down in mass range starting at GeV-TeV scales
  - Topics listed at https://snowmass21.org/cosmic/dm_particle#summerfall_2020_meetings
  - Indico with links to full recordings and minutes: https://indico.fnal.gov/category/1193/
  - Included theory and direct and indirect detection
  - >50 participants per meeting on average, with a high of 75.
- 147 LOIs cross listed with CF1 - *the most of any topical group*

CF1 Intersection with Area #51

- Classic WIMP experiments + Moderately low mass WIMP experiments (~>1 GeV)
  - LAr-TPC, LXe-TPC, SuperCDMS, Bubble/snowball chambers, gas TPCs, NaI
  - Partial list of relevant CF1 LOIs here
- New generation of lower mass searches (mostly on surface to date)
  - E.g. CCDs cross frontier boundaries
  - Quantum sensors in session 77, not discussed directly here

RF4: Baryon and Lepton Number Violation

This group covers the physics of baryon and lepton number violation. The group has a shared theory/experiment participation. Theory spans between models of baryo- and lepto-genesis in the early universe to BLV understanding via EFT and LQCD. The experimental activities include collider (e.g. TeV leptogenesis) and rare decay searches at accelerators, searches for baryon number violating processes (proton decay and n-nbar oscillations), and neutrinoless double beta decay (0n DBD). The group overlaps with subtopics of most other frontiers.

- 0n DBD experiments have substantial technical overlap with searches for particle dark matter and large neutrino detectors (p-decay, nu-oscillations)
- 0n DBD activities carried out jointly with NF5
- Common interests include u/g facilities, joint R&D and detector development, low bg design, fast light detection, low radioactivity low power cryo electronics

RF4 activities

- BLV ca. 2020: conference that served as the RF4 kickoff meeting
- DeltaB=2 ACFI workshop (marginally relevant to this session)
- ACFI workshop with NF5 on ‘beyond the tonne scale double beta decay’ (Dec 9-11, virtual - will be announced soon)
  Goal: long-term goals, contrib. paper writing

- LOI’s received:
  - Mostly shared with other frontiers and WG’s
  - 0n DBD: theory and experiment (many, with NF)
  - N-nbar (3) and proton decay (2)
  - (alpha,n) backgrounds (with CF1)

NF05: Neutrino Properties

- NF05 is the Neutrino Properties subgroup of Neutrino Frontier.
- “Neutrino Properties” is rather wide net, but in practice we consider our mandate mainly 0nubb; direct neutrino mass measurements; neutrino electromagnetic properties.
  - Most other topics have a natural home elsewhere in NF (BSM, oscillations, etc).
- We have held a series of summer workshops, to instigate discussions to encourage LOIs and nucleate community white papers.
- We are collaborating with RF04 to host a two-part workshop on beyond-ton-scale 0nubb searches in Dec and Spring

August 2020

- 19 Aug Mini Workshop: 0nubb Experiment II
- 12 Aug Mini Workshop: Neutrino Electromagnetic Properties
- 05 Aug Mini Workshop: 0nubb Experiment I

July 2020

- 22 Jul Mini Workshop: Nuclear theory of neutrinoless double-beta decay
- 15 Jul Mini Workshop: Particle theory of neutrinoless double-beta decay
- 08 Jul Mini Workshop: Direct Neutrino Mass Measurements

IF: Instrumentation Frontier

- **The Instrumentation Frontier group** is geared to discussing detector technologies and R&D needed for future experiments in collider physics, neutrino physics, intensity physics and at the cosmic frontier.
- **The IF sub-groups** are *Calorimetry, Cross Cutting and Systems Integration, Electronics/ASICs, Micro Pattern Gas Detectors,* ***Noble Elements****,* ***Photon Detectors****,* ***Quantum Sensors****, Radio Detectors, Solid State Detectors and Tracking, and Trigger and DAQ.*
- **Intersection with Area #51**: We should aim for the key instrumentation and driving technologies for this area does make it into the list of priorities for IF identifying any other synergies at the instrumentation level.

- **IF liaisons** for CF and NF involved in this group: Hugh Lippincott, Josh Klein and Mayly Sanchez.
- ~340 LOIs tagged as related to IF.
- **Planned activities:** Joint workshop with NF, CPAD workshop (as IF workshop) in the week of Mar 14, 2021.

Some discussion questions (but not meant to crowd out conversation)

- Does BRN serve what we need for Snowmass on this topic, or are there deficiencies we need to fill / areas we need to work to update?

- What specific recommendations can come out of the Snowmass process to advance interests of these detectors?

- Is there something useful Snowmass can do or recommend to ameliorate difficulties associated with stove-piping?