

NF05 Report: Snowmass and Neutrino Properties

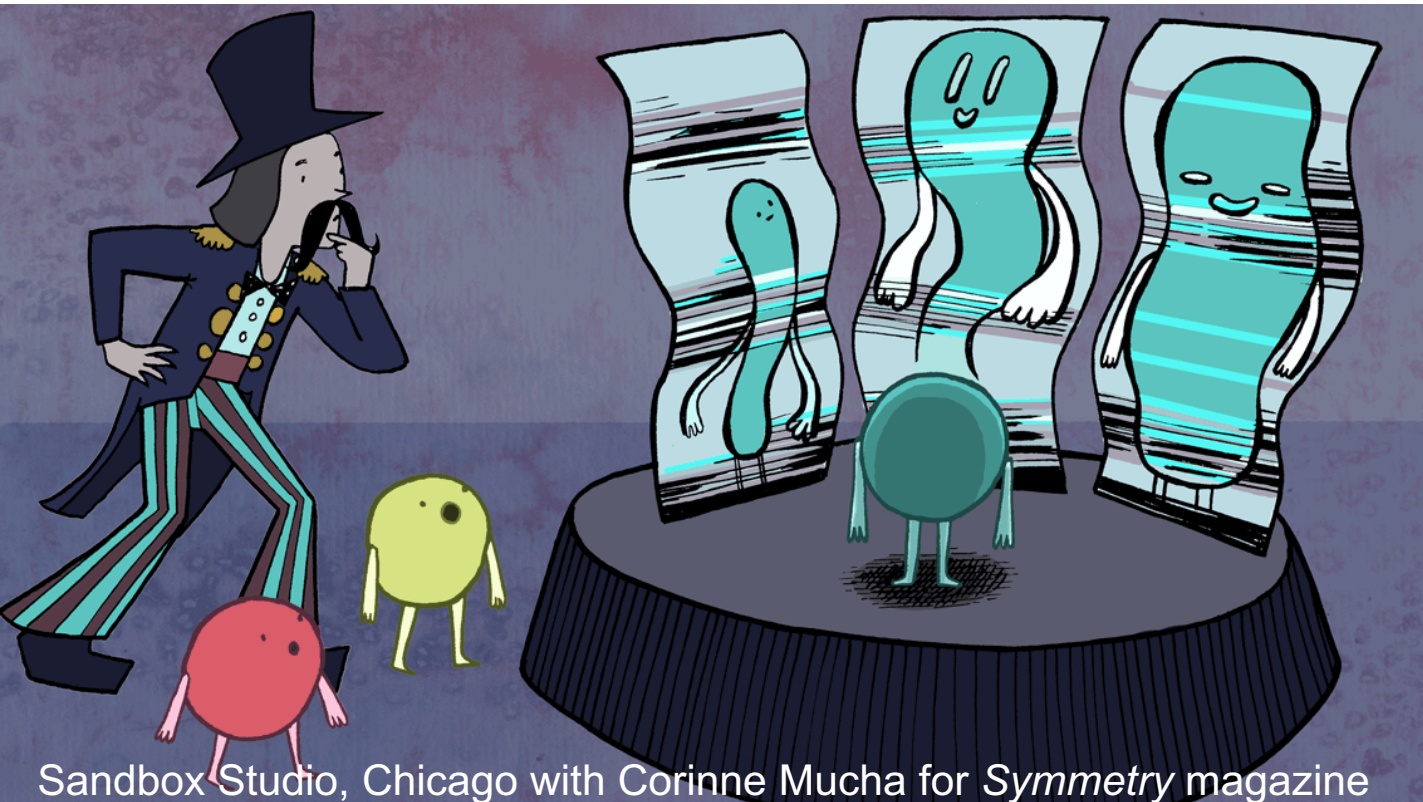
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*Neutrino Frontier Preparation for
the Snowmass Community
Planning Meeting*

September 16, 2020

Summer Mini-Workshops

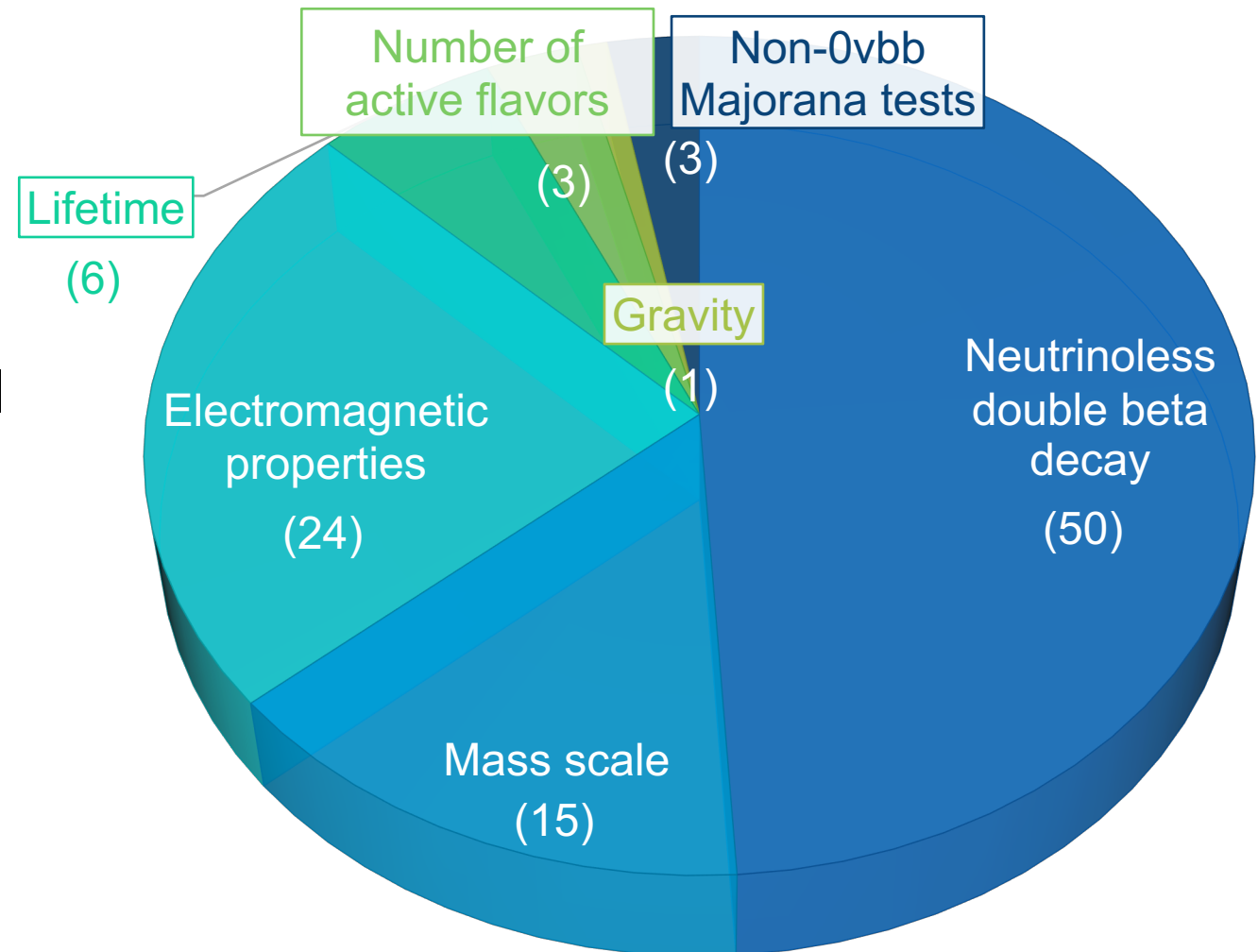
- ◆ We thank the community for strong participation in a series of 8 mini-workshops over the summer of 2020 – between 50-80 attendees each time
- ◆ Slides and recordings are available on indico: <https://indico.fnal.gov/category/1172/>

Date	Subject
8 July	Direct neutrino mass measurements
15 July	Particle theory of neutrinoless double-beta decay
22 July	Nuclear theory of neutrinoless double-beta decay
5 August	Neutrinoless double-beta decay experiment I
12 August	Neutrino electromagnetic properties
19 August	Neutrinoless double-beta decay experiment II

LOI Breakdowns for NF05

- ◆ We're watching about 85 LOIs (primary and secondary)

- ◆ 71 have significant experimental content
- ◆ 20 have significant theoretical content
 - ◆ (Several have both.)



(This breakdown only includes science-focused LOIs)

Overlaps with other NF Topical Groups

- ◆ LOIs with *both* NF05 and another topical group watching (either primary or secondary)
- ◆ Many LOIs are double-counted (or N-counted) here

NF01 Oscillations	NF02 Steriles	NF03 BSM	NF04 Natural Sources	NF06 Cross sections	NF07 Applications	TF11 Theory	NF09 Artificial Sources	NF10 Detectors
22	28	54	31	29	11	33	19	58

Multi-purpose experiments

$0\nu\beta\beta$ detector R&D

Neutrinoless double beta decay

- ◆ The next generation of $0\nu\beta\beta$ experiments (ton-scale; probing inverted ordering) is part of the Nuclear Physics Long-Range Plan (and many submitted LOIs!)
- ◆ In Snowmass, we're seeing a lot of ideas for the **next** generation after that – facilities that could probe beyond the inverted ordering
 - ◆ Detector technologies
 - ◆ New readout mechanisms; signal/background rejection; multipurpose facilities
 - ◆ Analysis techniques
 - ◆ New methods and frameworks for simulation and machine learning
 - ◆ Theoretical advances
 - ◆ Connections to LHC, oscillation measurements; neutrino self-interactions; leptogenesis

Electromagnetic properties

- ◆ Most LOIs are connected to CEvNS cross-section measurements
- ◆ Also:
 - ◆ Millicharged particles
 - ◆ Specific magnetic-moment searches for all three flavors
 - ◆ Astrophysical neutrinos

Neutrino mass scale

- ◆ Some LOIs relate this to cosmic frontier, and some to $0\nu\beta\beta$ or supernova neutrinos
- ◆ Most relevant LOIs are for direct, kinematic probes of neutrino mass scale
 - ◆ Tritium, holmium – mostly scaling of existing ideas and projects
- ◆ Community white paper is already planned, combining theory and experiment. See corresponding LOI:
https://www.snowmass21.org/docs/files/summaries/NF/SNOWMASS21-NF5_NF0-198.pdf

Out of scope

- ◆ Many important neutrino properties have their home in other topical groups
 - ◆ **NF01 (Oscillation):**
 - ◆ Mixing angles, mass splittings and ordering, and unitarity of PMNS matrix
 - ◆ **NF02 (Sterile neutrinos):**
 - ◆ Total number of neutrino flavors (active and sterile)
 - ◆ **NF03 (BSM); NF6 (Interactions):**
 - ◆ Exotic neutrino couplings
- ◆ We aren't following LOIs on these properties in an official capacity

Future Plans

- ◆ Joint sessions at Community Planning Meeting
 - ◆ Several planned sessions touch on $0\nu\beta\beta$
- ◆ Possible additional workshop series (or joint workshops)
- ◆ Facilitate white-paper development
 - ◆ Let us know if you're interested!

Thank you!