

Theory for Fundamental Symmetries, Neutrons, and Neutrinos

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Our Science

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Doing that almost always requires a theoretical understanding of what that physics might be and how it manifests itself, quantitatively, in the nuclei that we study.

We need a thriving community of talented theorists.

Situation in A Nutshell

Lots of high-profile physics and success stories in the theory program.

But we have some challenges:

- ▶ Our problems involve physics at several scales. We need to combine work in phenomenology/EFT, hadronic structure, and nuclear structure (and sometimes atomic physics). Experts in each of these areas must
 - ▶ Communicate and collaborate.
 - ▶ Be able to interact with neighboring fields: QCD, HEP, AMO ...

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 - ▶ Communicate and collaborate.
 - ▶ Be able to interact with neighboring fields: QCD, HEP, AMO ...
- ▶ We have the same problem as the community at large: We're small and have no national organizational center. And so we have
 - ▶ Fragmented research efforts
 - ▶ Difficulties getting faculty and staff positions in our field
 - ▶ Lack of political influence

Some Successful Recent Initiatives

- ▶ Amherst Center for Fundamental Interactions (ACFI)
- ▶ DOE Topical Theory Collaborations
 - ▶ **Recently completed:** Double-Beta Decay and Fundamental Symmetries (DBD)
 - ▶ **Just beginning:** Nuclear Theory for New Physics (NTNP)
- ▶ NSF Physics Frontier Center: Network for Neutrinos, Nuclear Astrophysics, and Symmetries (N3AS)

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These have been *great*,

- ▶ leading to results that would not have been attained otherwise
- ▶ seeding a few faculty, training good postdocs and students.

but

- ▶ ACFI and N3AS have fewer resources than lab-based centers, can't provide long-term path to faculty positions.
- ▶ The collaborative initiatives expire fairly quickly.

Example: DBD Topical Collaboration

2017-2022

Brought together researchers from EFT, LQCD, and nuclear structure for coordinated research that *would not have happened* otherwise.

Went from almost zero to a comprehensive framework for computing nuclear matrix elements and the first actual calculations.

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But the program is over and though such research is continuing, it's harder to carry out.

Quick Promo: New Topical Collaboration

Nuclear Theory for New Physics
co-chairs: *Vincenzo Cirigliano & Saori Pastore*

DEI Coordinator: *Maria Piarulli*

Lattice QCD

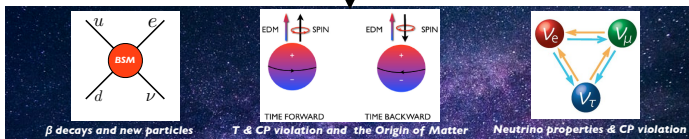
Coordinator:
Andre' Walker-Loud

**EFT /
phenomenology**

Coordinator:
Emanuele Mereghetti

Nuclear Structure

Coordinator:
Heiko Hergert



Asks

1. Longer lasting versions of topical collaborations, PFCs, and/or SciDAC programs
2. A faculty bridge program

An NSAC subcommittee to address these needs would help.

Could lead to a consortium like NP FRIB Theory Alliance or HEP Neutrino theory Network to

- ▶ administer bridge program,
- ▶ coordinate workforce development and workshops with hubs, topical centers, PFCs, and the INT.