
FRIB Theory Alliance avenues for planning and interpreting experiments

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FRIB-TA Director



What is the FRIB Theory Alliance?

- A coalition of scientists who seek to: <http://fribtheoryalliance.org>
 - foster advancements in theory related to diverse areas of FRIB science;
 - optimize the coupling between theory & experiment;
 - stimulate the field through bridge positions, the FRIB-TA Fellow program, Topical Programs, and international initiatives
 - 279 members; 13 member Executive Board
 - Filomena Nunes (MSU), Managing Director; Director serves one year term; Saori Pastore (Wash U.) is Director Elect; Jutta Escher (LLNL) is Past Director
 - Inaugurated in 2016; now in third funding cycle
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Theory that we do

- Nuclear forces
 - Nuclear structure
 - Nuclear reactions
 - Nuclear equation of state
 - Fundamental symmetries in nuclei
 - Nucleosynthesis in stars
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Structure theory that we do

- *Ab initio* methods
 - Shell-model calculations (both large-basis and effective-space)
 - Structure embedded in the continuum
 - Density Functional Theory
 - β -decay
 - Clustering in nuclei
 - Collective models
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Reaction theory that we do

- Direct knockout, transfer, ... reactions
 - Development of optical potentials
 - Three-body models
 - Statistical approach to nuclear reactions (Hauser-Feshbach etc.)
 - Central collisions
 - Theory of fission & fusion
 - Exotic decay modes
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 - Theory of fission & fusion
 - Exotic decay modes
- FRIB-TA has people who can compute implications of your measurements for BSM physics or nucleosynthesis or
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Topical Programs

- FRIB-TA sponsors Topical Programs that seek to engage theorists on topics of relevance to the experimental program
 - Produce a deliverable: often in the form of a White Paper
 - “Optical Potentials in Nuclear Physics”, White Paper by Hebborn, Nunes, Potel, Dickhoff, Holt, et al. arXiv:2210.07293
 - “Nuclear Isomers in the Era of FRIB”, organizers: Kondev, Misch, Mumpower
 - “Few-body Cluster Structures in Exotic Nuclei and their connections to FRIB experiments”, Perspectives paper by Bazin et al., arXiv:2211.06281
 - “Theoretical Justifications and Motivations for Early High-Profile FRIB experiments”, May 2023, Organizers: A. Brown, A. Gade, R. Stroberg
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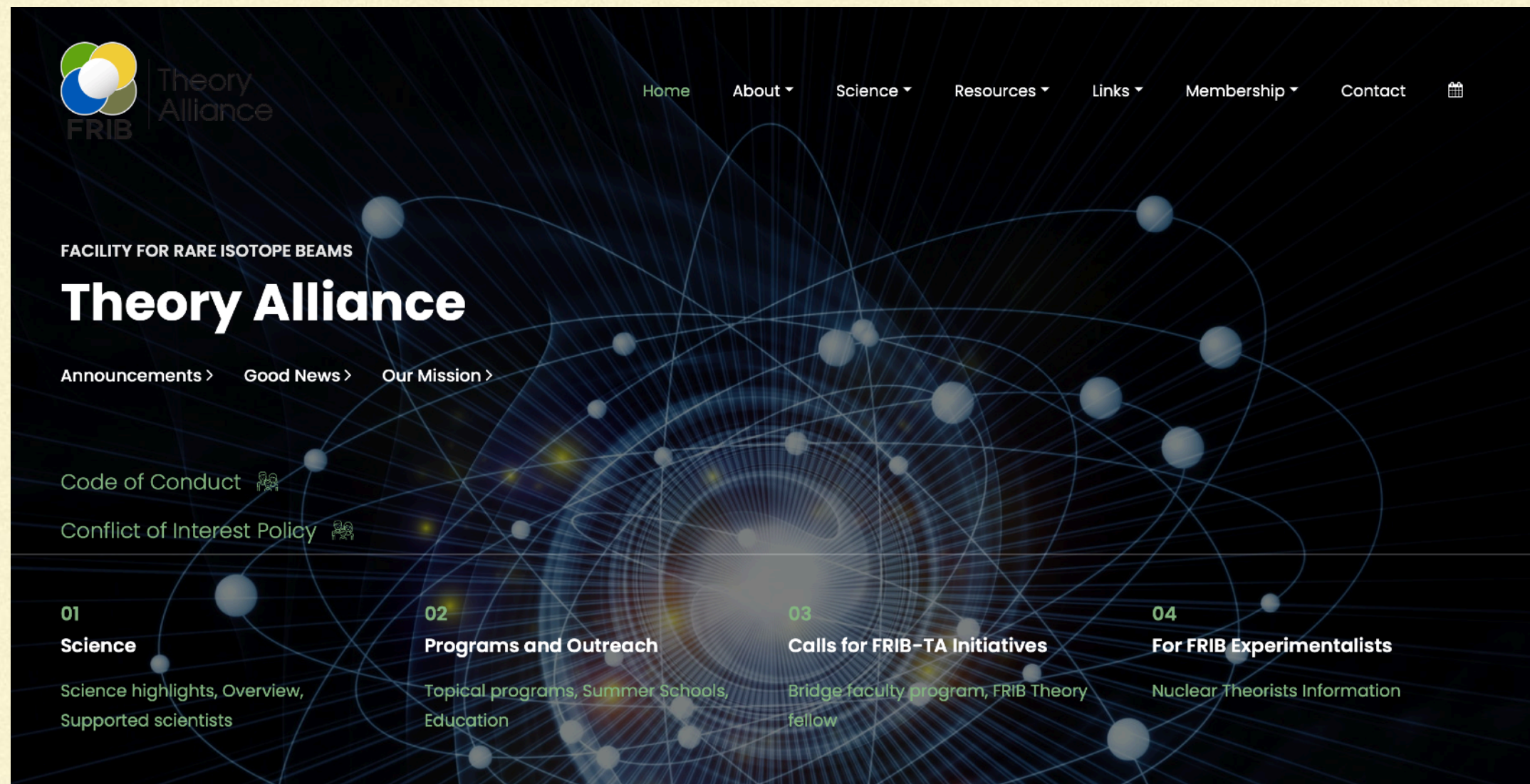
I-88T-HEORIST

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- We have put together a list of theorists who can provide input/calculations on various topics connected to experiment

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- Lists name, email address, website, interests, computer codes/resources, wish list for experiments

Name	Email address	Website	Areas of current interest	Resources (formal, computational, theory networks/collaboration) available	Other areas of expertise	Wish list for experimental data
Alex Brown	brown@nscl.msu.edu	https://people.nscl.msu.edu/~brown/	Structure of sd shell nuclei (Structure includes beta and gamma decay, moments, One and two nucleon spectroscopic factors) Structure in the region of 42Si Structure of pf shell nuclei Structure for Z=28-50 up to N=56 Structure in the regions of 132Sn and 208Pb Rms radii and neutron skins connected to the neutron equation of state Rapid-proton capture rates Level densities from the shell model Structure aspects of double Di-proton decay	Shell-model codes Oxbash and NuShellX		Structure data for the regions of 42Si, 60Ca, and 78Ni Rms charge radii of proton-rich nuclei
Witek Nazarewicz	witek@frib.msu.edu	https://people.nscl.msu.edu/~witek/www/Nazarewicz.htm	Nuclear structure; global properties of nuclei; nuclear collective motion Decay spectroscopy; physics of open systems Large amplitude collective motion; nuclear fission Nuclear input for nuclear astrophysics Uncertainty quantification for nuclear models; Bayesian inference Hyperfine interactions	NUCLEI SCIDAC (http://nuclei.mps.ohio-state.edu) BAND collaboration (https://www.ohio.edu/news/2020/05/ohio-leads-new-3-7-million-projectadvance-nuclear-physics-experiments) Several international collaborations	High performance computing Theory of open quantum systems	Masses, radii, and moments of radioactive nuclei Spin-isospin excitations Multi-particle decays; inter-nucleon correlations Data on superheavy nuclei Data on mirror nuclei Data on neutron-rich nuclei, including beta-decay information
Jutta Escher	escher1@llnl.gov	https://people.llnl.gov/escher1	Improving nuclear structure inputs for nuclear reactions: level densities, gamma-ray strength functions, optical-model potentials Integrating nuclear structure and reaction theory: inelastic scattering and transfer reactions Indirect methods for determining nuclear reaction cross sections for astrophysics and other applications Interplay of statistical and direct reactions, formation, and decay of compound nuclei		Symmetry-based approaches in nuclear structure and reactions	Elastic and inelastic scattering cross sections Decay properties of compound nuclei
Daniel Phillips	phillid1@ohio.edu	https://www.ohio.edu/cas/phillid1	Halo nuclei and quantum universality Bayesian inference Astrophysical reactions for light nuclei; R-matrix theory Neutron-neutron interactions	BAND collaboration (https://bandframework.github.io/) BUQEYE collaboration (https://buqeye.github.io/) Collaboration with several physicists at TU Darmstadt	Electron & photon scattering from light nuclei Effective Field Theory Three-body dynamics Parity violation	Neutron-neutron correlations in the final state Energies, radii, B(E1) strengths of weakly bound s-wave & p-wave states near the driplines
Jorge Piekarewicz	jpiekarewicz@fsu.edu	http://web2.physics.fsu.edu/~piekarewicz/	Neutron-rich matter on heaven and earth; Neutron stars, neutron skins, giant resonances; Covariant density functional theory; Bayesian statistics	Calibration and implementation of unified covariant density functional codes to describe ground-state properties of finite nuclei, their linear (RPA) response, and properties of neutron stars.		Masses of exotic neutron-rich nuclei of relevance to the neutron star crust; Neutron densities and neutron skins of very neutron-rich nuclei to constrain EOS; Electric dipole polarizability along isotopic chains; Charge radii of mirror and exotic nuclei; constraints on the EOS at twice saturation density from heavy-ion collisions of highly asymmetric nuclei
Kevin Fosse	fosse@nscl.msu.edu	https://kevinfossez.github.io/	Nuclear structure including the continuum (ab initio, shell model); Halo structures, two-neutron/proton decay, many-body resonances. Collective motion.	NUCLEI collaboration; (Ab initio) Gamow shell model (GSM), density matrix renormalization group (DMRG) method, In-medium similarity renormalization group (IMSRG), particle-plus-rotor model.	High-performance computing. Shell model interactions. Radiative capture reactions, alpha clustering.	Energies and spin-parity at the drip lines in the sd-pf region. Decay widths and decay channels. Beta-decay spectroscopy of proton-rich nuclei.

We are here to help!

- At least 14 different theorists involved in more than 35 PAC-I proposals*
- To recruit a theorist collaborator you can start by going to <http://fribtheoryalliance.org> and consulting the list of theorists there
- If that fails consult Filomena Nunes (nunes@frib.msu.edu), or myself (phillidl@ohio.edu). Between us we know a large fraction of the FRIB-TA membership and we love to connect theorists who want their approaches tested or applied with experimental efforts that will make use of that work
- The earlier you contact us the better we'll be able to help you

*Based on survey data
