# Topical Collaboration for GPDs

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# Background and Context

- Third round of FOAs for topical collaborations, following those of 2010 and 2016.
- Take-aways:

Structure

All applications submitted to this FOA must be in support of multi-institutional teams. Awards under this FOA will bring together, on a temporary basis, research groups of leading nuclear theorists, leveraging the resources of small research groups, and providing expanded opportunities for the next generation of nuclear theorists. Each team will function as a hub of a network of scientists from the participating institutions, supporting sustained interaction and communication within the network, and providing a mechanism for placing new researchers in permanent positions in nuclear theory. In addition, applications submitted to this FOA must be

Science

a. Hadron spectra from Quantum Chromodynamics, including exotics
b. Photo- and electro-production of meson and baryon resonances, including exotics
} spectroscopy
c. Phenomenology for semi-inclusive/exclusive electron scattering
d. Partonic and spin structure of hadrons
} hadron structure
e. Properties of hot/dense strongly-interacting nuclear matter
f. Phenomenology of relativistic nuclear collisions
} "Hot QCD"
g. Nucleon interactions and properties of nuclei
h. Unified description of nuclear reactions
i. Dynamics of fusion/fission
} Nuclear reactions/interactions
j. Nuclear reactions in cataclysmic astrophysical events
Nuclear astrophysics
k. Neutrino-nucleus interactions
l. Tests of the Standard Model using nuclei
} Standard Model and BSM

Connection to NSAC LRP

# Criteria

- A task that is achievable within *a five-year project*, rather than establishing a longer-term program.
- Exploiting emerging developments in experiment, theory, computation and global analysis.
- Identifying key teams within (primarily) the US community.
- Recognizing the need and opportunity for the creation of long-term positions in theory.

# Emerging Developments

- DVCS and DVMP data from 12 GeV upgrade of Jefferson Lab.
- First-principles lattice calculations of GFFs and x-dependent GPDs facilitated in the Exascale era
- Development of global-fitting methods with quantified uncertainties for one-dimensional distributions, and their extension to 3D TMDs and GPDs.

# Our discussions

## Position-space Femtography of Nucleons

*"To extract Generalized Parton Distributions from extant and upcoming experimental data, and first-principles LQCD calculation, with quantified uncertainties."*

1. The theoretical framework for GPDs and Generalized Form Factors (GFFs). QCD-inspired descriptions of GPDs and CFFs.
2. Lattice QCD calculations of GFFs, and of the *x*-dependent GPDs.
3. Global Fitting and Error Quantification to extract GFF and GPDs, exploiting first-principles lattice QCD calculations and QCD-inspired descriptions.
4. The internal distribution of mass, charge, and spin, and cross-connections for our understanding of the fundamental physics of the universe.
5. (Radiative Corrections in key experimental quantities.)

# Institutions/Teams

- ANL [I. Cloet,…]
- Hampton University [A.Accardi, J.Goity,…]
- Jefferson Lab [W.Melnitchouk,J.Qiu, D.Richards, N.Sato, C.Weiss,..]
- Old Dominion University [A.Radyushkin,…]
- Temple University [M.Constantiou,A.Metz,..]
- University of Connecticut [L.Jin,P.Schweitzer,..]
- William and Mary [C.Monahan, K.Orginos,…]