U.S. DEPARTMENT OF ENERGY | Office of Science

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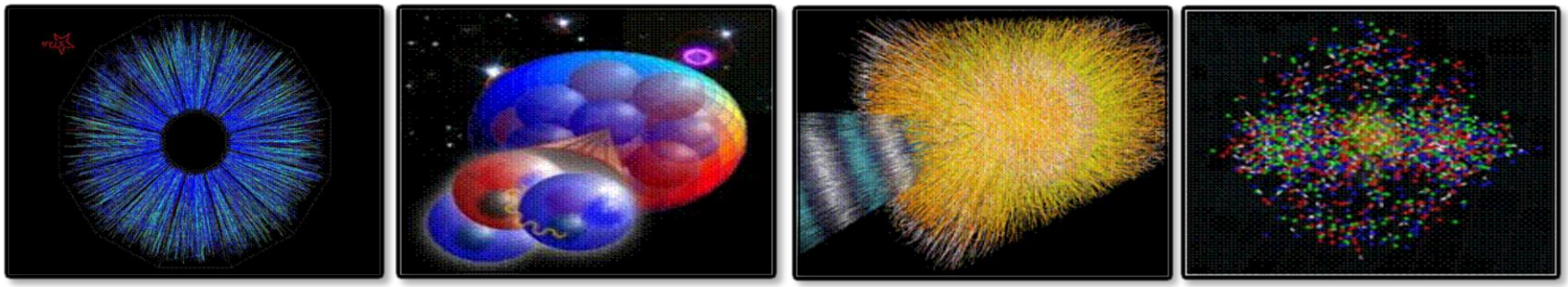
SciDAC-4 PI Meeting
23-25 July 2018

SciDAC-4 and Nuclear Physics

I. What's so special about computational NP?

II. The 3 NP SciDAC-4 Projects. (In breakout session.)

III. Comments / Questions?



I. What's so special about computational NP?

- It is a well-defined mathematical problem, and is **tractable** using MC. (The right answer, with errors -> 0.)

NP = the study of forms of matter dominated by the **strong interaction**.

Theory = **QCD**, quarks and gluons, a simple quantum field theory. (Bring in electroweak effects if needed.)

Solvable using exp(-S) Monte Carlo methods on a spacetime Lattice, "LQCD"; observables obtained from numerical correlation functions.

- **The results** are immediately comparable to ongoing NP experiments, and **are NEEDED by** those **experiment**s for planning purposes.

*e.g.*s of **LQCD predictions**: q,g confinement into hadrons; hadron spectra; "nuclear" forces between hadrons; multihadron bound states "nuclei"; hot QCD EOS (working); (light) nuclear reactions; hadronic m.e.s and decays.

Probs due to small $m_{u,d}$ (~there now), μ ne 0 (N_q ne $N_{\bar{q}}$). (Working on it.)

II. The 3 NP SciDAC-4 Projects

3. NUCLEI
Nuclear Computational Low Energy Initiative
PI Joseph Carlson (LANL)
[very effective, venerable, and amazingly prolific NP SciDAC Collab. UNEDF -> NUCLEI -> NUCLEI. Nuclei, properties, reactions, decays …; Nuclei R Us.]

2. LQCD
Computing the Properties of Matter with Leadership Computing Resources
PI Robert Edwards (TJNAF)
[direct calculations of experimental observables needed NOW by NP experiments from the QFT of the strong interaction, QCD.]

1. TEAMS
Towards Exascale Astrophysics of Mergers and Supernovae
PI William Raphael Hix (ORNL)
[nuclear astrophysics returns to SciDAC! Origins of nuclei, r-process, "multimessenger" calculations of various signals of candidate events, including CCSNe, neutron star pair mergers, and gravity waves!]

III. Comments / Questions?

Come to the breakout session!

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