

Preparing the next INCITE proposal: 2011-2013

USQCD will launch an initiative to apply for a new INCITE grant. The physics objectives of this application will be decided by the Executive Committee after consultation with the Scientific Program Committee and input from the entire collaboration.

SPC asked for input:

...We are not looking for detailed project descriptions but rather would like to see an outline of a broader perspective for a (sub)field of research, its research goals during the next three years and how it may profit from dedicated resources on leadership class computers. ...

...We would like to get input on research directions that may be identified as strategic goals of our community and are in line with long term goals of DOE computing initiatives...

Early Science Time on BlueGene/Q at ALCF

USQCD will also apply for EST on the next BG/Q installation at ALCF; expected to be available early in 2012 for a period of 3 months

The Executive Committee has asked the SPC to provide input on projects that are suitable for EST (all or a subset of the projects suggested for the next INCITE proposal)

SPC received 8 proposals:

- Simulations with Domain Wall Fermions (N. Christ: RBC+LHPC)
- QCD with Four Flavors of Highly Improved Staggered Quarks (R. Sugar: MILC)
- Flavor Physics with Four Flavors of Highly Improved Staggered Quarks (P. Mackenzie: FNAL+MILC)
- The Spectrum of Excited States and their Properties (D. Richards: HSC)
- Lattice QCD study of Hadronic Interactions (M. Savage: NPLQCD)
- Kaon Physics with Domain Wall Valence Quarks and Staggered Sea Quarks (R. Van de Water, J. Laiho, M. Lightman)
- QCD Thermodynamics (R. Soltz: hotQCD)
- Lattice Gauge Theory for Physics beyond the Standard Model (G. Fleming: BSM community (no-name))

- 6 proposals are based on and extend the topics of the current INCITE proposal (standard model parameters, mass spectrum of QCD, hadron structure and their interaction);

production of gauge configurations with almost physical masses close to the continuum limit;

analysis projects based on the configuration generation projects

- 1 proposal on QCD thermodynamics with highly improved staggered and DWF fermions;

equation of state, chiral transition and other thermodynamic observables

- 1 proposal on Beyond the Standard Model Physics;

SU(2) SUSY Yang-Mills, SU(3) Yang-Mills with 8-12 flavors

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generation of gauge field configuration:

4-flavor HISQ action: reach $a=0.045\text{fm}(128^3 \times 192)$ at physical values of the quark mass

(2+1)-flavor anisotropic clover at $a=0.12\text{fm}(48^3 \times 256)$ at physical values of the quark mass

(2+1)-flavor DWF: reach $a=0.14\text{fm}(48^3 \times 64)$ at physical values of the quark mass

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analysis projects based on the configuration generation projects

analysis projects:

- heavy-light program on HISQ ensembles
- hadron spectroscopy, excited states, nucleon-nucleon scattering on anisotropic clover ensembles
- broad pion and kaon physics program on DWF ensembles
- mixed action DWF/asqtad(HISQ) kaon physics program

QCD thermodynamics with highly improved staggered (HISQ) and DWF fermions

gauge field generation:

- calculations within 4-flavor QCD using the HISQ action on $48^3 \times 12$ ($T = 0 : 48^4$) lattices [$a \simeq 0.1\text{fm}$ at T_c] at physical quark mass values
- (2+1)-flavor QCD using DWF on $24^3 \times 8 \times 32$ at $m_\pi \simeq 200\text{MeV}$

analysis projects:

- equation of state and other thermodynamic observables on HISQ ensembles
- chiral aspects of the QCD transition on DWF ensembles

Beyond the Standard Model Physics

- concrete physics objectives still need to be worked out
- action(s) still need to be chosen

Potential BSM Projects:

- N=1 SU(2) SUSY Yang-Mills
(direct calculation of the gluino condensate)
- SU(3) Yang-Mills with $N_f=8$ fundamental fermions
(QCD like, reach small masses to apply chiral PT)
- SU(3) Yang-Mills with $N_f=12$ fundamental fermions
(QCD-like, nearly conformal or conformal?)

Recommendations made by the SPC:

- There are strong arguments in favor of a continuation of the current configuration generation and analysis program of USQCD with a **strong emphasis on a physics program with almost physical quark masses on large lattices close to the continuum limit**
- When arguing for such a program it does not seem to be appropriate to include a discussion of mixed action approaches, although such projects may become part of USQCD analysis projects using INCITE time
- QCD thermodynamics is also clearly an important topic in nuclear physics and we can make a large impact in conjunction with, and support of, the large experimental effort in the US and at LHC. It is also a gauge configuration generation project that can be supplemented with further analysis projects, and would be done at the physical point.

Recommendations made by the SPC (cont'd):

- BSM clearly is an important topic in the LHC era, but the unknown nature of the phase diagram and the cost of exploring it means we must be wise and focused to use our resources efficiently.

Summary:

- The SPC feels the projects will all contribute to a strong and successful INCITE proposal
- the mixed action approach should not be put forward as an argument for a new INCITE project
- For EST, the SPC suggests a proposal based on simulations at physical quark mass and large volumes to make the strongest impact. Specifically, one or more of the gauge generation proposals and a QCD thermodynamics project should be put forward.

The SPC expects that all projects that will enter the final INCITE proposal will have the chance and should be encouraged to refine their program. The SPC also expects to get the chance to comment on draft versions of the INCITE proposal.