USQCD

and

New Tests of the SM

Taku Izubuchi for SPC

USQCD AHM, FNAL, 2012-05-05

New kinds of tests for the SM

- Zero temperature projects, other than flavor physics (R. Van de Water's session) or "traditional" NP (M. Savage's session) on QCD ensemble.

  - try to support intensity frontier experiments
    (c.f. BSM projects : high energy frontier experiments, S. Catterall's session)

  - use the pool of USQCD's QCD ensembles
    no new configuration generation necessary (so far…)

  - fit in both of High Energy Physics and Nuclear Physics

  - are in exploratory stages, often limited by statistical error

Relevance to USQCD's goals

- QED, Isospin : An important area […] is the inclusion of electromagnetic effects and the isospin breaking […] will be further developed during SciDAC-3 and will be needed for some of the precision goals targeted in 2014. (HEP)

- g-2 : To make full use of this experimental effort, it is crucial to reduce the theoretical error to a similar level. This is a major challenge, […] LQCD can, in principle, provide improved results […] It is very hard to forecast the future of such pioneering calculations, but we expect significant progress during the period of the SciDAC-3 award. (HEP)

- NP proposal : Future Challenges: The currently exploratory calculations of nuclear parity violation must be greatly refined […] The neutron edm calculations have to be performed at the physical quark masses, and the impact of higher dimension operators evaluated. Efforts must be made to determine the strong interaction contributions to the light-by-light contributions to the muon g-2.

- SPC's testimony : "We expect/encourage more projects to come in this category in near future"

Proposals 2012/2013

- Izubuchi's propsal 18.8 M Jpsi h
  - Isospin breakings including QED charge of valence and sea
  - Muon's anomalous magnetic moment (g-2)μ
  - RBC / UKQCD 's DWF ensembles
- Aubin's proposal 5.6 M Jpsi h
  - HVP of (g-2)μ using MILC's staggered ensembles
- Shintani's proposal 4.72 M Jpsi h
  - Proton / Neutron Electric Dipole Moment (EDM)
  - Proton decay
  - Strangeness in Nucleon
    (many other proposals will also do this)
  - RBC / UKQCD 's DWF ensembles
- Lin's proposal 16.1 M Jpsi h
  - BSM semi-leptonic Neutron decay
  - MILC's staggered ensembles

Total requests : 11.8 % of all cluster requests

Targeted Experiments

- g-2
  FNAL E989, the new muon g-2 collaboration
  ¼ smaller total error on BNL's E821
  similar plans at J-PARC
- EDM
  Proton EDM is planned at BNL
  ongoing/plans at ORNL, FNAL, J-PARC, ...
- BSM via Neutron Decay
  Ultra Cold Neutron Source at LANL
- Proton decay , Strangeness in Nucleons
  Tank type US experiments, Super/Hyper Kamioka,
  DM detectors , ….

Questions from SPC

- Whether / how to support this category

- Is current approximate breakdown
  10% (BSM) 10% (NSM) 30% (CKM)
  20% (THERM) 30% (NP)
  sensible ?

- Which of HEP or NP does this belong to ?
  Does DOE/we care ?

Proposal talks

- T. Izubuchi (7.5’)
  ½ of Izubuchi’s proposal
- T. Blum (7.5’+15’)
  ½ of Izubuchi’s and C. Aubin’s proposals
- E. Shintani (15’)
- H-W. Lin (15’)