LQCD Project 2009 Annual Review

Response to scientific recommendations of the 2008 LQCD annual review.

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- The 2008 progress review resulted in 14 recommendations.
- 10 recommendations were associated with the scientific program and will be addressed in this talk.
- 4 recommendations were associated with technical and/or user aspects of the computing project, and will be addressed in the next talk.

Recommendations of the 2008 LQCD annual review are shown in blue.
Our responses are shown in black.

1. USQCD should consider including experimenters and theorists from outside the lattice community on the USQCD Executive Committee and Allocations Board. This would broaden the scientific program and allow a wider community to influence the prioritization of physics topics and the allocation process.

We agree that in setting scientific priorities USQCD should obtain broad input from experimenters and theorists outside the lattice community. We believe that the best way to obtain broad input is through the workshops we organize that bring lattice gauge theorists together with experimenters and/or outside theorists with similar interests. In the last two years we have held such workshops on CKM matrix elements, QCD at high temperatures and densities, physics beyond the Standard Model, and the structure and spectroscopy of hadrons. Each of these workshops has one or more organizers from outside USQCD, as well as from inside. We plan to hold workshops of this type on a continuing basis.

A key step in setting scientific directions for USQCD is the discussion of proposals and priorities held at the annual All Hands Meeting. We have decided to invite one of the outside coordinators of each workshop to make a presentation at the first All Hands Meeting following his/her workshop. This person is asked to summarize the workshop and participate in the discussion of USQCD priorities. We believe that this approach provides broader scientific input than including one or more physicists only representing a few specific subfields outside USQCD on the Scientific Program Committee or the Executive Committee. At the May 14-15, 2009 All-Hands Meeting, nuclear physicist Curtis Meyer summarized the November, 2008 JLab workshop, “Revealing the Structure of Hadrons”.

2. USQCD should continue its workshops with other segments of the high energy and nuclear physics communities. It should also continue its series of summer schools to encourage the grown of the field by attracting talented young physicists.

We intend to follow both of these recommendations. We scheduled a workshop on hadron structure that was held at JLab on November 21 and 22, 2008. We have scheduled one on QCD thermodynamics at BNL on June 8-12, 2009. We also expect to hold another workshop on weak interaction matrix elements in the coming year.

We have are coordinating with Europe to organize alternating summer schools. One was held at the INT, Seattle, August 8-28, 2007. The next will be held at Les Houches, Aug. 3-28, 2009.

3. As the accuracy of LQCD simulations have improved, small discrepancies between alternative methods and discrepancies with experimental results are becoming apparent. The source of these problems should be identified. The independence of the members of gauge ensembles should be monitored closely, and the results of such studies should be included in the stated errors of the resulting matrix elements.

One of our major objectives is to look for possible discrepancies between lattice calculations and experimental results. At present, the one case in which such a discrepancy may be occurring is the determination of the leptonic decay constant of the *Ds* meson. This question is under intense investigation by members of USQCD. We are not aware of any significant discrepancies in quantities calculated with different lattice methods; however, we believe it is essential to continue to investigate this possibility by calculating a number of quantities using different methods. The independence of members of gauge ensembles is monitored closely, and correlations are taken into account in error budgets. The committee is right to emphasize the importance of doing so.

4. USQCD should encourage planning within the community to ensure that analytic calculations in chiral perturbation theory are completed in a timely fashion.

We agree that for many projects it is imperative to carry out chiral perturbation theory calculations, and to have them completed in time to be used in analyzing the data. Members of our community are well aware of this fact. Many of them already do such calculations themselves, collaborate with theorists specializing in chiral perturbation theory, or actively encourage calculations that they need. Planning for such calculations is encouraged by the fact that doing so strengthens proposals for USQCD allocations.

5. USQCD should encourage more work on the charmonium and open-charm spectra, in light of recently discovered at the B factories. USQCD should similarly encourage spectroscopy calculations (light JPC exotics, etc.) that are relevant to the 12 GeV upgrade at JLAB, since this is currently the highest DOE NP experimental priority.

We have major efforts in progress in both of these areas, which could use more resources; however, we have other high priority projects in progress that would also benefit from more resources. The critical question is how to balance resources among high priority projects. We believe that our allocation process does a good job of this, but we actively solicit input from other sources.

6. USQCD should encourage the calculation of transport coefficients in finite temperature simulations, since these quantities are crucial to different theoretical approaches to the subject, and are central to experimental programs at the Relativistic Heavy Ion Collider (RHIC) and elsewhere.

We agree that these calculations are important. One of these, which was very highly rated by the Scientific Program Committee last year, has been completed. Several new projects in this area have been approved by the Scientific Program Committee for 2009/10.

7. In allocating time to Type C projects, USQCD should give special emphasis to exploratory work on physics beyond the Standard Model.

We agree. As we indicated at the 2008 review, Class C projects are under-subscribed, so the Scientific Program Committee and the Executive Committee have worked to encourage them in all subfields. Because beyond the Standard Model (BSM) physics is a less mature sub-field of lattice gauge theory, exploratory work in it is particularly appropriate for Class C allocations. However, it should be noted that we already have several BSM projects with large (Class A and B) allocations. Allocations for BSM projects have been increasing every year for the last few years. In the 08/09 allocation year, six out of sixteen high energy physics projects were BSM projects, and they were awarded 4.1% of USQCD resources. In the 09/10 allocation year, five out of sixteen HEP projects were BSM projects, and they were awarded 7.1% of USQCD resources.

8. USQCD uses a “bottom up”, proposal-driven allocation process. There is, therefore, no process to guarantee that the LQCD facilities will be used to meet the priorities of the broader High Energy and Nuclear Physics communities. Several of the recommendations above address this concern in part, but USQCD might consider developing a more definite roadmap outlining actual commitments of groups to particular calculations, with projected estimates of precisions. In particular, USQCD might consider a process that has been applied to large experimental collaborations, specifically providing allocations for some assigned activities to insure the physics community that specific high priority opportunities are not missed.

We do indeed use a “bottom up”, proposal-driven allocation process, and we believe very strongly that this is the correct approach for our field. In our LQCD and LQCD-ext proposals we set out roadmaps indicating our highest priority projects and, where possible, the precision we expected to reach with a given amount of computing resources. These high priority projects involve very exciting physics, and there has never been a lack of proposals to carry them out. It is the responsibility of the Scientific Program Committee in recommending allocations and the Executive Committee in approving them, to make certain that allocations are properly balanced among high priority areas. We have obtained input from the broader high energy and nuclear physics communities regarding priorities. We have made several presentations to the High Energy Physics Advisory Panel, which has provided advice on scientific priorities and strong support for our efforts. In nuclear physics, where NSAC has agreed on a comprehensive set of national milestones, these milestones have always been considered in the Scientific Program Committee’s discussions, and the national USQCD program has consistently been well aligned with them. The process outlined in response to Recommendation 1 will provide very useful input from the broader high energy and nuclear physics communities on a yearly basis.

9. USQCD should become more systematic in making physical quantities (and their associated error matrices) publicly available before chiral and/or continuum extrapolations, to allow future improvements in these areas to be propagated back to earlier results.

This is an interesting suggestion. We believe that it is important to discuss with members of USQCD and our experimental colleagues exactly what information would be most useful to include in publications and/or to post on the web. We believe that the workshops mentioned above are good venues for doing so.

10. The number of post-docs, graduates and undergraduates involved in LQCD research should be better documented, in order to understand the impact the project is having on the demographics of NP and HEP.

We agree. We have compiled a new version of the USQCD membership list that includes the academic rank of each of our members. Because junior members of the collaboration change rank and institution relatively often, we will institute regular surveys to help us keep the list up to date.