Computer Resources

Local Computing Environment

The bulk of our code development, debugging and data analysis is done on collaboration-member workstations. They are, of course, inadequate for carrying out all but our smallest simulations, or for storing the large lattices generated in our work. Some of us have access to larger local campus resources for code testing, and small to moderate sized projects: through the University of Utah Center for High Performance Computing, CD has a modest allocation on a 256-node Linux Opteron cluster; At Indiana University, SG has access to BigRed and Libra, which have been used for exploratory and small scale work on a=0.15 and 0.12 fm configurations. These machines are generally saturated with serial and low CPU count jobs and do not provide the capacity or capability for thousand core jobs required for the projects proposed here; and DT has access to time on an SGI Altix at the University of Arizona.

Current and Pending Allocations of Supercomputer Time

Our current NRAC grant, MCA93S002, which runs from October 1, 2007 to September 30, 2008, provides 19,124,000 service units on the TACC Sun Opteron Cluster, Ranger, 4,875,000 service units on the SDSC IBM BlueGene/L, 4,452,100 service units on the PSC Cray XT3, Big Ben, 3,137,500 service units on the NCSA Linux Cluster, Abe, and 1,565,000 service units on the NCSA Xeon Cluster, Tungsten.

We currently have an allocation of 9,800,000 core-hours on the Argonne National Laboratory's BlueGene/P, as participants in the USQCD Collaboration's Incite grant. We obtain additional time on the BlueGene/P through Argonne's Early Science Program, but there is no official allocation. This time is being used to generate gauge ensemble with lattice spacing $a \approx 0.06$ fm and light quark mass $m_l = 0.15\,m_s$, and a second ensemble with lattice spacing $a \approx 0.045$ fm and light quark mass $m_l = 0.2\,m_s$. We have been allocated approximately 18% of the time on the special purpose QCDOC at Brookhaven National Laboratory for the coming year. This allocation will be used to complete the generation of $48^3 \times 144$ configurations with $a \approx 0.06$ fm and $m_l = 0.3\,m_s$. We have an allocation of 5,046,000 processor-hours on the NERSC Cray XT4 for the period January 9, 2008 to January 9, 2009, and plan to apply for a renewal. This allocation has been used to generate and perform analysis on the $a \approx 0.06$ fm, $m_l = 0.1\,m_s$ gauge configurations, as well as to begin the generation of the ensemble with lattice spacing $a \approx 0.09$ fm and three quarks of equal mass $0.1\,m_s$. We have a joint allocation with our collaborators at FNAL of 5,500,000 processor-hours on the FNAL clusters for the study of the weak decays of particles containing heavy quarks. During the coming year, these resources will be used to perform studies on the $a \approx 0.12$ fm and 0.09 fm ensembles, supplementing the resources we request in this proposal for studies on the $a \approx 0.06$ fm ensembles. As members of the HotQCD Collaboration, we have access to a BlueGene/L at Lawrence Livermore Laboratory for the study of QCD at high temperatures. Although we do not have an explicit allocation, we are obtaining sufficient resources to carry out a substantial project.

Qualifications of the Principal Investigators

The principal investigators have had extensive experience in lattice gauge theory. Our research has covered a broad range of topics in this field, including high temperature QCD, the hadron mass spectrum, and weak decays of strongly interacting particles. It has involved the development of new algorithms and calculational techniques, small exploratory calculations, and very large simulations. We have made use of a wide range of high performance computers in our research including array processors, vector supercomputers and massively parallel computers. A list of the publications of our collaboration, the current members of our group, and the vita of the principal investigators are provided in an attachment.