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SciDAC-3: Searching for Physics Beyond the Standard Model: Strongly-Coupled Field Theories at the Intensity and Energy Frontiers
University of Arizona Component
Report period: September 1, 2013 - August 31, 2015

The Arizona component of the SciDAC-3 Lattice Gauge Theory program consisted of partial support for a postdoctoral position. In the original budget this covered three fourths of a postdoc, but the University of Arizona changed its ERE rate for postdoctoral positions from 4.3% to 21%, so the support level was closer to two-thirds of a postdoc. The grant covered the work of postdoc Thomas Primer.

Dr. Primer's first task was an urgent one, although it was not forseen in our proposed work. It turned out that on the large lattices used in some of our current computations the gauge fixing code was not working as expected, and this revealed itself in inconsistent results in the correlators needed to compute the semileptonic form factors for K and D decays. Dr. Primer participated in the effort to understand this problem and to modify our codes to deal with the large lattices we are now generating (as large as $144^3 \times 288$). Corrected code was incorporated in our standard codes, and workarounds that allow us to use the correlators already computed with the unexpected gauge fixing were been implemented.

The largest part of Dr. Primer's work was to adopt existing analysis code for using HISQ quarks to compute the $K \to \pi l \nu$ form factor at $Q^2 = 0$ to study the analogous processes $D \to \pi l \nu$, and $D \to K l \nu$. Study of these processes will lead to better calculation of the CKM matrix elements V_{cd} and V_{cs}. Dr. Primer prepared the necessary analysis codes, collected and analyzed the Monte Carlo data and worked on fitting the data to the expected theoretical forms. Although this project is still in progress, Dr. Primer presented progress reports at the yearly international conferences on lattice gauge theory.

Dr. Primer also tested application of the "truncated solution method" introduced by the RBC collaboration to the computation of the semileptonic D and K decays. For this application, this method did not seem to be advantageous.

Dr. Primer then tested the method in our project to compute the anomalous magnetic moment of the muon, where the TSM proved to be more successful. Codes and tuning parameters prepared by Dr. Primer are now being used for our ongoing $g - 2$ computations.

Dr. Primer also worked on using the Intel Phi co-processors that are available at the Texas Advanced Supercomputing Center (TACC) and National Energy Resources Supercomputing Center (NERSC) to accelerate our computations, as described in the statement of work in our proposal. (Members of the MILC collaboration at Indiana and Utah have been working on this for some time.)