Data and computations

Calculations are based on stochastic simulations of quantum fluctuations.

Main variables are quark fields and gluon fields, defined over a space-time hypercubical lattice.

Lattices as large as 128^4 **will be required.**
($\sim 3.2GB$ **for q.f. ,** $\sim 9.6GB$ **for g.f.)**

Observables are calculated by averaging over large ensemble of configurations.

Most demanding computational kernel is the calculation of quark propagators in presence of the gauge field. Needed for generating configurations and for calculating observables; requires solution of huge system of sparse linear equations.

Computations are parallel, but not trivially-parallel. They involve very large amounts of data motion.

Appropriateness for the SSI

- **Results will be crucial for the DOE mission.**
- **Project will challenge the power of the SSI resources.**
- **Tuning tested production codes to optimal performance (collab. with CS) will provide early showcase for SSI.**

Algorithm development

Algorithm development has been crucial for the progress of lattice calculations.

Recent theoretical advances have provided major breakthroughs in our ability of incorporating chirality in lattice simulations.

These new ideas require even more CPU and memory intensive calculations, e.g. extending the lattice in a fifth dimension (domain walls).

Our project will involve an active collaboration with applied mathematicians and computer scientists for algorithm development.