Modern Challenges for Lattice Field Theory.

M. Creutz, J. Kogut, H. Neuberger, T. Wettig

June 16, 2003

Abstract

Given the growing success of lattice field theory in addressing problems relevant to the experimental programs in high energy and nuclear physics, it is time to think about a new generation of problems. These will include challenging second generation calculations in QCD, as well as problems in other directions.

1 Introduction

This program, to be held at the KITP in Santa Barbara, is approved for a period of 12 weeks from Jan. 10, 2005 to April 1, 2005. We plan to organize the program into a sequence of 1-4 week focus segments which will cover the field of lattice field theory in as continuous a fashion as possible. This plan is flexible and its final form will depend on the availability of interested participants.

We plan to devote the last of the total of 12 weeks to a summarizing conference, assuming that this would be of interest.

During March we shall overlap with a program in condensed matter, and we have been encouraged to coordinate and identify areas of common interest. We have established contact with the organizers of the condensed matter program.

On the next page there is a more detailed list, in chronological order, each segment immediately following the previous one. Some of the segments are overlapping as mentioned.

2 Outline of program

The starting date is Jan. 10, 2005.

1. **Theory .... 4 WEEKS**

- *Stringy aspects of lattice gauge theories*
- *SUSY on the lattice*
- *Weyl fermions on the lattice*
- *Deconstruction*
- *Matrix models*

2. **Phenomenology .... 3 WEEKS - 1WK ovlp with 3.**

- *Unquenched: Staggered quarks*
- *Quenched/Unquenched: Wilson quarks*
- *Quenched/Unquenched: Overlap/Domain-wall quarks*

3. **Extreme env. .... 3 WEEKS - 1 WK ovlp with 4.**

- *High density*
- *High temperature*
- *Early Universe, Inflation, BAU*
- *RMT modeling*

4. **Computation .... 3 WEEKS**

- *Fermionic algorithms*
- *Simulations of systems relevant to condensed matter*
- *Real time problems*
- *Quantum computing*
- *Econo- and Bio- Physics*

5. **Summarizing Conference .... 1 WEEK**