Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Exotic excitations with fractional charges on frustrated lattices
ERICH RUNGE, Technische Universität Ilmenau, FRANK POLLMANN, PETER FULDE, Max-Planck-Institut für Physik komplexer Systeme — Geometrical frustration of lattices can lead to a macroscopic degeneracy in the classical limit and thus to many interesting physical effects. In spin systems these are e.g. translational invariant spin liquid ground states and deconfined spinons. In contrast to magnetic properties, one began only recently to explore the charge degrees of freedom on frustrated lattices. For the systematic study of charge degrees of freedom, we consider a model of spinless Fermions with nearest-neighbor hopping t and Coulomb repulsion V. Quantum fluctuations reduce the classical ($t = 0$) macroscopic degeneracy. For the strongly correlated limit $V \gg |t|$, it has been predicted that an added electron can decay into two mobile quasi-particles, leading to fractional charges of $e/2$ in 2D and 3D systems. For a deeper understanding of these charge degrees of freedom we calculated numerically the properties of static and dynamic charges on the 2D checkerboard lattice. We find evidence for a weak confinement between two fractional charges leading to excitations with very large spatial extend. Furthermore, we argue that the fractional charges are probably deconfined on the 3D pyrochlore lattice.

Erich Runge
Technische Universität Ilmenau

Date submitted: 03 Dec 2005 Electronic form version 1.4