Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Mapping the Braiding Properties of Non-Abelian FQHE Liquids.[1] EMIL PRODAN, F. D. M. HALDANE, Princeton University — Non-Abelian FQHE (NAFQHE) states have elementary excitations that cannot be individually locally-created. When widely separated, they give rise to topological (quasi-)degeneracy of the quantum states; braiding of such non-Abelian quasiparticles (NAQP's) implements unitary transformations among the degenerate states that may be useful for "topological quantum computing" (TQC). We have developed a new technique for explicit computation of NAQP braiding in models exhibiting ideal NAFQHE behavior (where the topological degeneracy is exact), in particular the Moore-Read $\nu = 5/2$ state. For systems of small numbers of NAQP's on a sphere, we have computed the non-Abelian Berry curvature and Hilbert space metric, as one NAQP is moved relative to a fixed configuration of the others, showing how the topological properties develop as the system size (NAQP separation) increases. We also studied the effect of perturbations (Coulomb interaction and substrate potentials) that lift the exact degeneracy, and become the dominant corrections when NAQP's are brought together so that quantum measurements can be made; these effects are likely to be crucial in determining whether TQC is viable in NAFQHE systems.

[1]Supported by NSF MRSEC DMR-0213706

Emil Prodan
Princeton University

Date submitted: 20 Nov 2006 Electronic form version 1.4