Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Quantum Chaos, Localization, and Entanglement in Disordered Heisenberg Models WINTON BROWN, Dartmouth College, DAVID STARLING, SUNY Fredonia, LEA SANTOS, LORENZA VIOLA, Dartmouth College — We explore the relation between quantum chaos, localization, and entanglement in a two-dimensional disordered Heisenberg spin-1/2 system. Apart from the recent interest in such systems as models for proposed quantum computing architectures, they exhibit interesting transition regions from integrability to chaos and from higher to lower degree of symmetry. Complementing the standard eigenvalue-based analysis for identifying the cross-over into chaos, we suggest looking at the relative delocalization of eigenvectors related to different disorder realizations as a basis-independent indicator of chaoticity. We investigate the behavior of several measures of bipartite and multipartite entanglement – including concurrence; von Neumann entropy; and, using the framework of generalized entanglement, a family of local purities. Our results indicate that bipartite entanglement decreases in the chaotic region, whereas the opposite holds for multipartite entanglement. Connections are established with predictions from random matrix theory.

Winton Brown
Dartmouth College

Date submitted: 24 Nov 2005 Electronic form version 1.4