Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Mode locking in quasiperiodic structures CREIGHTON THOMAS, Syracuse University, A. ALAN MIDDLETON, Syracuse University — AC driven extended systems, such as charge density waves or arrays of Josephson junctions, exhibit mode locking or giant Shapiro steps. This mode locking is seen experimentally as plateaus in a generalized velocity or current as a function of drive parameter. In conventional mode locking, the frequency of the response is a rational multiple of the frequency of the AC drive. For a model, we use a sandpile automaton model with local nonlinear update rules. When random quenched disorder is present in the automaton, a Devil's staircase with mode locking at all rational numbers has been previously seen. We investigate the use of quasiperiodic structures in place of the disordered structures. We find the novel phenomena of mode locking where the currents are a quasiperiodic multiple of the drive frequency. These quasiperiodic steps turn out to be stable to thermal fluctuations. Application of this model to Josephson junction arrays and structured colloidal systems will be presented.

A. Alan Middleton
Syracuse University

Date submitted: 30 Nov 2005 Electronic form version 1.4