1097-35-197 **Chris Curtis***, San Diego State University, Department of Mathematics and Statistics, 5500 Campanile Drive, GMCS 415, San Diego, CA 92182. *Tight-Binding Approximations and Edge States in Honeycomb Optical Lattices.*

Over the last several years, a great deal of interest has emerged over honeycomb optical lattices, which are modeled by a Gross-Pitaevskii (GP) equation with a periodic, two-dimensional potential. Using a tight-binding approximation in the semi-classical limit, a two-dimensional nonlinear discrete system has been derived as an approximation to the GP equation. We present results that establish the validity of this approximation on asymptotically long time scales.

By introducing an edge into the discrete system, we then present results on the propagation of modes localized along the edge, or edge modes. Ignoring nonlinearity, one can find a plethora of linear edge modes, but a central question is what is the impact of nonlinearity on these problems. In the case of weak nonlinearity, we have developed a rigorously justified approximation describing the impact of nonlinearity on the linear modes. The most important result from this is that the nonlinearity does not cause delocalization away from the edge. In the case of strong nonlinearity, we present numerical results which show the nonlinearity does not cause delocalization, and thus edge modes should be a stable feature for optical lattices with edges. (Received January 21, 2014)