1041-34-293 **Harish S. Bhat*** (hbhat@ucmerced.edu), University of California, Merced, School of Natural Sciences, P.O. Box 2039, Merced, CA 95344, **Braxton Osting** (bro2103@columbia.edu), Applied Physics and Applied Mathematics, S. W. Mudd Building, 500 W. 120th St., New York, NY 10027, and **Ehsan Afshari** (ehsan@ece.cornell.edu), Electrical and Computer Engineering, Cornell University, 406 Phillips Hall, Ithaca, NY 14853. *Short-wavelength phenomena in spatially discrete systems.*

We analyze a class of damped, driven wave equations on the two-dimensional square lattice. The phenomena of interest occur on length scales too small to be captured using continuum limits. In the first case, we describe a theory of diffraction, derived using lattice Green's functions, that captures the essential dynamics when the medium is linear. For a nonlinear medium, we give a perturbative method that captures the effect of nonlinear constructive interference. Our results are validated by the detailed agreement of theory, numerical simulations, and experiments. (Received August 13, 2008)