

**Ablowitz, Mark J.; Zhu, Yi**

**Nonlinear waves in shallow honeycomb lattices.** (English) Zbl 1258.41012  
SIAM J. Appl. Math. 72, No. 1, 240-260 (2012).

Authors' abstract: The linear spectrum and corresponding Bloch modes of shallow honeycomb lattices near Dirac points are investigated. Via perturbation theory, the dispersion relation is found to have threefold degeneracy at leading order with eigenvalue splitting at the following two orders; i.e., the threefold eigenvalue splits into single and double values. Multiscale perturbation methods are employed to describe the nonlinear dynamics of the associated wave envelopes. The dynamics of the envelope depends on different asymptotic balances whereupon a three-level nonlinear Dirac-type equation or a two-level nonlinear Dirac equation is derived. The analysis agrees well with direct numerical simulations.

Reviewer: [Lothar Berg \(Rostock\)](#)

**MSC:**

- [41A60](#) Asymptotic approximations, asymptotic expansions (steepest descent, etc.) Cited in **21** Documents
- [35C20](#) Asymptotic expansions of solutions to PDEs
- [35Q55](#) NLS equations (nonlinear Schrödinger equations)
- [35L60](#) First-order nonlinear hyperbolic equations

**Keywords:**

[honeycomb lattices](#); [nonlinear Dirac equation](#); [coupled mode equation](#)

**Full Text:** [DOI](#)