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**Martina Chirilus-Bruckner\*** ([martina\\_chirilus-bruckner@brown.edu](mailto:martina_chirilus-bruckner@brown.edu)) and **Clarence Eugene Wayne**. *On the existence of breathers in periodic media: Inverse spectral theory for open gap potentials.*

The concept of breathers, i.e. time-periodic, spatially localized excitations, has been introduced in the context of the Sine-Gordon equation, which, however, seems to be the only (constant coefficient) nonlinear wave equation to support such solutions. In this sense, breathers have been considered a rare phenomenon. Surprisingly, a nonlinear wave equation with spatially periodic step potentials has been found recently to support breathers (Blank et al. 2010) by using a combination of spatial dynamics, center manifold reduction and bifurcation theory. Via inverse spectral theory, we aim towards characterizing a larger class of potentials that allow breathers. The research is motivated by the quest of using photonic crystals as optical storage. (Received September 03, 2012)