SPECTRAL PROPERTIES OF SOLITON-BREATHERS IN A 2D HEXAGONAL CRYSTAL LATTICE

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In this work we study spectral properties of *intrinsic localized modes* (ILM), also known as *discrete breathers* (DBs), in a generic 2D hexagonal crystal lattice model of muscovite mica [1, 2]. For the first time the theory of exact traveling waves is extended to two dimensions and can also be easily extended to three dimensions [3]. Generically, these waves are *pterobreathers*, that is, traveling DBs with wings [4]. Exact time-periodic with spatial translation traveling waves in the $\omega - k$ representation are within resonant planes, each plane corresponding in the moving frame to a single frequency. These frequencies are integer multiples of a frequency called the fundamental frequency. A discrete breather is within a resonant plane called the breather plane and has a single frequency in the moving frame. The intersection of the resonant planes with the phonon surfaces produce co-traveling wings with a small set of frequencies. The $\omega - k$representation of a numerically obtained exact traveling wave is shown in Fig. 1, where the traveling wave consists of a breather and a soliton traveling together; thus, the name *soliton-breather*. Fig. 1 demonstrates the Fourier transform in two spatial variables and time (XYTFT) of the atomic displacements in the x-axis coordinate direction, that is, in the direction of travel, together with two branches of the phonon dispersion relation obtained from the linearized equations. To obtain such frequency-momentum representation is fundamental to be able to interpret possible signatures of localized nonlinear waves in physical spectra of real crystals.

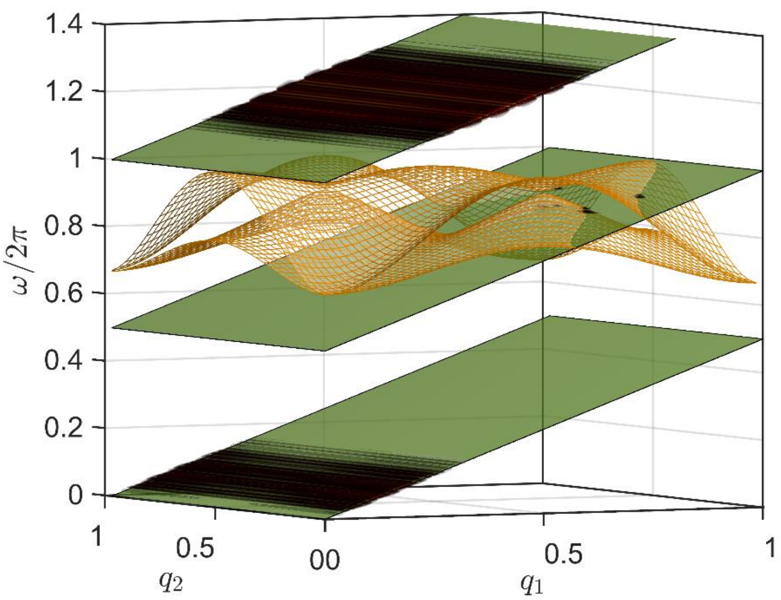

Fig. 1. Isosurface of the XYTFT of an exact soliton-breather, together with the resonant planes and the phonon surfaces