. (1)

where *m* is the mass,  is the acceleration of the mass displacement *un* at lattice site $n$, and *KN* is the spring constant representing *N*th-nearest-neighbour interactions, with *N*=3 in our case (see details in Methods). The corresponding dispersion relation is

. (2)

By fitting our measured dispersion relation to Eq. (2), we obtain *k1*=198 *N/m*, *k*3=454 *N/m*, and *m*=2.59\*10-5 *kg* for our experimental sample. The fitted curve is shown in Fig. S1, which is consistent with our measured result.