Phonon and magnon dispersions of incommensurate spin ladder compound Sr$_{14}$Cu$_{24}$O$_{41}$\(^1\) XI CHEN, Univ of Texas, Austin, DIPANSHU BANSAL, Oak Ridge National Lab, SEAN SULLIVAN, JIANSHI ZHOU, Univ of Texas, Austin, OLIVIER DELAIRE, Oak Ridge National Lab, LI SHI, Univ of Texas, Austin — There are a variety of compounds consisting of two or more interpenetrating sublattices with lattice periods incommensurate at least along one crystal axis. One example is spin ladder compound Sr$_{14}$Cu$_{24}$O$_{41}$ consisting of incommensurate spin ladder and spin chain sublattices. It has been predicted that unique phonon modes occur in these compounds due to the relative motion of the sublattices. In the low-wavelength limit, there is only one longitudinal acoustic mode due to the rigid translation of both sublattices. In addition, one extra pseudo-acoustic mode is present due to relative sliding motions of the two sublattices. Although the theoretical aspects of the lattice dynamics of incommensurate compounds have been studied, there have been few experimental investigations on their phonon dynamics. In this work, single crystals of Sr$_{14}$Cu$_{24}$O$_{41}$ are grown by the traveling solvent floating zone method. The phonon dispersion of Sr$_{14}$Cu$_{24}$O$_{41}$ is studied through inelastic neutron scattering measurements in order to better understand its phonon dynamics. In addition, its magnon dispersion is investigated and correlated to the large directional magnon thermal conductivity. The measurements reveal a wealth of intriguing features on phonons and magnons in the spin ladder compound.

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