

# Unveiling the phonon dynamics in quasi-2D organic-inorganic hybrid perovskites BA<sub>2</sub>MA<sub>n-1</sub>Pb<sub>n</sub>I<sub>3n+1</sub> (with $n = 1 - 4$ )

P. C. Wei<sup>A</sup>

<sup>A</sup>*Department of Materials Science and Engineering, National Cheng Kung University*

The original objective of this experiment was to investigate the phonon spectra of quasi-2D organic-inorganic hybrid perovskites. However, preliminary measurements revealed that the major acoustic phonon modes were located below 2.0 meV. This energy range is beyond the effective measurement capability of the GPTAS thermal neutron triple-axis spectrometer, making it difficult to obtain reliable data with sufficient statistical quality. After careful evaluation of the preliminary results, the experimental plan was revised, and a backup sample of the one-dimensional halide perovskite CsCu<sub>2</sub>Br<sub>3</sub> was selected for the remaining beamtime.

For this measurement, 10 single crystals were successfully co-aligned, yielding strong and well-defined Bragg reflections suitable for inelastic neutron scattering measurements. Phonon dispersion measurements were subsequently performed at 10, 100, 200, and 300 K along the  $[-K -K 0]$ ,  $[4-K 4-K 0]$ ,  $[0 0 4-H]$ , and  $[4 4 H]$  directions. The measured phonon dispersion relations are shown in Figs. 1 and 2.

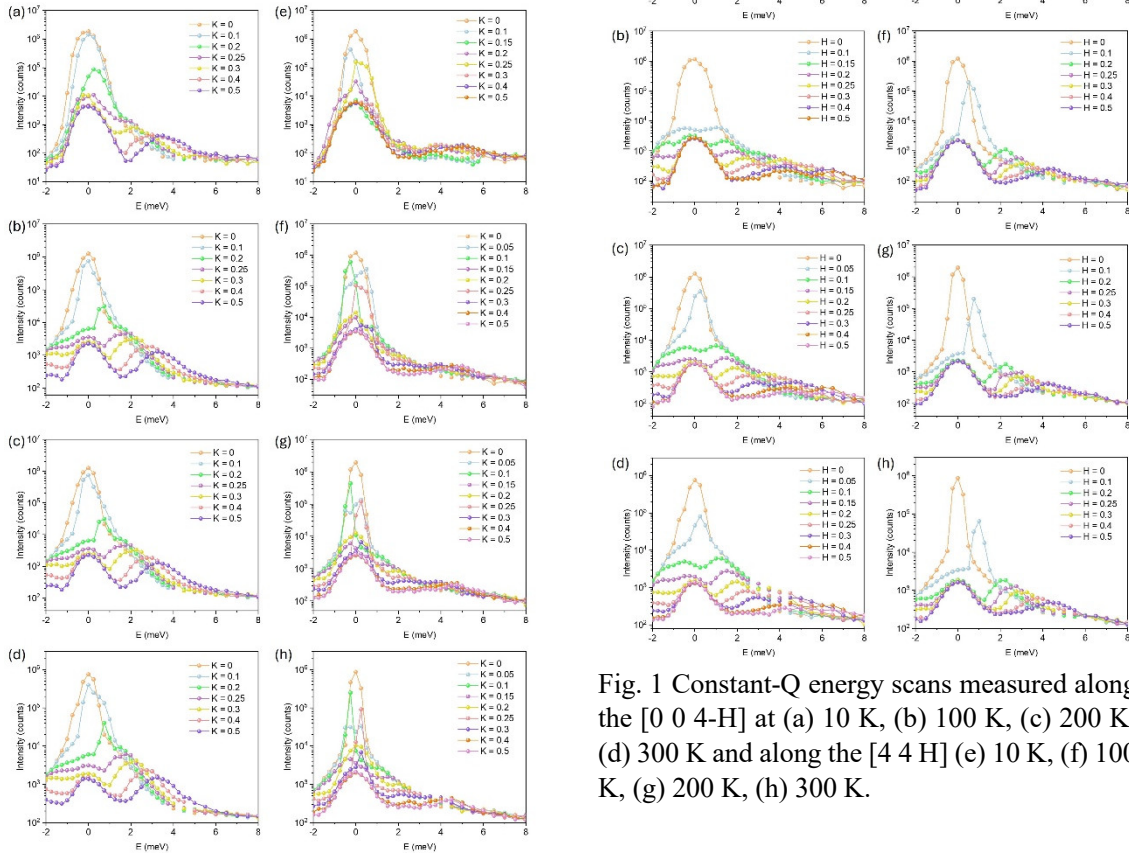


Fig. 1 Constant-Q energy scans measured along the  $[0 0 4-H]$  at (a) 10 K, (b) 100 K, (c) 200 K, (d) 300 K and along the  $[4 4 H]$  (e) 10 K, (f) 100 K, (g) 200 K, (h) 300 K.

Fig. 1 Constant-Q energy scans measured along the  $[-K -K 0]$  at (a) 10 K, (b) 100 K, (c) 200 K, (d) 300 K and along the  $[4-K 4-K 0]$  (e) 10 K, (f) 100 K, (g) 200 K, (h) 300 K.