Supplementary Figure 1: Magnetic field dependence of the magnetoelectric ratio, $\gamma$, for magnon modes in Ca$_2$CoSi$_2$O$_7$ (CCSO), Sr$_2$CoSi$_2$O$_7$ (SCSO) and Ba$_2$CoGe$_2$O$_7$ (BCGO). The labeling of the modes are specified in the main text and Fig. 3.

Supplementary Figure 2: THz absorption spectra of Ca$_2$CoSi$_2$O$_7$ (CCSO) and Sr$_2$CoSi$_2$O$_7$ (SCSO) measured in magnetic fields $B\parallel k\parallel[110]$ at $T=4$ K. The spectra are shifted vertically proportional to the magnitude of the applied magnetic field according to the right vertical axis. The distance between horizontal grid lines is indicated in each panel. Spectra recorded in the four cases, i.e. for beams propagating along and opposite to the magnetic field direction in two orthogonal polarizations ($E\parallel[001]$, $H\parallel[1\overline{1}0]$) and ($E\parallel[\overline{1}00]$, $H\parallel[001]$), are plotted with four different colours as explained in the inset. For counter-propagating beams the spectra show perfect overlap in CCSO. The overlap is also good for SCSO, though the accuracy of the measurement in this case is somewhat poorer due to fringes caused by multiple reflections within the sample.