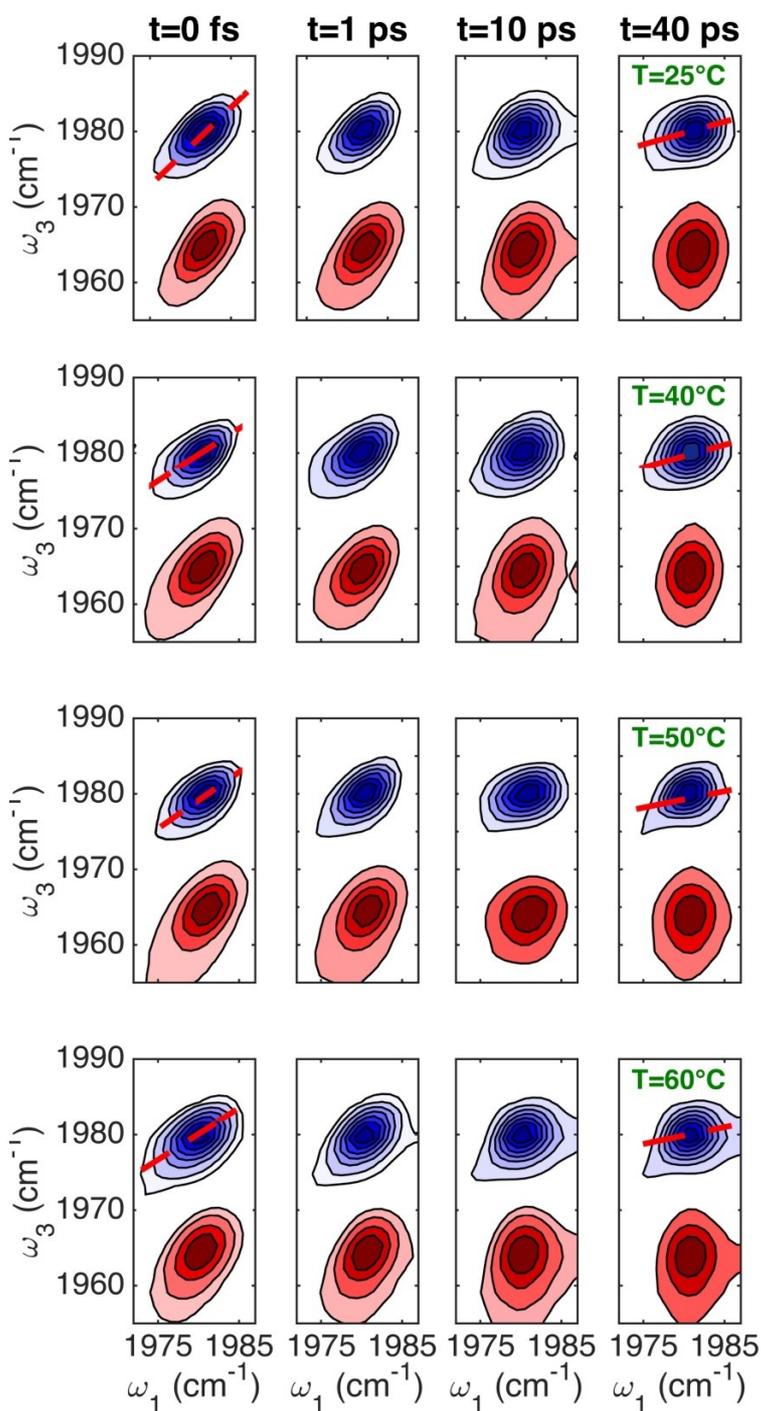
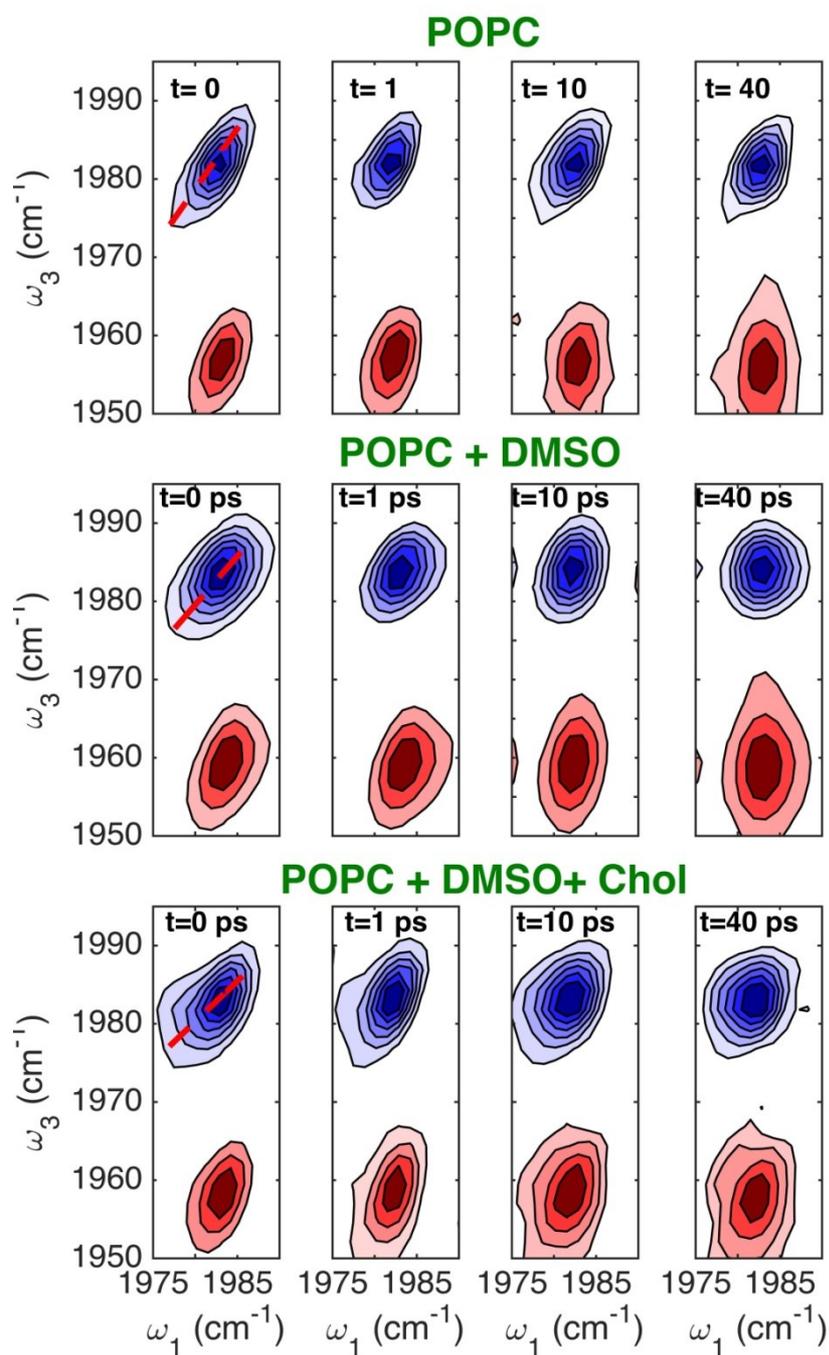


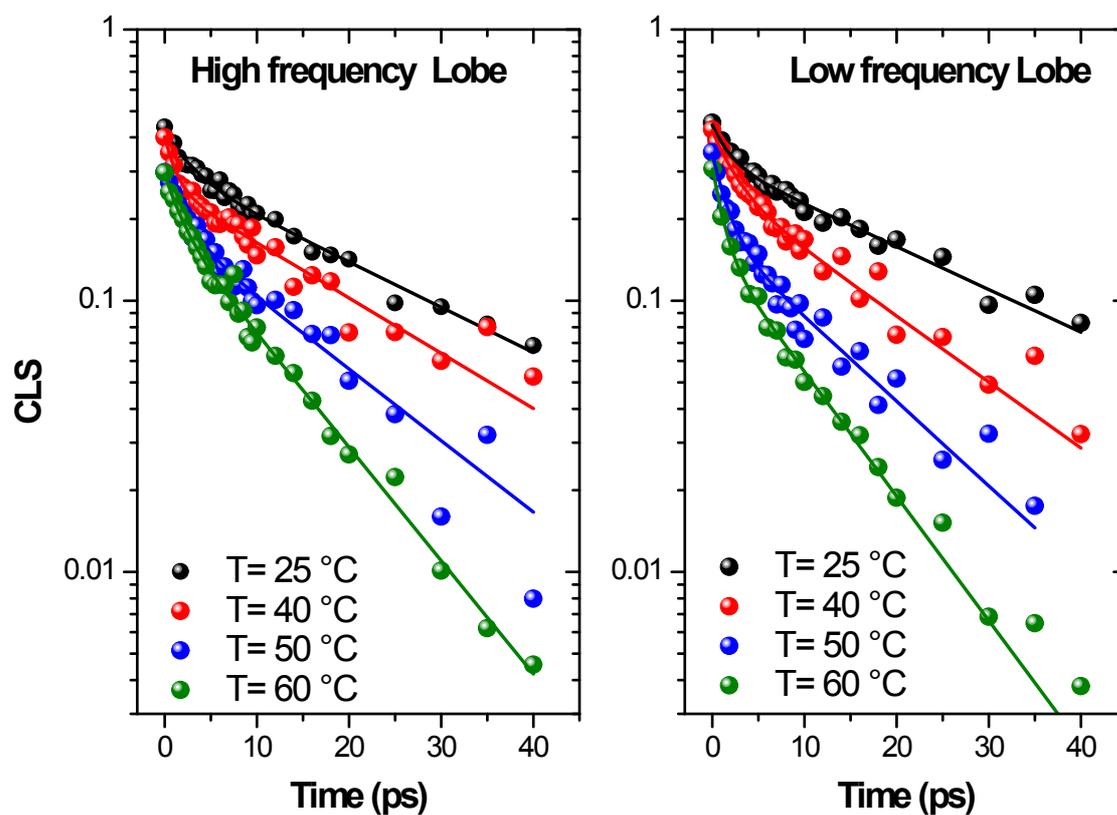
### Supporting Information



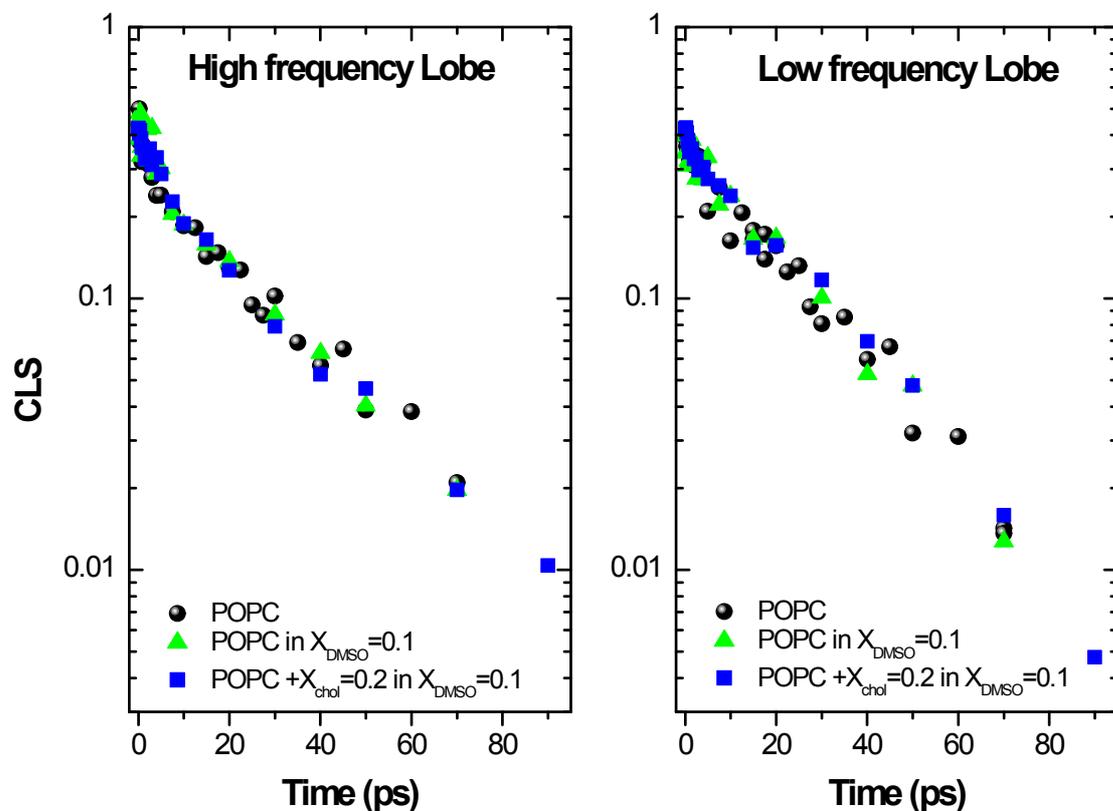
**Figure S1** 2D-IR spectra recorded at various population times (namely 0, 1, 10 and 40 ps) for the four temperature inspected of the aqueous POPC sample.



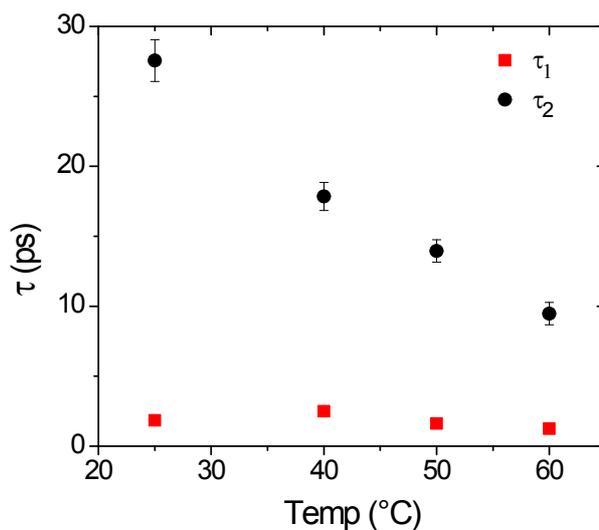
**Figure S2:** 2D-IR Spectra recorded, at room temperature, at various population times (namely 0, 1, 10 and 40 ps) for three distinct samples (from top to the bottom): POPC, POPC suspended in a Water/DMSO solution (0.1 DMSO mole fraction) and a mixture POPC/Chol (0.2 Cholesterol mole fraction) suspended in a Water/DMSO solution (0.1 DMSO mole fraction).



**Figure S3** Comparison of the CLS (dots), and the relative fitting curves (lines), extracted from the High Frequency Lobe and the Low frequency Lobe of the 2D-IR spectra reported in figure S1.



**Figure S4** Comparison of the CLS (dots) extracted from the High Frequency Lobe and the Low frequency Lobe of the 2D-IR spectra reported in figure S2.



**Figure S5.** CLS decay time constant following the bi-exponential fit of the CLS curves reported in figure S3 (continuous line) for the positive (low frequency) lobe.