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Title:Probing structure and phase-transitions in molecular crystals by terahertz time-domain spectroscopy

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Abstract:Since the introduction of ultra-fast laser techniques for the generation and detection of broadband terahertz pulses, terahertz time-domain spectroscopy has become a versatile tool for vibrational spectroscopy of molecular systems in the far-infrared. Due to their highly collective and delocalized character vibrational modes in this part of the spectrum are highly sensitive to molecular structure and arrangement within a molecular crystal. Here we utilize this sensitivity to differentiate between the enantiopure amino acid l-cysteine and its racemic crystalline dl-form. Using terahertz time-domain spectroscopy we are able to observe temperature induced solid-state phase transitions in polycrystalline dl-cysteine, as well as in polycrystalline benzoic acid. The dynamics of the transitions is studied by tracing the temperature dependency of spectral features that are assigned to certain conformational phases.

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