ULTRAFAST TERAHERTZ KERR EFFECT SPECTROSCOPY OF LIQUIDS AND BINARY MIXTURES

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The ultrafast TeraHertz Kerr effect (TKE) has recently been demonstrated as a nonlinear spectroscopic technique capable of measuring the dielectric relaxation of liquids. The true power of this technique lies in its ability to provide complementary information to measurements taken using heterodyne-detected optical Kerr effect (OKE) spectroscopy. The optical pulses in OKE measurements interact with the sample via the molecular polarizability, a rank-two tensor, in contrast with THz pulses that interact with the molecules via the dipole moment, a rank-one tensor. Given the different light-matter interactions in the two techniques, TKE measurements help complete the physical picture of intermolecular interactions at short timescales.

We report here our implementation of heterodyne-detected TKE spectroscopy, along with measurements of pure liquids, and binary mixtures. Some of the liquids presented here were previously believed to be TKE inactive, thus showing that we have achieved a greater sensitivity than the previous implementation in the literature. In addition, we will discuss a variety of binary mixtures and show how the TKE data can be compared with OKE data to deepen our physical understanding of intermolecular interactions in liquids.