FEMTOSECOND PUMP-PROBE 2D OPTICAL KERR EFFECT SPECTROSCOPY OF PARAHYDROGEN CRYSTALS

DAVID T. ANDERSON, *Department of Chemistry, University of Wyoming, Laramie, WY 82071-3838, USA*; FALK KÖNIGSMANN, NINA OWSCHIMIKOW and NIKOLAUS SCHWENTNER, *Institut für Experimentalphysik, Freie Universitat Berlin, Fachbereich Physik, Arnimalle 14, D-14195 Berlin, Germany*.

Solid hydrogen provides a rich variety of elementary excitations that span a broad spectral range: vibrons at 4150 cm^{-1}, rotons around 350 cm^{-1}, and phonons that cover a range between 0 and 100 cm^{-1}. A rather general feature of solid hydrogen, especially in the highly para-enriched form, is the surprisingly sharp linewidths associated with these elementary excitations while nevertheless the strict selection rules for the isolated H_2 molecule are broken by intermolecular interactions within the crystal. For these reasons solid parahydrogen is predestined for coherence studies. In this talk I will present recent femtosecond pump-probe two-dimensional (delay and wavelength) optical Kerr effect (OKE) measurements on parahydrogen crystals at 4.2 K. These 2D OKE spectra turn out to be a sensitive and precise tool to monitor coherent phonon and roton dynamics in hydrogen crystals. These measurements provide the first real glimpse into the real-time dynamics that occur in cryogenic hydrogen crystals with some real surprises. Currently these techniques are being applied to more complex topics and the most recent results with an emphasis on dynamics will be presented.