Investigation of Nonlinear Dynamics of Liquid Water with FELBE

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The hydrogen-bond network of liquid water is extremely dynamical, in which perturbations to the network dissipate on the picosecond time scale. For this reason, probing the nonlinear properties of liquid water is challenging. Recent studies have demonstrated a strong transient anisotropy of water when resonantly excited at 12.3 THz. Here, this works expands on the previous results, where single color pump-probe measurements with FELBE on static and free flowing (liquid jet) samples were performed. Results reveal that the pump-probe signal has contributions from thermal, acoustic, and nonlinear responses. Comparison of the static and liquid jet samples demonstrates an increased nonlinear response of the liquid jet due to resonantly enhanced excitation of the librational band of water. These results open the door to investigate the dynamics of hydration water in various aqueous systems, in particular those of proteins for which the hydration water is an integral part of their structure and function.