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The effect of salt solutes on the relaxation dynamics of water from 65 to 720 GHz NGUYEN VINH, MARK SHERWIN, JIM ALLEN, ITST, Department of Physics, University of California, Santa Barbara, KEVIN PLAXCO, Department of Chemistry and Biochemistry, University of California, Santa Barbara — During the past decade, a variety of measurement techniques have provided evidence that ions and other solute molecules effect the structure and dynamics of the water molecules directly surrounding them. Most of these experiments have employed infrared spectroscopy which explores vibrational relaxation of the hydration shell by observing int*ra*molecular vibrations. Terahertz spectroscopy, in contrast is sensitive to int*er*molecular dynamics. Here we use a vector network analyzer based *terahertz dielectric relaxation spectrometer* operating over the frequency range from 65 to 720 GHz. The literature on relaxation dynamics of water is extensive and variable. But these measurements clarify the situation and confirm that the dynamics of water over this regime are best described in terms of three Debye relaxation processes with the characteristic times of 8.56, 1.1 ps and 179 fs (at 25.0 ° C). Remarkably, while the relaxation times themselves are not sensitive to salt concentration, the relative strength of the relaxation modes depends in a systematic way on the solute molarity. We discuss these results by relating the salt concentration dependent strength of the three processes to the dynamics and structure of first three hydration shells. Our measurements shed light on the dynamics of hydration shells around solute molecules in a biologically relevant environment.

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