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Influence of the hydrogen bond quantum nature in liquid water and heavy water on stimulated Raman scattering

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Abstract: Stimulated Raman scattering (SRS) of liquid water and heavy water have been investigated using Nd:YAG laser. The SRS spectra of liquid heavy water indicate that ice-VII and ice-VIII structures are formed by shock-induced compression (SIC) in forward and backward directions, respectively. Simultaneously, the SRS spectra reveal of liquid water that only ice-VII structure is formed in the backward direction. The difference in ice structures formed by SIC in liquid water and heavy water could be attributed to the effect of the hydrogen bond quantum nature with H^+ . SRS spectra of 2 M NaOH water solution with ice-VII and ice-VIII structures have been successfully obtained in forward and backward, respectively, as OH^- greatly reduce the quantum nature of hydrogen bonds by neutralizing H^+ in water. The hydrogen bond quantum nature is important for understanding isotope calibration test structure and isotopic effect.

Keywords SRS; liquid water; heavy water; the hydrogen bond quantum nature; NaOH solutions

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