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Small-to-Large Polaron Transition in Water SHAHRIAR SHADKHOO, ROBIJN BRUINSMA, Department of Physics and Astronomy, University of California, Los Angeles — Heavier charged particles, such as protons, dissolved in water form a hydration shell, which partially shields the charge and significantly increases their effective mass. On the other hand, electrons do not form a hydration shells in water. Leggett's path-integral formalism can be combined with Feynman's polaron theory to construct a theory for the effective mass of a charged particle in water in terms of the charge structure factor, $S(\mathbf{q},\omega)$ of water, or alternatively, the frequency and wavefunction dependent dielectric function of water. Measurements of $S(\mathbf{q},\omega)$ for density fluctuations indicate that water has a soft mode with a wave number in the range of an inverse Angstrom. By combining these experiments with analytical and numerical models of the dielectric function of water, we discuss the small-to-large polaron transition in water.

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