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Probing the Stepwise Solvation of the Sulfate Dianion: Gas Phase Infrared Spectroscopy of $\text{SO}_4^{2-} \cdot (\text{H}_2\text{O})_n$ Clusters ($n=3-24$) KNUT R. ASMIS, GERARD MEIJER, Fritz-Haber-Institut der Max-Planck-Gesellschaft, Faradayweg 4-6, D-14195 Berlin, Germany., GABRIELE SANTAMBROGIO, MATHIAS BRUEMMER, LUDGER WOESTE, Institut fuer Experimentalphysik, Freie Universitaet Berlin, Arnimallee 14, D-14195 Berlin, Germany., JIA ZHOU, DAVE T. MOORE, DANIEL M. NEUMARK, Department of Chemistry, University of California and Chemical Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, CA 94720, USA. — Hydrated sulfate dianions are of paramount importance in diverse branches of science. However, a microscopic, molecular level understanding of the nature of the solute-solvent interaction as well as the composition of the solvation shell has not yet been achieved. Here we report the first gas phase infrared spectra of multiple charged anions in general, namely of mass-selected $\text{SO}_4^{2-} \cdot (\text{H}_2\text{O})_n$ dianions ($n=3-24$) employing the infrared multiple photon dissociation technique in combination with radiation from the free electron laser FELIX. The infrared spectra ($550-1800 \text{ cm}^{-1}$) were measured in the region of the stretching and bending modes of the sulfate core as well as characteristic intra- and intermolecular water modes, allowing an unprecedented, atomic level insight into structure of the complex as well as the nature and strength of the underlying hydrogen bonding interaction.

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