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Effect of salt entropy on protein solubility and Hofmeister series
YUBA DAHAL, JEREMY SCHMIT, Department of Physics, Kansas State University — We present a theory of salt effects on protein solubility that accounts for salting-in, salting-out, and the Hofmeister series. We represent protein charge by the first order multipole expansion to include attractive and repulsive electrostatic interactions in the model. Our model also includes non-electrostatic protein-ion interactions, and ion-solvent interactions via an effective solvated ion radius. We find that the finite size of the ions has significant effects on the translational entropy of the salt, which accounts for the changes in the protein solubility. At low salt the dominant effect comes from the entropic cost of confining ions within the aggregate. At high concentrations the salt drives a depletion attraction that favors aggregation. Our theory explains the reversal in the Hofmeister series observed in lysozyme cloud point measurements and semi-quantitatively describes the solubility of lysozyme and chymosin crystals.

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