

Combining neutron, light and x-ray scattering to probe the distribution of ions in polyelectrolyte solutions

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Abstract. The spatial distribution of counterions in polyelectrolyte solutions determines the osmotic, charge transport and structural properties of solutions. Here, neutron, light, and X-ray scattering are combined to investigate how counterions arrange themselves around anionic polyelectrolytes. Combining SANS and SAXS allows the structure factor of the polymer backbone and that of the counterions to be evaluated separately. Light scattering experiments are used to evaluate the osmotic pressure of polyelectrolyte solutions, which allows us to measure the fraction of free (osmotically active counterions). The fraction of dissociated counterions is nearly independent of concentration and controlled by the Bjerrum length of the solvent media, in agreement with the predictions of classical polyelectrolyte theories. The concentration fluctuations of the polymer backbone and counterions are strongly coupled over most of the concentration range. For solvophobic counterions, this coupling breaks down above a critical concentration, where counterions delocalise and their fluctuations decouple from those of the polymer. These results show how the interplay between electrostatics and counterion solvation control the solution properties of charged macromolecules.

Monday, April 20, 2026

10:45 AM (UTC-05:00) Eastern Time (US & Canada) | Hybrid format, remote presentation

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