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Field Theory of Polyelectrolyte Complexation YURI POPOV, GLENN FREDRICKSON, University of California, Santa Barbara — We study polyanion-polycation solutions using a field-theoretic approach formulated in terms of auxiliary fields (conjugate to mass and charge densities). Within this framework, we derive exact Hamiltonians for a wide variety of systems: with implicit or explicit solvents, for symmetric or asymmetric polyions, with or without salt. By systematic expansion, we analytically obtain one-loop fluctuation corrections to the mean-field results for these systems in arbitrary dimensions. As an example, we study the symmetric salt-free polyanion-polycation mixture in implicit solvent. We demonstrate that this basic system and its phase diagram are described by three universal reduced variables. We obtain simple analytical expressions for thermodynamic quantities and structure factors, including two correlation lengths - Edwards's length and a polymer electrostatic length. We also conduct scaling analysis in dilute and semi-dilute regimes and show that the concentration of pair formation is exponentially small in polymer length.

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