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Electrostatics of planar interfaces in salt solution WILLIAM KUNG, Northwestern University, A.W.C. LAU, Florida Atlantic University, MONICA OLVERA DE LA CRUZ, Northwestern University — We present an exact field-theoretic formulation for a fluctuating, generally asymmetric, salt density in the presence of a charged plate. The non-linear Poisson-Boltzmann equation is obtained as the saddle-point of our field theory action. Focussing on the case of symmetric salts, we systematically compute, in the weak-coupling limit, first-order correction to the free energy density, arising from electrolyte fluctuation, which can be explicitly obtained in closed form. We find that for systems with moderate salt density, fluctuation corrections to the free energy depends sensitively on the salt concentration as well as their charge valency. Further, we find that electrolyte fluctuation leads to a reduced electrostatic repulsion between two point charges when they are close to the plate. We also consider the application to interfaces separating two semi-infinite regions of different dielectric media.

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