

## **Orientalional ordering of molecules near a charged spherical surface**

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We consider a spherical electric double layer that is formed by small mobile ions and solvent molecules captured inside a charged spherical surface. The diffusive electric double layer is a result of the competition between electrostatic attraction and translational entropy loss of the small ions results. In the theory, we incorporate solvent molecules as interacting Langevin dipoles. In addition, the surface ordering of solvent molecules is taken into account. The finite size of ions is considered. The free energy and the dielectric permittivity of the system is calculated. Finally, the entropic contribution for small number of particles is considered. This consideration has an application in the prediction of the liquid–liquid extraction efficiency for rare-earth metal cations from water.