Effective potentials in soft matter

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Colloidal suspensions are complex fluids involving many length and time scales. In order to make progress in their investigation, we often rely on coarse-grained models giving rise to effective potentials among colloidal particles, where some degrees of freedom can be traced out. In general, these amount to implicitly include the effect of the solvent and of co-solute small particles in a description for the large colloids only. By this route, it has been shown that effective forces can deeply modify the phase diagram of colloidal particles, starting with the pioneering case of depletion interactions[1].
In this talk I will discuss new types of effective potentials that can be generated among colloidal particles by exploiting the cosolute properties, for example when the cosolute is close to percolation[2] or it self-assembles into polymer chains[3]. Also, when colloidal particles are soft, the range of the effective interaction becomes longer as compared to standard depletion[4].
Finally, I will discuss how to derive effective potentials by integrating out internal degrees of freedom when the colloidal particles have a complex architecture, as in the case of microgels or even proteins.

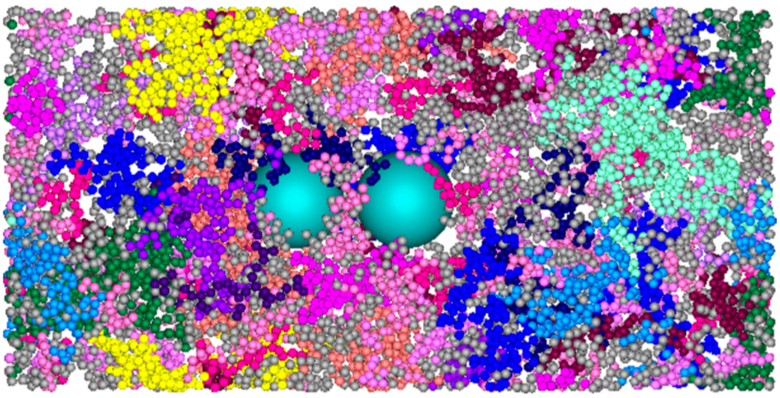

Fig.1 Two colloids immersed in a percolating co-solute.

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[2] N. Gnan, E. Zaccarelli, F. Sciortino, Nat. Comm. 5,3267 (2014).
[3] N. A. Garcia, N. Gnan and E. Zaccarelli, arxiv/1611.07315 (2016).
[4] L. Rovigatti, N. Gnan, A. Parola and E. Zaccarelli, Soft Matter 11,692 (2015).