We analyze the depletion interaction between two hard colloids in a hard–sphere solvent and pay special attention to the limit of large size ratio between colloids and solvent particles which is governed by the well–known Derjaguin approximation. For separations between the colloids of less than the diameter of the solvent particles (defining the depletion region), the solvent structure between the colloids can be analyzed in terms of an effective two–dimensional gas. Thereby we find that the Derjaguin limit is approached more slowly than previously thought [1]. This analysis is in good agreement with simulation data which are available for a moderate size ratio of 10. Small discrepancies to results from density functional theory (DFT) at this size ratio become amplified for larger size ratios. Therefore we have improved upon previous DFT techniques by imposing test particle consistency. However, the improved results show no convergence towards the Derjaguin limit and thus we conclude that this implementation of DFT together with previous ones which rely on test particle insertion become unreliable in predicting the force in the depletion region for size ratios larger than 10.

[1] M. Oettel, cond-mat/0310523, accepted in PRE