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## Evidence of Many-Body Interactions in the Virial Coefficients of Polyelectrolyte Gels

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### Abstract

The phase behavior of materials ranging from gases to polymer solutions can often be understood ser of their first few virial coefficients that quantify intermolecular interactions in the limit of low molecular co ( $A_2$ ) and third ( $A_3$ ) virial coefficients, or their equivalent *chi*-interaction parameters in a polymer correspondingly been adopted as fundamental measures of intermolecular interaction having fund: materials classification, design and characterization. It is often implicit in this type of description of | interactions between the molecules can be described by *pairwise decomposable interactions* and it is phase behavior applies to complex liquids, such as ionic and polyelectrolyte solutions, polyelectrolyte c body interactions associated with polymer and ion solvation, and hydrogen bonding interactions of the v associated “hydrophobic effect” governing solvation of charged molecules or uncharged moieties in wat different patters of phase behavior. Along this lines, simulations of simple hydrophobic solutes (moc molecules or simple molecules such as methane or noble gases) in water at ambient temperatures have interaction of two particles may be predominantly repulsive, corresponding to a positive second virial, 1 many particles can become attractive, corresponding to higher virials being negative, and this can lead 1 pattern of phase behavior is exhibited experimentally by all the polyelectrolyte gels that we study. evidence of many-body interactions on the solution properties of polyelectrolyte gels.