

## An augmented van der Waals theory of strongly interacting fluids

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A novel perturbation method for the structural and thermodynamic properties of the fluids with hard core plus attractive interparticle interaction is reported. The method is based on a new reference system, the short-range attractive Yukawa model of the range parameter  $z_0 = 6$  that is free of the vapor-liquid phase transition. We show that the inclusion of a short-range part of the total attractive interaction into a reference system allows a natural extension of the traditional first-order perturbation theory of simple fluids to practically all thermodynamic states. The theory is applied to evaluate the structure factor [1], thermodynamic functions and the liquid-vapor coexistence curve [2] of the Lennard-Jones-like medium range and Coulomb-like long range Yukawa fluids as well as to the Sutherland fluid. Comparison with computer simulation data and the second-order Barker-Henderson perturbation theory is discussed.

1. R. Melnyk, F. Moučka, I. Nezbeda, A. Trokhymchuk, *J. Chem. Phys.* 127 (2007) 094510.
2. R. Melnyk, I. Nezbeda, D. Henderson, A. Trokhymchuk, *Fluid Phase Equilibria*. 279 (2009) 1.