Phase coexistence and interfaces in statistical mechanics

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Following van der Waals, Kac, Uhlenbeck and Hemmer have introduced in the 60's a class of interactions, the Kac potentials, which model the van der Waals, liquid-vapour phase transitions. The analysis of these models on a scale comparable to the range of the interaction gives rise to variational problems involving some non local free energy functionals, while, on a larger scale, stochastic effects become important. Phase transitions, phase coexistence, interfaces and their evolutions have been studied. I will shortly review some of the results, with emphasis on the stochastic effects and the problems which arise when maximum principle type of properties are no longer satisfied.