Abstract

The present work deals with optimum ground states and their realization in terms of vertex state models for many particle systems in dimensions $D \geq 2$. This concept can be adapted to quantum spin systems with spins S on arbitrary lattices as long the coordination number z satisfies the inequality $S \geq nz/2$. The optimum ground states of the models are exact and the ground state properties can be investigated. The models which are subject to this work show a huge variety of interesting physical behaviour. Vertex ground states with antiferromagnetic, weak antiferromagnetic and weak ferromagnetic order are introduced. For these models quantum phase transitions can be observed which are first or second order. In case of a second order phase transition different critical exponents are determined. For some of the models they are within the universality class of a classical 2D-Ising model. The dependence of the physical properties on the magnitude of the spin, dimensionality of the model as on the underlying lattice is investigated.