Eight-vertex model in a field

Roman Krcmar*†[1] and Ladislav Samaj[2]

[1]Research Center for Quantum Information (RCQI) – Institute of Physics, Slovak Academy of Sciences Dúbravská cesta 9, 84511 Bratislava, Slovakia, Slovakia

[2]Department of Complex Physical Systems (DCPS) – Institute of Physics, Slovak Academy of Sciences, Dúbravská cesta 9, SK-845 11 Bratislava, Slovakia, Slovakia

Abstract

The eight-vertex model is generalization of the ice-type or six-vertex model. It was exactly solved by Baxter [1] for the case without a fields. It was shawn that universality hypothesis does not hold for this model. Special type of the universality was defined so called weak universality. Eight-vertex model with fields is not integrable, but prediction was made [1,2], that weak universality will be destroyed by switching on the fields. For almost forty years was this conjecture not tested. We decided to test it [3]. The general eight-vertex model on a square lattice was studied numerically by using the Corner Transfer Matrix Renormalization Group (CTMRG) method. The method was tested on the symmetric (zero-field) version of the model, the obtained dependence of critical exponents on model's parameters is in agreement with Baxter's exact solution and weak universality is verified with a high accuracy. We confirmed numerically the conjecture in a subspace of vertex weights, except for two specific combinations of vertical and horizontal fields for which the system still exhibits weak universality. The eight-vertex model can be mapped from electrical to magnetic representation. The model is usually studied in the magnetic representation, we will present results for electric representation were even weak universality does not apply, model is fully non-universal. [1] Baxter R. J., Phys. Rev. Lett., 26 832 (1971).
Baxter R. J., Ann. Phys. (N.Y.), 70 193 (1972).
Baxter R. J., Ann. Phys. (N.Y.), 70 323 (1972).
Baxter R. J., Exactly Solved Models in Statistical Mechanics,
3rd edition (Dover Publications, Inc.) (2007).
Kadanoff L. P. and Wegner F. J., Phys. Rev. B, 4 3989 (1971).
Krcmar R. and Samaj L., EPL, 115 56001 (2016).

*Speaker

†Corresponding author: krcmar.roman@gmail.com