Bi- and Tetracriticality: Statics and Dynamics

R. Folk[1], Yu. Holovatch[1,2], and G. Moser[3]
[1] *Institute for Theoretical Physics, Linz University, A-4040 Linz, Austria*
[2] *Institute for Condensed Matter Physics, National Acad. Sci. of Ukraine, UA-79011 Lviv, Ukraine*
[3] *Department for Material Research and Physics, Paris Lodron University Salzburg, A-5020 Salzburg, Austria*

We calculate the static critical behavior of systems of $O(n_\parallel) \oplus O(n_\perp)$ symmetry by renormalization group method within the minimal subtraction scheme in two loop order. Summation methods lead to fixed points in $d = 3$ describing multicritical behavior. The stability boarder lines between the fixed points in the space of order parameter (OP) components $n_\parallel$ and $n_\perp$ and spatial dimension $d = 3$ are calculated. They are shifted in two loop order considerably with respect to the one loop calculation [1] in quantitative agreement with higher loop order calculations [2]. In consequence for the interesting case of an antiferromagnet in a nonordering magnetic field ($n_\parallel = 1$, $n_\perp = 2$) the biconical fixed point is stable instead of the Heisenberg fixed point. Moreover the stability region in the space of order parameter components of the biconical fixed point is strongly reduced leading to very small transients exponents.

We use the new static results to further analyze the relaxational dynamical critical behavior of these systems [3]. The three different multicritical static universality classes correspond three different dynamical universality classes within the static borderlines. The Heisenberg and the biconical fixed point lead to strong dynamic scaling (same time scale for the two relaxation rates) whereas in the region of stability of the decoupled fixed point weak dynamic scaling holds (different time scales for the two relaxation rates). The value of the dynamical critical exponent is found as $z = 2.052$ for the biconical fixed point at $n_\parallel = 1$ and $n_\perp = 2$. The dynamical transient exponent corresponding to the time scale ratio w is $\omega_w = 0.004$.

This work was supported by the Fonds zur Förderung der wissenschaftlichen Forschung under Project No. 19583

[1] J. M. Kosterlitz, D. Nelson, and M. E. Fisher, Phys. Rev. **13**, 412 (1976)
[2] P. Calabrese, A. Pelissetto, and E. Vicari, Phys. Rev. **13**, 412 (2003)
[3] V. Dohm and H.-K. Janssen, Phys. Rev. Lett. **39**, 946 (1977)