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Spin-glass-like transition in the Ising models with locally competing temperatures.

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The possibility of the occurrence of the spin-glass-like and ferromagnetic transitions in nonequilibrium systems based on the Ising model with spin-flip rates combining two Glauber rates at different temperatures is discussed. The models comprise the Sherrington-Kirkpatrick model and the Ising model on random graphs with edges corresponding, with certain probability, to positive and negative exchange integrals. Only in rare cases such nonequilibrium systems with non-zero heat flux can be mapped onto equilibrium ones at certain effective temperature. Nevertheless, Monte Carlo simulations show that transitions to the ferromagnetic and spin-glass-like phases occur in all cases under study as the probability of contact with each thermal bath is varied, and the phase diagrams resemble qualitatively those for the corresponding equilibrium models obtained with varying temperature. Theoretical calculations based on the mean-field approximation and the TAP equations predict correctly the location of the phase border between the paramagnetic and ferromagnetic phases, while in the case of the border between the paramagnetic and spin-glass-like phases only qualitative agreement between theoretical and numerical results is achieved. The obtained results can be interesting for modelling the opinion formation by means of the well-known majority-vote and related models.

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