Entropy driven mechanism for ordering, phase separation and patterning in binary stochastic systems

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We have studied phase transitions in extended systems, wherein the ordered phase only results if a randomly fluctuating source is introduced into the dynamical system. We consider ordering processes in systems with internal noise with intensity dependent on the field variable. It was shown that phase transformation observed in systems with conserved and non-conserved dynamics are of entropy driven mechanism when the ordered phase appears due to the balance between the relaxing forces moving the system to the homogeneous state, and field-variable dependent fluctuations pulling the system away from the disordered state.

Considering entropy-driven phase transitions in systems with non-conserved dynamics it was shown that in the case of symmetrical local potential reentrant phase transitions can be observed. In systems with an asymmetric local potential phase transitions display hysteresis-like behavior of the order parameter. Considering phase separation processes in stochastic systems with a field dependent kinetic coefficient and an internal multiplicative noise it was found that dynamics of spinodal decomposition at early and late stages essentially depends on the field dependent mobility. It was shown that internal fluctuations lead to slowing down kinetics of domains growth. A mean field approach was carried out in order to obtain the stationary probability, bifurcation and phase diagrams displaying reentrant phase transitions. It was shown that phase separation scenario is determined by entropy driven mechanism. We have studied the entropy-driven mechanism leading to stationary patterns formation in stochastic systems with local dynamics and non-Fickian diffusion. It is shown that a multiplicative noise is able to induce and sustain stationary structures. It was found that at small and large noise intensities the system is characterized by unstable homogeneous states. At intermediate values of the noise intensity three types of patterns are possible: nucleation, spinodal decomposition and stripes with liner defects (dislocations).