Instabilities and pattern formation in a generalized Cahn-Hilliard modelwith 2+1 components
Equation de Cahn-Hilliard généralisée pour 2+1 composants : instabilités générant une micro-structuration

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The Cahn-Hilliard equation describes the dynamics of phase separation in the conservative case (first order phase transition). This process is driven by the minimization of the free energy, especially of its interfacial part, during the Ostwald ripening, or coarsening. In 1D however, the lower energy state that should end the dynamics is very slow to reach. This is even more the case when the Cahn-Hilliard dynamics is modified to take into account long range interaction terms [1] : the lower energy state is then only reached for particular initial states. A dynamical criterion proposed by Misbah and Politi [2] to predict the end of the coarsening process (and the final wave length of the pattern) shows results that differ from the simple minimization of the free energy.

In order to understand this difference, we have investigated possible transition modes that may describe the dynamic of coarsening in those systems.

We have also explored a model where the Cahn Hilliard dynamics is coupled with a diffusion equation for the surfactant that favors interfaces. This scenario enables to speed up the dynamics and favors pattern formation or micro-structuration.

Références

1. P. POLITI & A. TORCINI, Dynamics versus energetics in phase separation, *J. Stat. Mech.* P03016 (2015).
2. P. POLITI & C. MISBAH, When does coarsening occur in the dynamics of one-dimensional fronts ?, *Phys. Rev. Lett.* **92**, 090601 (2004).