Research proposal

As a future work, I would like to study the following two topics;

[**Diffused interface and monotonicity formula**] Concerning to the analysis of the general critical points of the Modica-Mortola type energy in our previous work, we would like to consider the energy functional with anisotropic property. However it is known that in anisotropic case, that monotonicity formula, which is important tool to show the regularity of sharp interfaces, does not hold generally. Thus we would like to be clear which kind of restriction we have to impose in order to construct monotonicity formula. For an interesting generalization, we would like to study this energy functional on Riemannian manifold. Some analysis on Reimannian manifold are studied by F. Pacard and M. Ritoré, as a generalization of the Modica and Mortola's result on Euclidean space. The main point we have to overcome is to construct a monotonicity formula. In order to consider this direction, we have to start from understanding geometric property deeply.

[**The Cahn-Hilliard/Allen- Cahn equation**] For the Cahn-Hilliard/Allen-Cahn equation, which is studied in my latest paper, some analysis of time asymptotics are done in these days by Dr. Israel. We would like to do more precise analysis. We expect that at time infinity the solution converges to a solution of a stationary Allen-Cahn equation, analogically to the Cahn-Hilliard equation. As a future work, we would like to study a stochastic version of this equation. Considering with the derivation of this equation by Karali and Katsoulakis, it is more natural to consider it with stochastic perturbations. We are interested in a singular limit in the same scaling as the one which converges to a curvature flow in the singular limit in the deterministic case. In order to consider this direction, we have to know more stochastic treatment. Additionally, we state that we are interested in time asymptotics as same as deterministic case.