Postdoc opening at University of Rouen Normandy

A 10-months postdoctoral position, project "SIAMA", funded by the Labex EMC3.

Phase field modelling of ice crystal growth

Contexte :
The formation process of snowflakes keeps challenging the scientific community as the growth mechanism remains yet misunderstood. Indeed, snowflake morphology at millimetric scale results from the interplay of complex phenomena, from quantum mechanics at a atomic scale, to facet kinetics at a macroscopic scale. Beyond theoretical consideration, ice crystal morphology has also piqued interest of industrials. Yet, very few models currently succeed in reproducing correctly the diversity of snow crystal forms, and link the model parameters to thermodynamic quantities.

Recently, phase field model was developed to model the growth of ice crystals. It was shown that this approach is capable of reproducing properly the morphology and growth kinetics of isolated snowflakes in supersaturated atmosphere [1,2]. Benefiting from the modularity and versatility of the phase field model, this approach can be extended to describe the growth of snowflakes in real atmospheric conditions. It can notably be equipped with stochastic effects, for the asymmetric growth of more exotic morphologies of snowflakes in the Nakaya diagram. Continuum fluid dynamics can also be easily introduced in phase field equations to simulate the air flow around the snowflake during its fall from clouds. This could notably answer the need expressed by meteorology and aircraft safety for new metrologies, able to estimate ice water content in clouds.

Goal :
The goal of this study is a further development of the phase field model to describe the growth of ensemble of ice crystals. The special interest will be done for the link between the meteorological conditions and the morphology of the ice crystals.

Références :

1. G. Demange, H. Zapolsky, R. Patte, M. Brunel "A phase field model for snow crystal growth in three dimensions", Nature Partner Journal Computational Materials, 2017.
2. G. Demange, H. Zapolsky, R. Patte, M. Brunel "Growth kinetics and morphology of snowflakes in supersaturated atmosphere using a three-dimensional phase-field model", Phys. Rev. E, 96(2): 022803, 2017.

3. M. Brunel, G. Demange, M. Fromager, M. Talbi, H. Zapolsky, R. Patte, K. Aït Ameur, J. Jacquot-Kielar, S. Coetmellec, G. Gréhan, B. Quevreux "Instrumentation for ice crystal characterization in laboratory using interferometric out-of-focus imaging", Review of Scientific Instruments, 88(8):083108, 2017.

Profil of candidate:
The candidate should have a PhD in computational physics, a solid background in solid state physics, ideally, in free energy methods. The candidate will also play a central role in interacting with the experimental partners, to suggest the most relevant experiments, and interpret experimental data and observations.

Interested candidates can apply electronically (CV including full publication list and references) by sending an email to: helena.zapolsky@univ-rouen.fr
The selection process will be finished December 1, 2017.

Contacts :

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