# Internship Program for International Students

## Internship Subject Form

<table>
<thead>
<tr>
<th>Name of the Host Laboratory</th>
<th>Laboratoire de physique de la matière condensée (Condensed matter physics, PMC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Website of the Host Laboratory</td>
<td>pmc.polytechnique.fr</td>
</tr>
<tr>
<td>Research Group</td>
<td>Physics of irregular systems</td>
</tr>
<tr>
<td>Internship Supervisor</td>
<td>Mathis Plapp</td>
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<tr>
<td>Internship Subject</td>
<td>Phase-field simulations of crystal growth and solidification</td>
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</tbody>
</table>

**Student’s level**
- [x] Advanced Undergraduate Students (3rd or 4th year)
- [x] Master’s students (1st or 2nd year)
- [ ] PhD students

**Proposed Duration**
- [x] 3 months
- [ ] 4 months
- [ ] 5 months
- [ ] 6 months

**Prerequisites**
Knowledge or experience in at least one of the following areas: statistical physics (phase transitions), solidification (materials science, thermodynamics), partial differential equations, computer simulations.

**Internship description (max. 15 lines)**
The solidification of alloys can produce a huge variety of complex microstructures, such as dendrites (tree-like structures, similar to snowflakes), lamellar or fibrous composites, or polycrystalline grain structures. The phase-field method has emerged in recent years as a comprehensive tool for the modelling and simulation of such structures. This method uses phenomenological equations of out-of-equilibrium thermodynamics, a system of coupled nonlinear partial differential equations that can be integrated in time using standard numerical methods. In this internship, the student will learn the fundamentals of this method and use or modify existing codes to explore aspects of pattern formation in solidification or fluid mechanics.

The boxes marked with cross implies eligible.