



# Call for Doctoral Candidate Applications

## Advanced Leidenfrost Effect

Funding: European Commission HORIZON-MSCA-2023-DN-01-01 GA: 101169365

### General Information:

When a liquid droplet is placed on a solid surface with a temperature significantly higher than the boiling point of the liquid, the droplet “levitates” above the surface on a thin layer of its vapor, a phenomenon known as the **Leidenfrost effect**. While this effect is highly undesirable in certain cooling applications due to the **reduced energy transfer** between the solid and evaporating liquid caused by the poor heat conductivity of the vapor, it can be of significant interest in various processes where **avoiding contact with the surface** is advantageous.

**The LeidenForce project aims to comprehensively study the Leidenfrost effect and propose novel applications**, either to mitigate its adverse effects or leverage its advantages. More precisely, the objectives of the LeidenForce consortium are to:

- (i) shift the fundamental understanding of the transition to the Leidenfrost state,
- (ii) optimize the heat transfer between the droplet and the substrate,
- (iii) utilize the isolated droplet to manipulate small amounts of liquid in unconventional scenarios (e.g., on a liquid surface, within a channel), and
- (iv) harness the vapor film to capture or confine particles using an external electrical field.

The practical implications will be leveraged by non-academic institutions involved in aviation (such as AIRBUS), metallurgy (CRM), and space exploration (Centre Spatial de Liège).

### Hiring Institution

Hiring LeidenForce Member: Université libre de Bruxelles, Web: <https://www.tips-ulb.be>

Address: Université libre de Bruxelles

Av. F.D. Roosevelt, 50, CP 165/67, B-1050 Bruxelles – Belgique

Type of contract: temporary fellowship: 36 months (MSCA)+12 month(FWB)

Job status: full-time

Hours per week: 38 hours

Offer starting date: **01/03/2025**

EU Research Framework: HORIZON-MSCA-2023-DN-01-01 GA: 101169365

## Open Position

**Topic:** Stability of the vapor film under a Leidenfrost droplet

Description: The vapor film under a droplet in Leidenfrost state clearly plays a pivotal role in the overall phenomenon. Yet, even though its static shape has been studied in details, typically using a lubrication (thin film) assumption, its dynamics still needs to be understood. In particular, one can expect several types of unstable regimes leading to self-sustained vertical oscillations, axisymmetric or not, sometimes even triggering spontaneous symmetry-breaking star-shaped patterns and motion in a random direction, as experimentally shown by the ESPCI team. Understanding these fascinating objects requires good skills in applied mathematics and fluid mechanics, with a focus on nonlinear dynamics and hydrodynamic instability. The work proposed is mostly **theoretical**, and to a lesser extent experimental, with possible secondment(s) in ESPCI (Paris), NTNU (Trondheim), and ULiège (Liège), where the various models may be compared with experiments. Validation of the analytical models against full numerical simulations is also possible in collaboration with UTwente (Enschede).

**Supervision:** Pierre Colinet

**Hosting lab:** Université Libre de Bruxelles, TIPs – Fluid Physics

Location:

Ecole Polytechnique de Bruxelles

C.P. 165/67 – Av. F.D. Roosevelt 50, B-1050 Bruxelles – Belgium

## Benefits

The MSCA programme offers a competitive salary and attractive working conditions, in accordance with the MSCA regulations for doctoral candidates.

You will be enrolled in the PhD program of your choice at the FREE UNIVERSITY OF BRUSSELS (Brussels, Belgium), and have the opportunity to learn from a consortium of 8 institutions (10 Beneficiaries + 3 Partner organizations). In addition to the individual scientific projects, all DCs will benefit from further continuing education, which includes possible secondment at CSL, AIRBUS, a variety of training courses for specific and transferable skills, and active participation at international conferences.

Successful candidates will be offered a 48 months full-time fellowship, with a monthly salary of **3400.00 € (average gross salary, before statutory deductions; corresponding to a net amount around 2.350,00 € for EU-fellows and about 2640,00 € for non-EU fellows)**, plus an additional **mobility allowance (600€ per month, unconditional)**, and an additional **family allowance (600€ per month, if applicable)**.

## Eligibility criteria

a) To apply for these MSCA Training positions, applicants must fulfil the following criteria:

- **Mobility:** to be eligible for a position, you should not have resided in the country of the host institution (i.e. Belgium) for more than 12 months over the three years before the starting date of the position, excluding holidays and (refugee status) asylum application.

Candidates must prove that they fulfil the aforementioned criterion through relevant documentation (certificates, official statements, residency card, ...).

b) Specific requirements for the proposed project:

- Educational Level: Master in engineering, physics, chemistry, or equivalent.
- Required languages: English
- Skills/Qualifications: The candidate should ideally have theoretical/numerical skills in fluid dynamics
- Eligibility to enrol in the PhD programme of the Free University of Bruxelles: acquired 60 ECTS of bachelor and master training.

### **Selection Criteria**

The selection committee uses a number of indicators to evaluate the applicant's preparedness, motivation and potential.

*1st phase, remote pre-selection:*

The Scientific, Technological & Academic excellence will be considered at first, based on:

- Quality of the CV, in general
- Any demonstrated research experience, in particular internships on similar topics or using similar techniques.
- Undergraduate performance: overall, with a special focus on relevant field-specific courses (e.g. fluid physics, capillarity, stability, ...)
- Any demonstrated previous recognitions (grants, awards, ...)
- Reference letters provided by professors and senior scientists: Two reference letters are expected (better: names and emails of two referees we can contact).
- Letter of Motivation: past research experience, motivation for applying to this particular PhD project, academic fit, contribution of the project to the candidate's future careers plans, ...
- Additional relevant skills (field-specific): demonstrated, e.g. through previous projects, and or through previous participation in scientific contests, trainings, ...

*2nd phase, interview(s):*

Should the candidate be preselected at phase 1, a second phase will consist in at least one interview (in presence or at distance) through which the motivation, the proactive behavior, the capacity to work collaboratively, the organizational skills, the communication skills and the capacity to engage in a scientific discussion and manage problems, will be assessed, among other aspects.

The final decision will be the result of a consensus of an evaluation committee that will take into account the results of both recruitment phases 1 and 2. The candidate will be informed of the section results by email.

The evaluation committee will be trained to avoid any gender or minority biases.

## **Application Process:**

All the documents that prove the eligibility and qualifications of the candidate should be provided. As for the selection process candidates are expected to provide at least the following documents:

- A brief introduction letter (no more than one A4 page) that summarizes the documents and the nature of the information provided for the selection
- A full CV
- The two requested reference letters (better: coordinates of 2 persons able to give their opinion on you as a scientist)
- The letter of purpose/motivation (no more than two A4 pages)

All documents must be sent by email to the Principal Investigator of the proposed project (Pierre Colinet – [pierre.colinet@ulb.be](mailto:pierre.colinet@ulb.be)) **before March 21<sup>st</sup>, 2025**. The title of the application email should be “LeidenForce PhD position ULB – *your full name*” in order to ensure correct processing. Every incomplete application will be rejected.