


Proposal Evaluation Form

	EUROPEAN COMMISSION Horizon Europe Framework Programme (HORIZON)	Evaluation Summary Report - Postdoctoral Fellowships
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Call: HORIZON-MSCA-2021-PF-01
Type of action: HORIZON-TMA-MSCA-PF-EF
Proposal number: 101067895
Proposal acronym: TMAB
Duration (months): 24
Proposal title: Fluctuations of passive objects in confined active baths
Activity: EF-PHY

N.	Proposer name	Country	Total Cost	%	Grant Requested	%
1	ECOLE SUPERIEURE DE PHYSIQUE ET DECHIMIE INDUSTRIELLES DE LA VILLE DEPARIS	FR	211,754.88	100.00%	211,754.88	100.00%
	Total:		211,754.88		211,754.88	

Abstract:

"Thermometer" of an active bath -- A systematic experimental investigation into the fluctuations of passive objects in active baths

Original non-equilibrium phenomena arise in active matter in the presence of confinement. This project aims at studying the fundamental principles governing the emergence of collective organization and structured interaction when active and passive objects interact both under confinement and in the presence of curvature. This project will pave the way towards the elaboration of novel soft-matter exotic phases.

The interplay between complex environments and active matter suggests a possibility to control and engineer active matter by carefully designing the confinement structures. It is now well established that confinement may influence transport, rheology, pressure, spatial distribution and collective motion of active matter. However, curved confining walls, which are ubiquitous in biological systems, show of their own, specific rich and intriguing effects on active matter. Systematic experiments in a well controlled and measurable experimental system will deepen our understanding of confinement effects on active-passive interactions, guiding real-life applications of active matter.

In this project, we propose to build a well-controlled active matter experiment based on the 3D tracking of particles driven by a bath of motile bacteria which are confined inside spherical droplets using a double emulsion technique. This novel experimental system stems from two key technological innovations and will enable a systematic investigation in to the following topics:

- i) Active motion of passive spheres confined in droplets
- ii) Exploring the validity and consequences of the "active temperature" concept
- iii) Complex-shape objects in confined active baths: towards new self-assembly principles

A collaborative efforts of theoretical and experimental approaches will advance the fundamental understanding of active matter.

Evaluation Summary Report

Evaluation Result

Total score: 83.80% (Threshold: 70/100.00)

Criterion 1 - Excellence

Score: **4.00** (Threshold: 0/5.00 , Weight: 50.00%)

- **Quality and pertinence of the project's research and innovation objectives (and the extent to which they are ambitious, and go beyond the state of the art).**
- **Soundness of the proposed methodology (including interdisciplinary approaches, consideration of the gender dimension and other diversity aspects if relevant for the research project, and the quality and appropriateness of open science practices).**
- **Quality of the supervision, training and of the two-way transfer of knowledge between the researcher and the host**
- **Quality and appropriateness of the researcher's professional experience, competences and skills.**

Strengths:

- The proposal addresses a timely and strongly emerging/developing topic ("active matter") with high technological, economical and societal relevance.
- Description of state-of-the-art is very good. Comprehensive references are given and drawn conclusions for the proposed research are sound and credible. The proposal is highly innovative and clearly goes beyond-state-of-the-art.
- The overall methodology is sound and well suited to address the aim of the proposal. The proposed developments in particle tracking are very good. If successful, existing experimental techniques will be substantially improved by the proposal.
- The proposal clarifies the relevance of interdisciplinarity of the research, which will appropriately combine key different expertise in several disciplines, such as statistical physics, hydrodynamics, biophysics and image processing.
- The proposal will be supervised by three well-established scientists, each with their own expertise and robust track record of publication. They all have key competences that will be important for the planned research activities as well as appropriate supervision experience of researchers at all career stages.
- The proposal sufficiently describes non-scientific training activities, such as communication and research management.
- The two-way knowledge transfer is sound and convincing in both directions.
- Regarding their stage of career the scientific track record of the researcher is very good (number and quality of publications). Also, the researcher has significant experience of contributing talks at international conferences.
- The researcher experience is appropriate for conducting the proposed research.

Weaknesses:

- The objectives of the proposal (apart the first one) are not explicitly formulated and presented via actions foreseen in the proposal.
- The proposal does not fully clarify whether the experimentally accessible sizes of inner and outer emulsion droplets, bacteria and probe particles will allow for a full separation and appropriate resolution of size and length scales of the individual components. In addition, the question of particle "softness" (i.e. inner emulsion droplet = flexible, printed probe particles = rigid) is not addressed with sufficient details.
- The specific training for the researcher regarding scientific and technical disciplines is insufficiently described in the proposal. In addition, the involvement of the researcher in tutoring and/or supervising is not sound enough.
- The proposal insufficiently addresses whether the host group will have the possibility to bring the needed expertise in image processing which plays important role in the project. In particular, the description of an automated 3D tracking system based on artificial intelligence technology is provided with insufficient detail. Hence, the appropriateness and robustness of the proposed method cannot be clearly judged.

Criterion 2 - Impact

Score: **4.50** (Threshold: 0/5.00, Weight: 30.00%)

- **Credibility of the measures to enhance the career perspectives and employability of researchers and contribution to their skills development.**
- **Suitability and quality of the measures to maximise expected outcomes and impacts, as set out in the dissemination and exploitation plan, including communication activities.**
- **The magnitude and importance of the project's contribution to the expected scientific, societal and economic impacts.**

Strengths:

- The proposal appropriately describes generic measures which will enhance future career perspectives of the researcher in academia.
- The researcher will learn new experimental methods. This will be beneficial at this early stage of the researcher's career.
- Scientific dissemination measures are briefly discussed and are convincing concerning publication of relevant results in high impact journals. The strategy regarding conferences' attendance is only fair, since the planned conferences are not really within the main topic of the proposal (e.g. "International Soft Matter Conference" or similar workshops).
- The scientific, fundamental impact of the proposed research is well-described and convincing, highlighting the importance of the results in the field of active matter.
- Long-term (post-proposal) application of the equipment and methodology to be developed in the proposal, in case of success, can significantly contribute to various fields: non-equilibrium thermodynamics, rheology, therapeutics (for drug delivery).

Weakness:

- Communication and outreach activities are insufficiently discussed in the proposal; specifically the outreach plan is not sound enough and the involvement of different target audiences remains insufficiently justified.

Criterion 3 - Implementation

Score: **4.20** (Threshold: 0/5.00, Weight: 20.00%)

- **Quality and effectiveness of the work plan, assessment of risks and appropriateness of the effort assigned to work packages.**
- **Quality and capacity of the host institutions and participating organisations, including hosting arrangements.**

Strengths:

- The research is organized in three sequential work packages, whose time allocation is appropriate and balanced to the number of milestones and deliverables. Also, it is an appropriate set of tasks as compared to the available person months.
- The Gantt chart is quite complete, including research work packages, management and dissemination activities.
- Risks associated with image processing, fabrication of the experimental systems and their observation are well assessed; The respective contingency plans are well justified.
- The research infrastructure is very good, providing what is needed for the realization of the scientific program.

Weaknesses:

- The administrative risks relevant to this proposal are insufficiently discussed.
- The description of the secondment provided is insufficient.
- The proposal insufficiently describes how the researcher will be integrated in the host and secondment team and how they will interact /conduct the proposal with the three different supervisors, plus the secondment supervisor.

Scope of the application

Status: **Yes**

Comments (in case the proposal is out of scope)

Not provided

Exceptional funding

A third country participant/international organisation not listed in [the General Annex to the Main Work Programme](#) may exceptionally receive funding if their participation is essential for carrying out the project (for instance due to outstanding expertise, access to unique know-how, access to research infrastructure, access to particular geographical environments, possibility to involve key partners in emerging markets, access to data, etc.). (For more information, see the [HE programme guide](#))

Please list the concerned applicants and requested grant amount and explain the reasons why.

Based on the information provided, the following participants should receive exceptional funding:

Not provided

Based on the information provided, the following participants should NOT receive exceptional funding:

Not provided

Use of human embryonic stem cells (hESC)

Status: **No**

If YES, please state whether the use of hESC is, or is not, in your opinion, necessary to achieve the scientific objectives of the proposal and the reasons why. Alternatively, please state if it cannot be assessed whether the use of hESC is necessary or not, because of a lack of information.

Not provided

Use of human embryos

Status: **No**

If YES, please explain how the human embryos will be used in the project.

Not provided

Activities excluded from funding

Status: **No**

If YES, please explain.

Not provided

Do no significant harm principle

Status: **Not applicable**

If Partially/No/Cannot be assessed please explain

Not provided

Exclusive focus on civil applications

Status: **Yes**

If NO, please explain.

Not provided

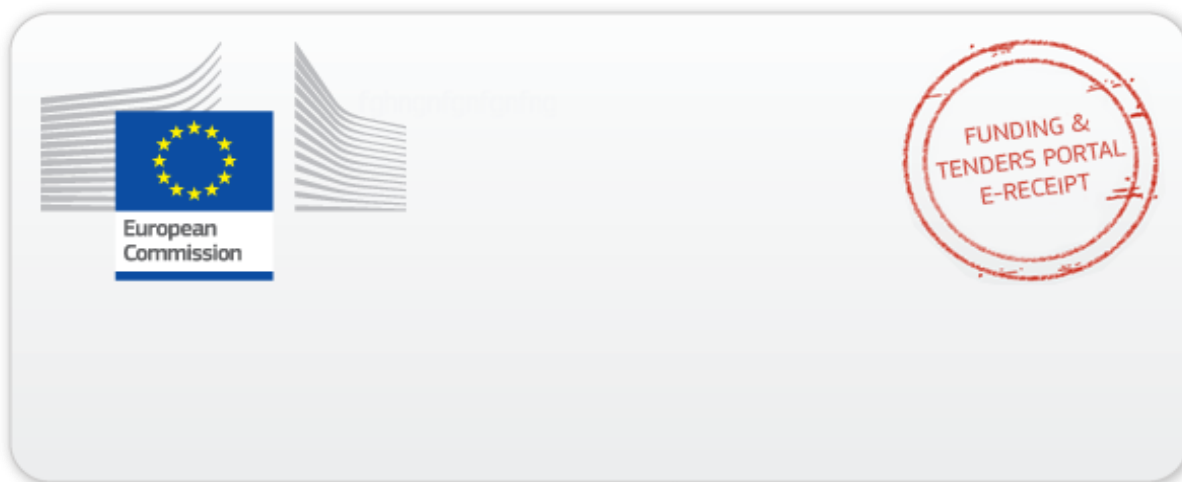
Artificial Intelligence

Status: **No**

If YES, the technical robustness of the proposed system must be evaluated under the appropriate criterion.

Overall comments

Not provided



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