Proposal for a M2 internship (spring 2026) and a PhD thesis starting in september/october 2026

Understanding the detachment of microscopic fibrils of viscoelastic polymer

Laboratoire de Physique des Solides and Laboratoire FAST, Orsay

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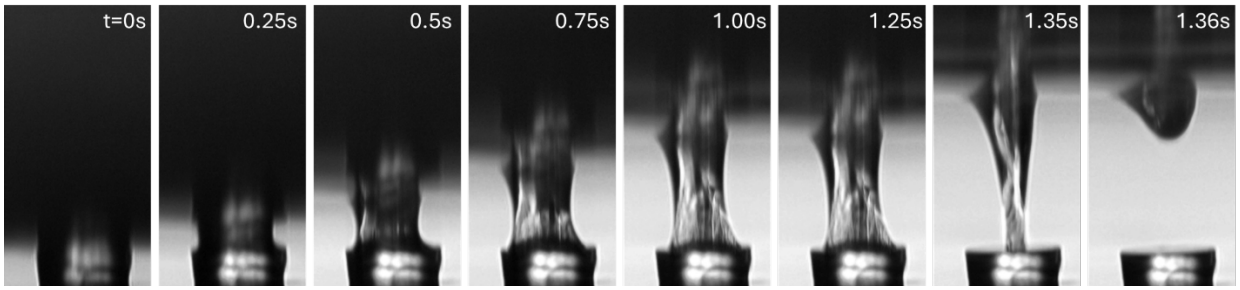
Viscoelastic polymer adhesion is everywhere in the industry —from aerospace and electronics to packaging— and it also drives advances in cutting-edge technologies such as soft biomimetic robotics and tissue engineering. As a major topic in soft matter physics, it sits at the intersection of mechanics, rheology, and interfacial science.

During the peeling of a viscoelastic polymer adhesive, the release of the thin adhesive layer typically triggers cavitation or fingering instabilities at the detachment front. This process continues with the formation of microscopic fibrils that stretch before ultimately detaching. Yet, a key theoretical challenge remains: understanding the detachment criterion governing each individual fibril, which is essential to building a predictive model for adhesion forces.

This M2 internship and PhD project offers an outstanding opportunity to explore the fundamental mechanisms behind the detachment of microscopic fibrils formed during the peeling of viscoelastic adhesives. The candidate will design and carry out experiments where controlled adhesive layers are brought into contact with micrometer-size pillars and separated at controlled velocities. A single adhesive fibril —whose diameter is tuned by the pillar size— will be created, stretched, and eventually detached, enabling direct measurement of its mechanical response.



Detachment process of a fibril of initial diameter 70 µm at a separation velocity of 100 µm/s. The fibril starts to stretch and then progressively detaches from the surface.

The research will combine micrometric optical imaging and quantitative force measurements to link detachment dynamics with the intrinsic viscoelastic properties of the material and its interfacial interactions with the substrate. The project will involve both commercial adhesives and tailor-made materials synthesized in the laboratory with finely controlled mechanical characteristics.

The M2 internship and the PhD will take place in Université Paris-Saclay in Orsay at the Laboratoire de Physique des Solides in close collaboration with laboratoire FAST. The candidate will benefit from a dynamic and supportive research environment, frequent exchanges within the supervising team, and access to advanced experimental facilities. This stimulating setting is ideal for a motivated candidate eager to contribute to the development of a quantitative physics of adhesion at the microscopic scale.

Ultimately, the goal is to establish and validate a model —based on the experimentally determined detachment criterion of adhesive fibrils— capable of quantitatively predicting the adhesion strength of adhesive tapes from the material intrinsic properties.

The thesis will be supervised by Christophe Poulard (Professor, Université Paris-Saclay) and co-supervised by Pierre-Philippe Cortet (CNRS Research Director).