M2 Research Internship: Physics of Paragliding

November 19, 2020

Laboratory name: Laboratoire d'Hydrodynamique, LadHyX
CNRS identification code: UMR CNRS 7646
Internship location: Ecole Polytechnique, Palaiseau.
Thesis possibility after internship: YES
Funding: YES

Supervision: Caroline Cohen, Sophie Ramananarivo, Michael Benzaquen (X)
Heni Montel (Freedom Parapente)

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Subject

Paragliding is a young adventure sport consisting in flying lightweight, free-flying, foot-launched glider aircrafts with no rigid primary structure (see figure below). Dating from the early 80's, paraglider wings haven't ceased to evolve, both in terms of performances and security.

While most of the research done by paragliding manufacturers has focussed on optimising wings for steady flight phases, unsteady regimes have only received limited quantitative attention. In particular, many questions remain unsolved when it comes to the physics of the launching phase. How does a seemingly simple rag inflate in response to a slight breaze to become a rather stable aircraft in just a matter of seconds? And are the current wings optimal in this regard?

The present internship will be devoted to designing, building and running a reduced-scale model experiment to study the inflation and launching phase. Provided current conditions allow it, we shall also devote time to filming real launches in slow motion in collaboration with our partners at Puy de Dôme, and processing such images to reconstruct in 3D the dynamics of the wing during inflation. Analysing historic data on how wings have naturally evolved will most certainly also be of interest to our purpose.

The internship will be held at the Laboratoire d'Hydrodynamique de l'X in close connection with Henri Montel and his team at Freedom Parapente (Puy de Dôme). Good experimental skills are advised.

References

[1] Ramananarivo, Godoy-Diana, & Thiria (2011). Rather than resonance, flapping wing flyers may play on aerodynamics to improve performance. PNAS, **108**(15), 5964-5969.

[2] Ramananarivo, Mitchel, & Ristroph (2019). Improving the propulsion speed of a heaving wing through artificial evolution of shape. Proc. R. Soc. A. **475**(2221), 20180375.