PhD position in optical metrology

Application of Dual-wavelength Digital holography to 3D characterization of micrometric droplets produced by a viscoelastic filament breakup

Digital holography can be used to access the 3D position of liquid objects with micrometric size particles transported by fluid flows. CORIA lab has more than two decades of expertise in this field. In its dual-wavelength configuration it is possible to obtain accurate velocity measurements within a given volume without prior knowledge of the 3D object positions. This is a major asset since several planes can be recorded simultaneously and analysed a posteriori.

The present PhD proposal deals with drops formed on a viscoelastic liquid filament that is obtained by stretching a liquid bridge between two plates. Viscoelastic liquids are commonly encountered in industrial and medical applications but the conditions for observing drops-on-filament structures remain unclear, as well as their characteristics. In a recent joint project between LOMC and CORIA labs (LabEx EMC^3 IBOASD), digital holography was applied to these high-aspect ratio objects in a calm environment with very promising results (see figure below). [1]

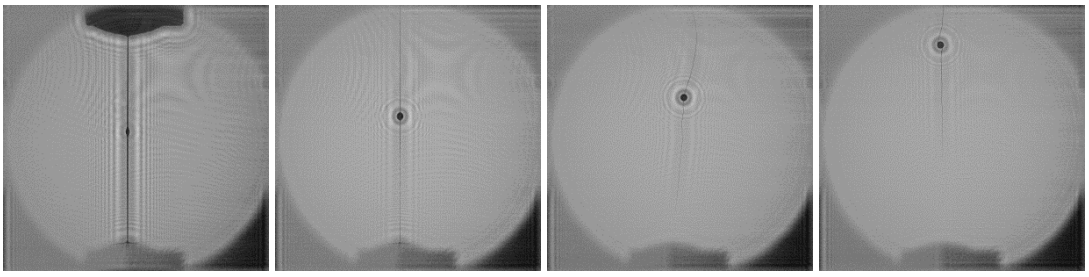

Figure – Holographic images of a stretched viscoelastic filament ($t=t_0$, t_0+5s, t_0+9s, t_0+11s)

The objective of the PhD proposal is to develop and apply dual wavelength digital holography to visualization and the 3-D size/velocity/trajectories measurement of micrometric droplets. These droplets will be obtained by stretching a viscoelastic liquid filament within the IBOASD stretching device. Here, we will study the influence of a controlled gas flow on the drop movements with an interest for medical applications such as viscoelastic mucosaliva ejection from respiratory infection.
The applicant should hold a Master's Degree in General Physics. Skills in optics or fluid metrology will be particularly appreciated. A marked taste for image processing and experimental work is needed.

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[1] M. Kozulic, M. Mirzaei, G. Godard, D. Lebrun, O. Crumeyrolle, MC. Renoult. 3D monitoring of a pearling instability. *APS Division of Fluid Dynamics*, 2019, Portland, United States. ⟨hal-02418339⟩ *V0034, 72th Annual Meeting of the APS Division of Fluid Dynamics (November 23, 2019 – November 26, 2019). DOI: https://doi.org/10.1103/APS.DFD.2019.GFM.V0034*