SEMS: RESEARCH PROJECT DESCRIPTION

Project Background and Description

Holographic Velocimetry of Liquid Droplets

This project aims to develop laser methods to characterize droplet breakup, splashing, spreading and coalescence.

Aims:
1. Develop an in-line digital holography setup to characterize small fast-moving objects. In this configuration a single collimated laser beam is used to illuminate the objects and also as the reference beam.
2. Utilize holographic methods to study the inner structure of flows, particularly liquid jets.
3. Develop a time-resolved protocol to characterize the dynamics of droplets in the submicron size.

Digital holography is a technique in which the interference pattern created by the interaction of coherent light scattered from an object and a reference beam from the same source is recorded on a sensor. In fact, digitally captured holograms can be processed digitally to generate a 3D representation of the objects located between the coherent source (very often a laser) and the sensor. The major advantage of this approach is its resolution, as holographic methods go beyond the diffraction limit of conventional optics to resolve features in the nanometer range. This project aims to develop a technique to characterize the dynamics of flows down to the nanometer scale.

Project Scope

- Develop a holographic time-resolved visualization rig.
- Characterize the physics of droplets.
- Understand the dynamics of very small droplets.

Desired Skills from the Student

- A basic background in instrumentation or optics is desired but not compulsory.
- Experience in Laboratory work (physics or engineering) would be advantageous.
- A good degree in Engineering, or Physics or Optics.
- Experience writing reports and/or scientific papers would be advantageous.

Supervisory Team

- Primary: Jose Rafael Castrejon-Pita (S. Lecturer, PhD).
- Secondary: Ahmed Ismail (Research Fellow, PhD)