Simultaneous observation of the scattered light in the rainbow region of two falling droplets

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Abstract

The droplets are falling within a observation chamber and while they are falling they are illuminated by a vertical laser beam, as shown in Fig. 1. The light scattered in the forward hemisphere is used to determine the droplet size using the interference pattern. The light scattered in the backward hemisphere in the region of the first rainbow is used to obtain the refractive index. The two lenses in front of the two cameras are not used as Fourier lenses anymore. The droplets are first imaged by the lenses and then the image plane of the cameras is moved along the optical axis in order to obtain defocussed images of the droplet. Then interference fringes in the forward direction and the first rainbow in the backward direction become visible. For the forward direction this is a well known method used in the so called ILIDS or IMI technique, which allows to determine the droplet sizes and velocities in a plane of a multiphase flow field. Here, in addition to the scattered light in the forward direction, the position of the rainbows from the light scattered in the backward direction is determined for two droplets of slightly different terminal velocity falling simultaneously within the observation chamber. Examples for two droplets of different substances are shown. In one case the distance between the droplets increases and in the other case a collision of the two droplets is observed.

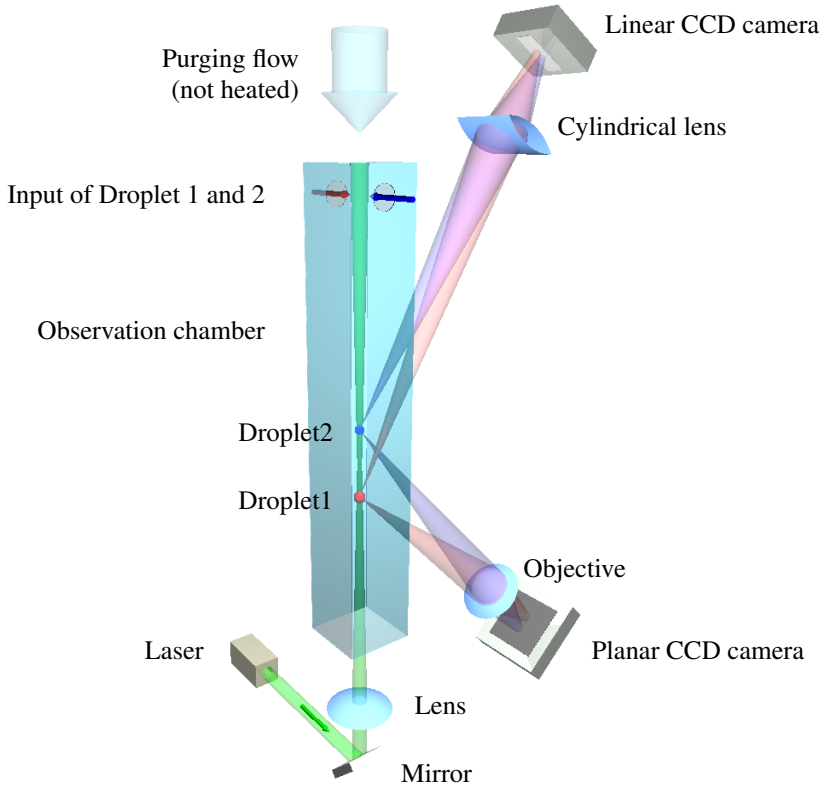

Figure 1: Schematic view of the experimental setup

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