Abstract Submitted
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Study of downward annular pipe flow using combined laser-based approaches[1] JAE SIK AN, Imperial College London, ANDREY CHERDANTSEV, Institute of Thermophysics, Siberian Branch of Russian Academy of Science, IVAN ZADRAZIL, OMAR MATAR, CHRISTOS MARKIDES, Imperial College London — In downward annular flow, the liquid phase flows as a film along the pipe wall and the gas flows in the core of the pipe. The liquid free-surface is covered by a complex multiscale system of waves. The interaction dynamics of the interfacial waves with each other and with the gas stream exert a significant influence on the pressure drop, heat transfer and mass interchange between the phases. The complexity of the interface requires the application of measurement techniques with high spatiotemporal resolution. In this work, two approaches based on the principle of laser-induced fluorescence, namely planar LIF and brightness-based LIF, are applied simultaneously to study interfacial phenomena in these flows, while simultaneous LIF and PIV are used to obtain velocity field information in the liquid phase underneath the waves. Sources of measurement bias are then analysed: total internal reflection at the out-of-plane interface; steep longitudinal slopes and transverse wave curvature; presence of gas bubbles in the liquid film. Although each method has its own limitations, a combined technique can provide reliable spatiotemporal measurements of film thickness to accompany the velocity information. Finally, flow development is studied in a moving frame of reference over long lengths.

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