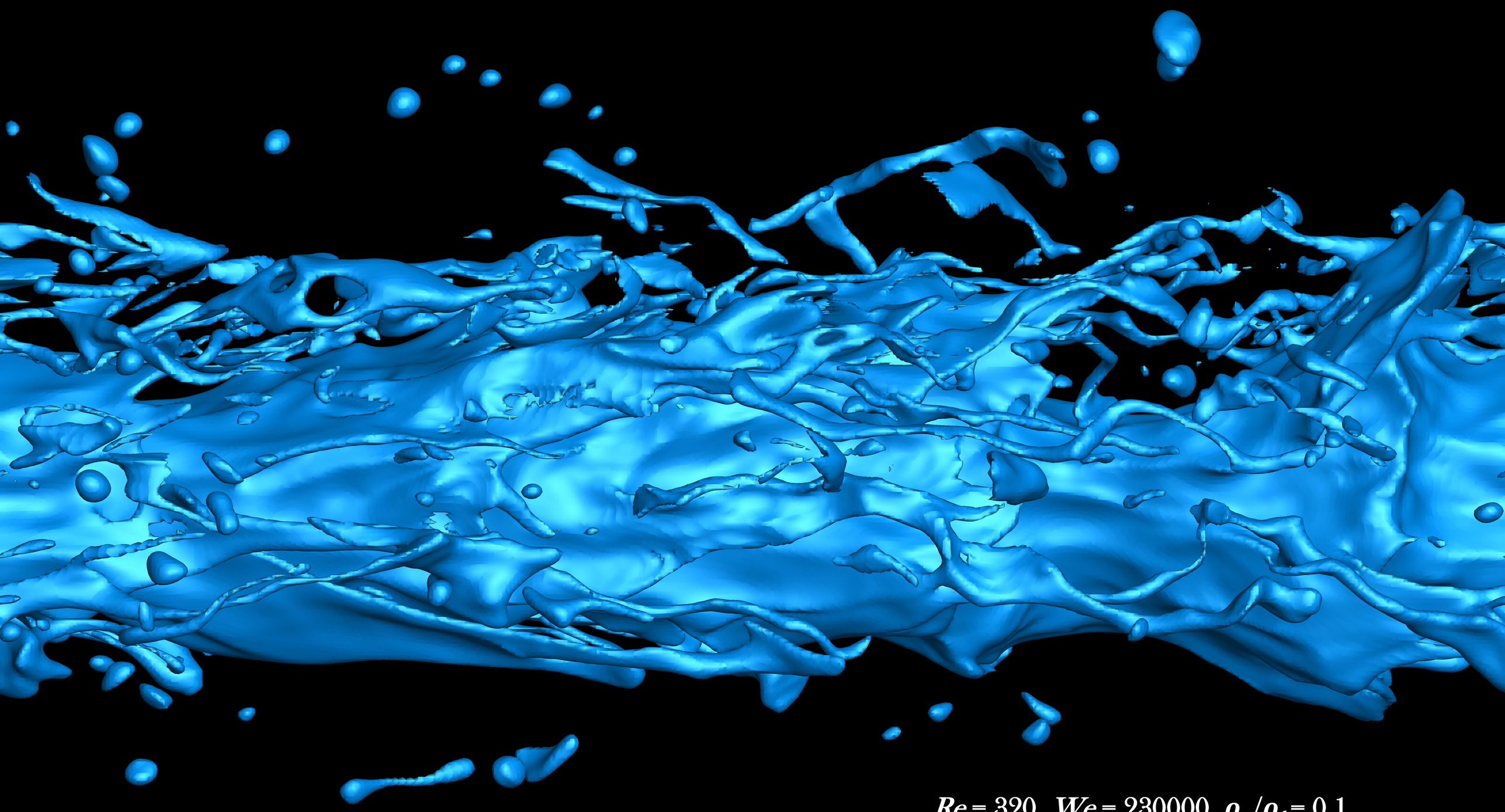
Computational Simulation of Liquid Jet Atomization

D. Jarrahbashi[1], W. A. Sirignano[2], P. P. Popov[2], F. Hussain[3]



$Re = 320,\ We = 230000,\ \rho_g/\rho_l = 0.1$

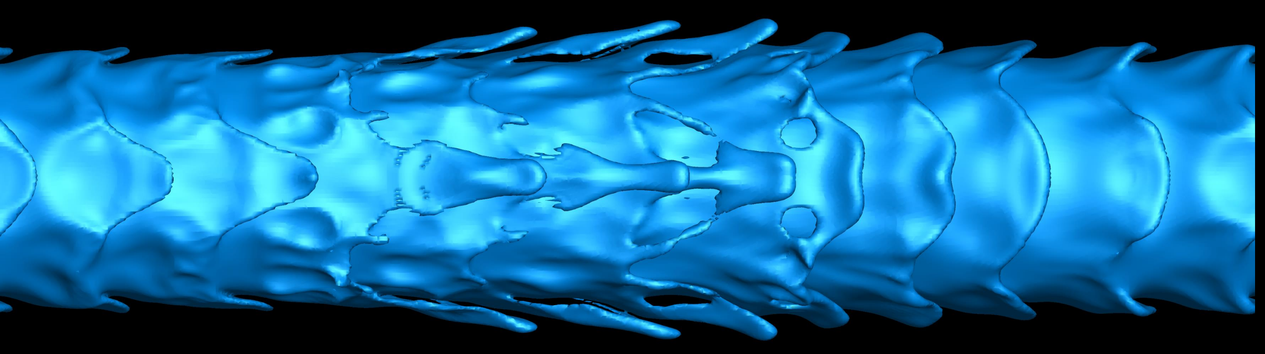


Fig. 1. $Re = 1600,\ We = 230000,\ \rho_g/\rho_l = 0.1$

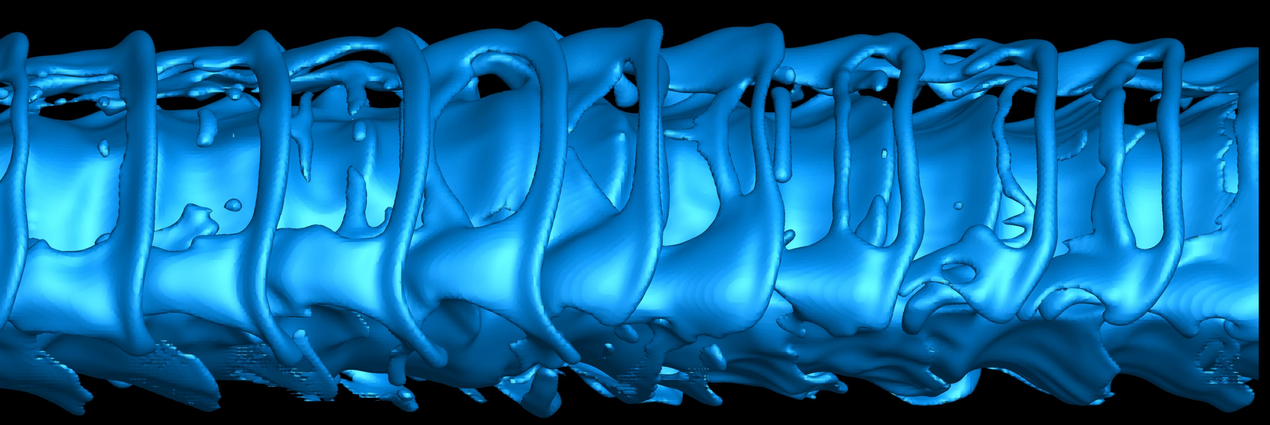


Fig. 2. $Re = 1600,\ We = 230000,\ \rho_g/\rho_l = 0.5$

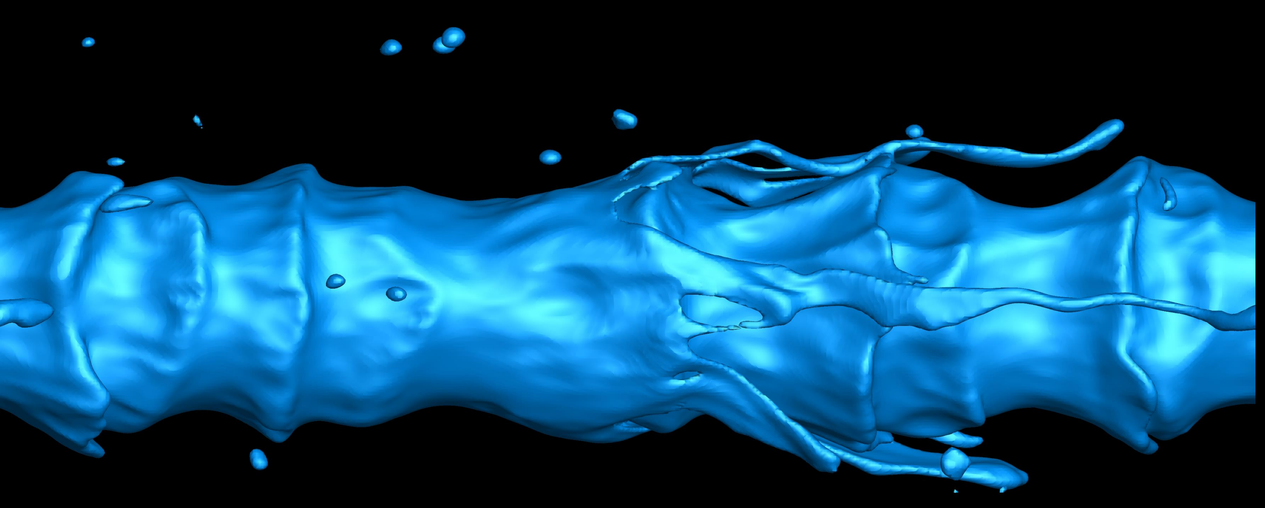


Fig. 3. $Re = 320,\ We = 230000,\ \rho_g/\rho_l = 0.05$

Direct numerical simulation of temporal instabilities, leading to spray formation of a round liquid jet segment with an outer, coaxial high-density gas flow revealed three physical domains of break up.

At higher *Re* and *We*, ligaments and then droplets develop following hole and liquid bridge formations (Fig. 1).

At higher gas densities throughout the *Re* range, several holes merge forming two bridges per lobe before breaking to form ligaments (Fig. 2).

For lower gas density and *Re* or *We* the well-ordered lobes are replaced by irregular, smaller-scale corrugations along the conical wave crest edge from which ligaments grow. (Fig. 3).

Georgia Tech
UCI University of California, Irvine
TEXAS TECH UNIVERSITY