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Respiratory Droplets Transport via Vortex Dynamics during Expiration[1] ALAN PILLOW, CHANDLER CAIN, RANGANATHAN GOPALAKRISHNA, JOHN HOCHSTEIN, JEFF MARCHETTA, DANIEL FOTI, Department of Mechanical Engineering, University of Memphis — Human-to-human transmission of upper respiratory diseases such as COVID-19 is primarily driven by the dispersion of virus-laden droplets that are expelled from the nose and mouth. Aerosolized droplets can accumulate in the air for hours and be present at sufficiently high concentrations to pose a significant health hazard especially in confined spaces. Large-scale coherent vortical structures, induced along the surfaces of the mouth and nose, play a particularly crucial role in determining the transport of aerosolized droplets. In this study, high-resolution particle imaging of a fully pulsed flow imitating a human cough reveals coherent motion and dispersion of droplets away from the source. The transient interactions of the droplets with vortical structures are detailed at different temporal phases including the initial starting pulse, the immediate trailing jet, and asymptotic behavior downstream. The coupling between the vortical structures and the droplets is investigated based on the distribution of droplet sizes and concentration. The penetration of the jet along with the lifetime or extinction of the droplets are visualized as a function of the distance from the source, droplet size, and droplet concentration.

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