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Simulations of the Interactions of Coherent Vortical Structures and Respiratory Droplets during Expiration[1] DANIEL FOTI, ALAN PILLOW, CHANDLER CAIN, RANGANATHAN GOPALAKRISHNAN, JOHN HOCHSTEIN, JEFF MARCHETTA, Department of Mechanical Engineering, University of Memphis — Two of the most critical questions pertaining to reducing transmission of respiratory infections and social distancing are what human-to-human separation distances are safe, and how can airborne transmission be mitigated. Coherent vortical structures induced by a cough on the surface of the mouth and nose affect the transport of respiratory droplets. Computational simulations are undertaken to capture the spatio-temporal interactions of the coherent vortical structures and the respiratory droplets that can aerosolized and become airborne. The simulations are validated with complementary experimental measurements to assess the ability of numerical models to capture the spatio-temporal evolution of the droplets and aerosolized particles convected in a fully pulsed jet, which is used to model a human cough. Comparisons of the high-resolution images and simulated droplets are discussed. Lagrangian droplets are tracked as they are expelled from a transient fully pulsed jet and interact with the incipient vortices as they disperse outward. The coupling between the droplets and the vortical structures is detailed as a function of the distribution of droplet sizes. The formation and evolution of the vortical structures are shown to transport and disperse the droplets.

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