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Extended lifetime of respiratory droplets in a turbulent vapor puff DETLEF LOHSE, KAI LEONG CHONG, CHONG NG, NAOKI HORI, RUI YANG, Physics of Fluids Group, University of Twente, ROBERTO VERZICCO, Physics of Fluids Group, University of Twente, and Tor Vergata, Rome — We numerically study a respiratory event with a turbulent jet together with 5000 exhaled droplets using a Lagrangian-Eurlerian approach. In our simulation, droplets are coupled to the ambient velocity, temperature and humidity fields such that we realistically account for the droplet evaporation in a respiratory event. In this study, we focus on cases with different ambient relative humidity (RH) with ambient temperature at 20^oC and exhaled vapor at 34^oC. We found that for RH= 50%, the lifetime of the droplets with initial diameter of $10\mu m$ can be extended by up to 30 times as compared to the lifetime estimation by W. F. Wells (1934). The substantial increase in lifetime is attributed to the collective effects during droplet evaporation and the role of the respiratory humidity. The amount of lifetime extension even become more pronounced for larger RH, for example, the extension can go up to 200 times for RH= 90%. Our tool is a starting point for larger parameter studies, and our findings on extended lifetimes have implications on airborne disease transmission such as the pandemic of COVID-19.

Detlef Lohse
Univ of Twente

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