Evaporation and dispersion dynamics of respiratory droplets under different environmental conditions

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The mechanisms of pathogen transmission driving the pandemic spread remain poorly understood. Despite many advances, there is still a significant gap in unravelling the fundamental transmission dynamics from a mechanistic perspective. This critical gap involves the modes of transmission between the individual host and the potential targets. Regarding the current COVID-19 pandemic, we still do not know if the main transmission route is via large droplets or via respiratory aerosols and the critical size that separates the two classes of particles.

We will use highly-resolved numerical simulations to investigate the lifetime of expiratory droplets under different environmental conditions. Different cases have been analyzed by changing relevant parameters as atmospheric temperature, humidity, air turbulence intensity.

Our results highlight turbulence's role to enhance droplet lifetime due to resuspension mechanism acting against the gravitational force. Moreover, turbulence affects the range of "potentially harmful" particles in both aerosol and droplet transmission, suggesting that both modalities can contribute at the same time to the spreading of the disease.

Short Bio

Gaetano Sardina is Associate Professor of Fluid Mechanics at Chalmers University of Technology in Gothenburg (Sweden). He received a Master's (2007) and PhD (2011) from Sapienza University of Rome (Italy). His main current interests are in the simulation and fundamental physical aspects in the transport of particles, droplets and bubbles in Newtonian and complex flows. His research spans from industrial to environmental and biological applications.

of the turbulent flow with pressure gradients, and the internal flow in bent pipes. He is mainly using high-order (spectral) methods, for which adaptive meshing is another research interest.