Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Simulation-based study of airborne transmission of COVID-19 in two practical settings HAN LIU, SIDA HE, JIAQI LI, LIAN SHEN, JIARONG HONG, Department of Mechanical Engineering St. Anthony Falls Laboratory, University of Minnesota — COVID-19 has shown a high potential of transmission via virus-carrying aerosols as supported by growing evidence. However, detailed investigations that draw direct links between aerosol transport and virus infection are still lacking. There is a dire need for quantitative assessment of the risks of such airborne infection, which can significantly reduce the uncertainties and inconsistencies in our current preventive measures. To fill in the gap, we conducted large-eddy simulations (LES) of indoor airflow and the associated aerosol transport in two practical settings, where likely cases of airborne infection caused by asymptomatic individuals were reported and the detailed information of infection process through contact tracing/surface viral samplings are available. Our simulation resolves turbulence eddy transport, models subgrid-scale effects, and incorporates thermal effect to enable a more accurate assessment of spatiotemporal variation in aerosol exposure and surface contamination due to aerosol deposition. Our results show LES predicts the hot spots of aerosol exposure and surface contamination that coincide with the reported locations of infected individuals and viral positivity, providing strong support and in-depth insights to airborne transmission pathway of COVID-19.

Han Liu
Department of Mechanical Engineering
St. Anthony Falls Laboratory University of Minnesota

Date submitted: 10 Aug 2020 Electronic form version 1.4