

Abstract Submitted  
for the DFD17 Meeting of  
The American Physical Society

**Particle sedimentation and impaction in the respiratory airways**

LAURA NICOLAOU, Imperial College London, TAMER ZAKI, Johns Hopkins University — Impaction is the dominant deposition mechanism for micron-sized particles in the upper airways. However, sedimentation becomes significant as the flowrate decreases and particle size increases. In order to assess the relative importance of impaction and sedimentation, we examine particle transport and deposition under different inhalation conditions, and for different particle sizes. Two important dimensionless parameters are (i) the Stokes number,  $Stk$ , and (ii) the ratio of the gravitational settling velocity to the fluid velocity,  $V_g$ . Their ratio is the Froude number, which measures the relative importance of inertial to gravitational forces. Instantaneous definitions of the Stokes and Froude numbers are derived, based on the local flow properties, in order to obtain a more accurate representation of the particle trajectories. The instantaneous Froude number can be 3-4 orders of magnitude smaller than the reference value in regions of the flow. Therefore, gravitational effects should not be neglected. In addition, deposition is shown to correlate with high values of  $StkV_g$ . Particles with high  $V_g$  deposit primarily in the mouth, via sedimentation, while particles with high  $Stk$  deposit mainly in the larynx and trachea, via impaction.

Laura Nicolaou  
Imperial College London

Date submitted: 19 Jul 2017

Electronic form version 1.4