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Dynamics of inertial particles in the respiratory airways in the small-Stokes, small-Péclet regime PRABHASH KUMAR, MAHESH PANCHAGNULA, ANUBHAB ROY, Indian Inst of Tech-Madras — We investigate the Lagrangian transport of micron and sub-micron size particles in the human lung using a novel Maxey-Riley-Langevin model. The respiratory airways are divided into two primary zones: (i) conducting zone and (ii) acinar zone. The particle transport in the conducting zone is showed to be mainly governed by fluid convection (low Strouhal number). In the acinar zone, particle intrinsic motion (i.e.,Brownian transport) is shown to become increasingly important. The transition between a convection-dominant and diffusion-dominant motion in the Lagrangian reference frame is observed to occur at about the 17^{th} branching generation in the lung. The particle transport by hydrodynamics and by Brownian motion are shown to not obey superposition - an observation that bears importance in the context of disease propagation. Finally, Boussinesq-Basset history force is shown to not play a role in particle transport.

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