In a particular size range, a uniformly distributed turbulent aerosol will spontaneously cluster. The clustering is caused by the inertial mismatch between the dense particles and the much lighter surrounding gas; vortices in the flow "centrifuge" the particles into the interstitial straining regions. The resulting nonuniform particle concentration field enhances the collision rate by as much as two orders of magnitude. An effect of this magnitude may potentially explain open questions concerning the early development of cumulus clouds. In particular, the early-stage growth of droplets in a cloud is believed to be dominated by vapor condensation (over coalescence) due to the low collision efficiency of cloud droplets below 10 microns in diameter. However, condensation growth leads to a simple rate law that is too slow to explain observations. We argue that turbulence plays a more significant role than was previously thought because clustering can affect condensational growth and dramatically enhance the collision rate, offsetting the low collision efficiency. We discuss a statistical measure of clustering called the radial distribution function (RDF). Measurements of the RDF in direct numerical simulations of particle-laden turbulence are compared to recent experimental measurements of the same in a turbulence box, made by collaborators at SUNY Buffalo. The good agreement supports the hypothesis that turbulence is playing a critical role in the early development of clouds.

Refreshments will be served in at 11:00am and the public is cordially invited to attend.