COLLEGE OF ENGINEERING
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Spring 2021 Mechanical Engineering Distinguished Speaker Series

Dr. Lance Collins
Vice President and Executive Director
Virginia Tech Innovation Campus
Alexandria, VA.

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Role of non-continuum fluid mechanics on atmospheric clouds

ABSTRACT

As we admire puffy clouds on warm summer day, their apparent static beauty belies a turbulent churn that is too distant for our eyes to see. That churn, along with gravity, cause micron-size droplets to grow. Initially, droplet growth is driven by condensation of supersaturated vapor onto the surface. Eventually, coalescence accelerates the process towards rain. What is interesting, and somewhat unexpected, is that coalescence would be precluded by a continuum fluid, as the lubrication force required to expel the fluid between the droplets diverges like one over the gap separation. At separations on the order of the mean free path of air (~70 nanometers), non-continuum effects slow the divergence of the force sufficiently to allow coalescence to occur. Using a non-continuum resistivity formulation, we calculate coalescence for settling droplets and show qualitative agreement with recent high-fidelity measurements by collaborators.

Speaker Biography

Lance R. Collins in 2020 was named the inaugural vice president and executive director of the Virginia Tech Innovation Campus planned in Alexandria, VA. Prior to that he served as the Joseph Silbert Dean of Engineering at Cornell University from 2010-2020 and the S. C. Thomas Sze Director of the Sibley School of Mechanical & Aerospace Engineering from 2005-2010. In 2011, he was part of the team that successfully bid to partner with New York City to build Cornell Tech, which opened its Roosevelt Island campus in 2017. In his role as dean, Collins accelerated the college's efforts in diversity, overseeing the increase in the proportion of underrepresented minority students from 8 to 19 percent, and the percentage of undergraduate women from 33 to 50 percent, more than twice the national average. For those efforts, he received the inaugural Mosaic Medal of Distinction from Cornell Mosaic and the Edward Bouchet Legacy Award from the Bouchet Graduate Honor Society.

Collins is a professor of mechanical engineering. His research is focused on the application of direct numerical simulation to a broad range of turbulent processes. He is a fellow of the American Physical Society, the American Association for the Advancement of Science, and the American Institute of Chemical Engineers. In 2014, he received the William Grimes Award from the AIChE and in 2021 he was elected to the National Academy of Engineering. Collins graduated from Princeton in 1981 with honors and holds a M.S. and Ph.D. from the University of Pennsylvania, all in chemical engineering.

Host: Dr. Danesh Tafti