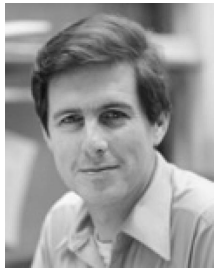

ROBERT W. VAUGHAN was at the center of developments of high-resolution, solidstate NMR techniques at the moment of his untimely death in 1979. His research has contributed much to our understanding of hydrogen-bonding in organic and inorganic solids, chemical bonding in metallic hydrides and metal carbonyl clusters, motion and structure in polymers, and motion and structure of surface hydroxyl groups on oxide catalysts.

The Vaughan Lectures in Chemical Engineering are made possible by the Robert W. Vaughan memorial fund established by the friends and associates of Robert Vaughan. The objective of the Vaughan Lectureship is to honor distinguished young scientists in any of the fields of Chemical Engineering, Chemical Physics or Applied Physics.

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1983 - Manfred Morari, University of Wisconsin
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1986 - Ignacio Grossmann, Carnegie Mellon University
1987 - Robert A. Brown, Massachusetts Institute of Technology
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1991 - Sangtae Kim, University of Wisconsin
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The 33rd Annual

ROBERT W. VAUGHAN LECTURESHIP IN CHEMICAL ENGINEERING

THURSDAY, MAY 8, 2014
4:00 P.M.
HARTLEY MEMORIAL SEMINAR ROOM
106 SPALDING LABORATORY

Refreshments will be served in
113 Spalding Laboratory at 3:30p.m.

Athanasios Nenes

Professor
Georgia Institute of Technology

Athanasios Nenes is a Professor and Georgia Power Faculty Scholar in the Schools of Chemical and Biomolecular Engineering and Earth and Atmospheric Sciences at the Georgia Institute of Technology, and an affiliated researcher of ICE-HT/FORTH (Patras, Greece). He received a Diploma in Chemical Engineering, National Technical University of Athens, Greece (1993), M.Sc. in Atmospheric Chemistry, University of Miami (1997) and a Ph.D. in Chemical Engineering, California Institute of Technology (2002). His expertise is on atmospheric particulate matter (aerosol), their impacts on air quality and interactions with clouds and climate. He is an author in more than 160 peer-reviewed manuscripts, and is co-developer of the ISORROPIA aerosol thermodynamic equilibrium codes, co-inventor of the Continuous Flow Streamwise Thermal Gradient CCN chamber and Scanning Flow CCN Analysis. He has received the Atmospheric Sciences Section Ascent Award, American Geophysical Union (2012), Outstanding Faculty Research Author Award, Georgia Institute of Technology (2012), Kenneth T. Whitby Award, American Association for Aerosol Research (2011), the Henry G. Houghton Award, American Meteorological Society (2009), the Sigma Xi Young Faculty Award, Georgia Institute of Technology (2007), the Sheldon K Friedlander Award by the American Association for Aerosol Research (2005), the Blanchard-Milliken Young Faculty Fellowship by the Georgia Institute of Technology (2004), a NASA New Investigator Award (2004) and a National Science Foundation CAREER Award (2004).

Quantitatively understanding the impacts of airborne particles on clouds, storms and climate

The effect of human activities on climate is a grand challenge facing society today. Humans influence climate in many ways. Emissions of greenhouse gases (GHGs) tend to warm climate, by reducing the amount of infrared radiation that is emitted to space. Increased levels of suspended atmospheric particles ("aerosols") exert a net cooling effect by directly scattering and absorbing of incoming solar radiation. Aerosols also affect clouds by acting as the seed for droplet (or ice crystal) formation. "Seeding" of clouds by anthropogenic pollution is thought to cool climate by modulating cloud reflectivity and development. Aerosol variations have also been proposed to affect the development of storm systems, precipitation and the hydrological cycle overall. Quantitatively constraining aerosol impacts on clouds and climate however is very uncertain and significantly affects predictions of climate sensitivity to GHG levels. The large uncertainty originates largely from the complex and multi-scale coupling of aerosols and clouds. Added to this complexity is the large variability and range of aerosol types, each of which is characterized with its own ability to nucleate droplets and ice crystals.

This talk presents key advancements on the description of aerosol-cloud interactions in climate model frameworks through the combination of observations, theory and modeling. We will first focus on advancements in the physical representation of droplet and ice formation in models, and demonstrate how instrument development efforts helped solve long-standing issues regarding parametric uncertainty for droplet formation from atmospheric aerosol. We will then focus on the importance of aerosol-cloud interactions in storm development, specifically on the role of aerosol in the rapid intensification of tropical cyclones. We will conclude by presenting work on airborne atmospheric microbes, an understudied class of particles with potentially important and unique impacts on cloud formation. Results will be presented using a combination of molecular tools and functional experiments on airborne microbes collected *in-situ* from airborne platforms.