



College of Engineering
Department of
Mechanical & Industrial Engineering

The Sidney E. Fuchs Seminar Series

3:30-4:20pm, Friday, April 4, 2014
Frank H. Walk Design Presentation Room



Electrical Actuation of Small Diffusion Flames

by **Derek Dunn-Rankin***

**Professor and Department Chair,
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Hydrocarbon flames have long been known to contain naturally a small quantity of charged species that allow them to act as weak plasmas. Electric fields can influence these flames, including changing their shape, their sooting behavior and their ignition limits. This talk describes an understanding and interpretation of these influences based on more than a decade of collaborative research with Professor Felix Weinberg, one of the most influential of combustion scientists in the field. Among other aspects, the presentation covers the basics of ion-driven winds in flames, our early efforts to electrically counteract buoyancy, the consideration of flames as components in electric circuits, the time response of zero-gravity flames in electric fields, and electric field control of heat flux and carbon monoxide emission from flames impinging on quenching plates. It also describes our zero-gravity flight experiment scheduled for operation in the Combustion Integrated Rack on the International Space Station in 2016.

* Dr. Derek Dunn-Rankin is Professor and current Chair in the Department of Mechanical and Aerospace Engineering at the University of California, Irvine (UCI). He received his Ph.D. degree (1985) from the University of California, Berkeley, with an emphasis in combustion science. He was a post-doctoral researcher at Sandia National Laboratories Combustion Research Facility in Livermore until 1987, when he joined the faculty of Mechanical Engineering at UCI. Dr. Dunn-Rankin's research is primarily in combustion and energy, droplet and sprays, applications of laser diagnostic techniques to practical engineering systems, with recent emphasis on miniature combustion systems, electrical aspects of flames, and the direct combustion of methane hydrates. He has more than 350 technical publications and presentations in these fields, and he is a longtime Board officer of both the International Combustion Institute and the Institute for the Dynamics of Explosions and Reactive Systems. He has supervised the completion of 50 M.S. and 22 Ph.D. degrees at UCI. Professor Dunn-Rankin is currently the co-Director for CAMP, the California Louis Stokes Alliance for Minority Participation, a program designed to increase minority representation in science and technology in the University of California. He received a National Science Foundation Presidential Young Investigator Award in 1989, the Society of Automotive Engineering Ralph R. Teetor Engineering Educator Award in 1991, a Fulbright Scholar Fellowship in 1997, a Japan Society for the Promotion of Science Fellowship in 2008, and the Oppenheim Prize of the Institute for the Dynamics of Explosions and Reactive Systems in 2013.