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*Present the 28th Annual Blue-Green
Joint Chemical Engineering Seminar*

Professor L. Gary Leal

Warren & Katharine Schlinger Professor of Chemical Engineering
University of California, Santa Barbara

Thursday, November 19, 2009



*Joint Lecture Series Inaugurated
Winter 1982*



L. Gary Leal
2009 Recipient

Professor Gary Leal is the Warren B. and Katherine S. Schlinger Distinguished Professor of Chemical Engineering at UCSB. He received his undergraduate degree in chemical engineering from the University of Washington, and his MS and PhD degrees from Stanford University in 1969, where he worked with Prof. Andreas Acrivos. Following two years as an NSF postdoctoral fellow at the University of Cambridge (UK), he joined the faculty in the Chemical Engineering Department at Caltech where he remained from 1970-1989. Professor Leal moved to UCSB in 1989, where he has served twice as department chair. He has also held a visiting position, as the Rothschild Visiting Professor, Isaac Newton Institute for Mathematics, University of Cambridge in 1996.

His current research interests are focused on the dynamics of complex fluids, with a focus on the use of rheo-optical techniques for polymeric liquids, computational studies of model complex fluids, and studies of drop breakup and coalescence to understand the fundamental mechanisms of dispersion in polymer blending processes. He has published approximately 250 papers, written two textbooks and edited several other books. He was recognized in 2001 by ISI Thompson Scientific as an Original Member in the list of the 100 Most Highly Cited Researchers in Engineering. He has also supervised 54 PhD students. The research of Professor Leal and his students has been recognized via a number of awards, including the Fluid Dynamics Prize of the APS, The Bingham Medal of the Society of Rheology, and the Allan P. Colburn and William Walker Awards from the AIChE. He has also been a Guggenheim Fellow, and received the Camille and Henry Dreyfus Teacher-Scholar Award. He has been a member of the National Academy of Engineering since 1987. He is a member of a number of editorial boards and, since 1998, has served as one of the two editors of *Physics of Fluids*.

The Effect of Interface Slip on Drop Dynamics: Deformation, Breakup and Coalescence

The breakup and coalescence of drops play a critical role in the dispersion of two immiscible fluids, and specifically with the important materials process of producing polymer blends. Although the bulk fluid properties of the polymeric liquids in the latter case can often be modeled as Newtonian under typical mixing conditions, detailed experimental studies of breakup and coalescence for polymeric liquids at the level of individual drops do not agree with theoretical predictions based upon a classical Newtonian fluid mechanics formulation. In this talk, we explore the idea that the difficulty may be caused by a breakdown in the classical treatment of the fluid interface. It is known that the interface between two immiscible polymers can be relatively diffuse, with a width that may be as large as 10-20 Angstroms and a viscosity within this interfacial region that is significantly less than that of either of the two bulk polymers. These features of a polymeric interface will make it appear in the classical fluid mechanics framework as a Navier slip surface. For the very small drops (and the thin films that appear during coalescence) this slip may be significant. In order to evaluate the role of slip we have used boundary integral techniques to solve the problems of drop deformation/breakup and coalescence in the creeping flow limit. I will briefly discuss a method to solve the difficult mathematical problem that results from including slip in the boundary integral framework (which has potential applications in many other applications including some flows in microfluidics devices), and then discuss the predicted consequences of slip on the processes of drop breakup and coalescence.

Schedule of Events

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| 4:00 p.m. – 5:00 p.m. | Lecture
1670 CSE Building |
| 5:15 p.m. – 6:00 p.m. | Poster Session
Tishman Hall
CSE Building |
| 6:00 p.m. | Dinner
Johnson Rooms A, B, and C
Robert H. Lurie Engineering Center |