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Colloquium

Fluid Flow Far From Equilibrium: From Shear Thinning to the Glass Transition

Prof. Dr. Mark O. Robbins, Department of Physics and Astronomy, Johns Hopkins University

Abstract:
The talk will describe nonlinear rheology in extreme conditions that change fluid structure and flow mechanisms. Elongational flow of entangled polymers produces near complete molecular alignment but only changes the viscosity by an order of magnitude and does not destroy the confining tube. A transition in the mechanism of shear thinning in lubricants from alignment to thermal activation is shown to be generic and allows simulations to examine whether the viscosity diverges at a finite glass transition temperature.

Bio:
Mark Robbins grew up near Boston and received his BA and MA degrees from Harvard University. He spent a year as a Churchill Fellow at Cambridge University and received his PhD from University of California, Berkeley, in 1983. Following a postdoctoral fellowship at Exxon's Corporate Research Science Laboratory in New Jersey, he joined the Department of Physics and Astronomy at Johns Hopkins in 1986. He was promoted to associate professor in 1988 and to professor in 1992. Robbins received a Presidential Young Investigator Award in 1986, a Sloan Foundation Fellowship in 1987, and a Simons Fellowship in Theoretical Physics in 2012 and 2019. He became a fellow of the American Physical Society (APS) in 2000 and the American Association for the Advancement of Science (AAAS) in 2018. He served as chair of the APS Group on Statistical and Nonlinear Physics and of the advisory board of the Kavli Institute of Theoretical Physics (KITP) at the University of California, Santa Barbara, and is on the advisory board of the Boulder School for Condensed Matter and Materials Physics. He has organized symposia and workshops for the Materials Research Society, the Aspen Center for Theoretical Physics, and KITP, most recently “From the Atomic to the Tectonic: Friction Fracture and Earthquake Physics in 2005 and “Physical Principles of Multiscale Modeling, Analysis and Simulation in Soft Condensed Matter” in 2012. He chaired the 2010 Gordon Research Conference on Tribology.

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