JOHNS HOPKINS
Center for Environmental & Applied Fluid Mechanics

Weekly CEAFM Seminar: Spring 2012

Friday, February 10, 2012
11:00 a.m. – 12:00 p.m.
Gilman 50 (Marjorie M. Fisher Hall)

"Learning from plants about water at negative pressures"

Presented by
Dr. Abraham Stroock
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Abstract: Liquids, like solids, have tensile strength. Indeed, biologists have long believed that plants exploit this strength to *pull* water out of the soil and up to their leaves during transpiration, with the pressures in the sap dropping to as low as -100 bar (i.e., tensions up to 100 bar). Nonetheless, the role of liquid water under tension in transpiration has remained controversial. Furthermore, the properties of this metastable liquid state have been explored only sparsely in other scientific and technological contexts. In this talk, I will discuss the physics of transpiration in plants and present a bio-mimetic route to large tensions in the laboratory. Based on experiments with "synthetic plants", I will illustrate the surprising processes that are enabled by working in this regime. I will then discuss the origin of the limit of stability of liquid water in plants (natural and synthetic) and more generally. Throughout the presentation, I will point to potential lessons about plant physiology that we can extract from this exercise in bio-mimicry. I will conclude with the presentation of opportunities to exploit this regime to gain insights into the fundamental character of liquid water (e.g., the origin of water's anomalies) and to address important technological challenges in the management of energy and natural resources.