Boulder Fluid Dynamics Seminar Series

Tuesday, July 23, 2013
3:30pm-4:30pm (refreshments at 3:15pm)
Bechtel Collaboratory in the Discovery Learning Center (DLC)
University of Colorado at Boulder

Application of the eddy covariance technique to estimating metabolism in running waters

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Inland aquatic systems are active components of the carbon cycle, with organic matter production and consumption in these waters serving as conversion mechanisms for carbon. The standard method for measuring metabolism in running waters, the open-channel method, depends on an estimated diffusion coefficient that causes some uncertainty in the measurements. The aquatic eddy correlation technique measures benthic fluxes based on simultaneous measurements of vertical flow velocity and the oxygen concentrations associated with this flow a short distance above the sediment surface and may be a preferred alternative to the open channel method. We designed an optode-based eddy correlation system that measures benthic oxygen fluxes in shallow running waters and compared the measurements from this system to those made with the open-channel method. We will use the results of these measurements to recommend metabolism measuring procedures in running water and to answer questions about the fate or organic matter in Colorado plains rivers.

Acoustic streaming in high-intensity discharge lamps

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High-intensity discharge (HID) lamps are one type of arc discharge lamp. They are routinely used to illuminate stadiums, warehouses, roadways, greenhouses and other venues requiring a large amount of light from a compact source. Although HID lamps are comparably efficient -- roughly 25% of the electrical energy delivered to these lamps is converted to useful light -- further increases in efficiency are limited by buoyancy-driven flows of the hot gas comprising the arc. Researchers have shown that these undesirable flows can be effectively countered by acoustic streaming flows: time-mean flows induced by time-periodic standing acoustic waves, the latter being excited by modulating the lamp current at an acoustic eigenfrequency. Interestingly, neither the very large magnitude nor the orientation of acoustic streaming flows arising in HID lamps can be explained by classical streaming theories. In this talk, a new theory will be described that properly accounts for both these features. A computationally-efficient strategy for modeling the thermo-fluid mechanics of acoustically-stabilized HID lamps will also be discussed.