

HYDRODYNAMICS AS A DESIGN METHOD FOR COMPOSING LIGHT WITH BIOLUMINESCENT PHYTOPLANKTON

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Abstract

Bioluminescence is the emission of visible light by living organisms resulting from a chemiluminescent reaction, in which chemical energy is converted into light. Among bioluminescent organisms, marine dinoflagellates emit light in response to mechanical stimulation, making them highly sensitive to hydrodynamic forces and valuable biological indicators of flow dynamics. Previous studies have investigated the relationship between light emission, shear stress, and fluid acceleration, demonstrating that bioluminescence can be used to visualize flow structures.

In this talk we will focus on *Pyrocystis* spp., whose light emission highlights regions of high shear stress within fluid domains. Experimental evidence shows that bioluminescence is activated when the local shear stress exceeds approximately 0.3 N/m^2 , suggesting that this dinoflagellate can function as a living biosensor for hydrodynamic processes. Beyond flow visualization, the talk explores how fluid dynamics can be intentionally tuned to generate and shape bioluminescent light patterns.

Keywords: Bioluminescence, Hydrodynamics, Shear stress, Light design

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