I²CNER Seminar Series

International Institute for Carbon-Neutral Energy Research (WPI-I²CNER)
Kyushu University

Title # Photomolecular Effect: Direct Water Evaporation with Light

Speaker ***Professor. Gang Chen***
Carl Richard Soderberg Professor of Power Engineering,
Massachusetts Institute of Technology, U.S.A.

Time& Date 16:00 PM (JST), Friday, December 5th, 2025

Venue Hybrid format (#217, Conference Room A, I²CNER Bldg.1, Ito Campus, Zoom)

Abstract

In recent years, experiments from different groups have reported that evaporation under sunlight from hydrogels and other porous materials can exceed the thermal evaporation limit by several times, i.e., super-thermal. We hypothesize that photons can directly cleave off water clusters at the liquid-vapor interface in a way similar to the photoelectric effect, which we call the photomolecular effect. We carried out experiments on different materials to exam this effect. We suggest that the photomolecular effect is responsible for a long-time puzzle in atmospheric science: experiments reported more cloud absorption than theory could predicts; and may also be related to why plants evolved to reject more green light since we observe that the photmolecular effect peaks at green light. Progress in theoretical description of the photomolecular effect will also be summarized. Our study suggests that the photomolecular effect should happen widely in nature, from clouds to fogs, ocean to soil surfaces, and plant transpiration, and can also lead to new applications in energy and clear water.

About the Speaker

Dr. Gang Chen is the Carl Richard Soderberg Professor of Power Engineering at Massachusetts Institute of Technology (MIT). He obtained his Ph.D. degree from the Mechanical Engineering Department at UC Berkeley under the guidance of then Chancellor Chang-Lin Tien. He was a faculty member at Duke University and UCLA, before joining MIT in 2001. He served as the Department Head of the Department of Mechanical Engineering at MIT from 2013 to 2018 and he serves on the board of Asian American Scholar Forum. He received an NSF Young Investigator Award, an R&D 100 award, an ASME Heat Transfer Memorial Award, an ASME Frank Kreith Award in Energy, a Nukiyama Memorial Award by the Japan Heat Transfer Society, a World Technology Network Award in Energy, an Eringen medal from the Society of Engineering Science, and the Capers and Marion McDonald Award for Excellences in Mentoring and Advising from MIT. He is a fellow of American Association for the Advancement of Science, the American Physical Society, The American Society of Mechanical Engineers, and the Guggenheim Foundation. He is an academician of Academy Sinica, a fellow of the American Academy of Arts and Sciences, a member of the US National Academy of Engineering and the US National Academy of Sciences

Registration https://forms.office.com/r/c45EpwnSKU

Host Prof. Koji Miyazaki

Contact I²CNER・Q-PIT Office of Research Support Services,
Research Support and Public Relations
TEL: +81 92 802-6935
Email: iq-kenkyu@jimu.kyushu-u.ac.jp

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