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INSTITUTO DE FÍSICA APLICADA E ENGENHARIA DE MATERIAIS
INSTITUTE OF APPLIED PHYSICS AND MATERIALS ENGINEERING

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奮進新程
Strive Forward and Achieve Beyond

IAPME Seminar

Celebrating the 45th Anniversary of the University of Macau: From artificial intelligence (AI) to Hydrovoltaic Intelligence (HI)

7 May 2026

Prof. Wanlin GUO
Nanjing University of Aeronautics and Astronautics (NUAA)

Venue: N23-4018
Time: 10:30 - 11:30
Hosted by: Prof. Qibing PEI

Abstract

This report starts from the wisdom of living beings in acquiring energy for survival, extends to the understanding of natural intelligence and brain functions, and then to the frontier progress and challenges of artificial intelligence. Furthermore, based on the relationship between water and life, as well as water and energy, it proposes the concept of hydrovoltaic intelligence: exploring how the synergy of 'intelligence' and 'energy' can lead the future development of science, technology, and human civilization.

Unicellular organisms, emerging 3.5–4.1 billion years ago in water, harnessed environmental energy, displaying primal intelligence. Billions of years of evolution yielded human intelligence: learning, reasoning, problem-solving, and thinking via complex neuronal networks (over 70% water) operating at ~20 W.

Turing's 1950 question—"Can machines match human intelligence in games?"—sparked AI, inspired by brain neurons. Today's AI excels in games but devours energy; data centers are electricity-hungry, unlike efficient NI. Our hierarchical modeling reveals the brain stores/processes vast information at ~1.26× the theoretical limit—over 8 orders of magnitude more energy-efficient than top AI chips.

Our hierarchical modeling and non-linear dynamics analysis show that our brain can store and process huge information at energy consumption ~1.26 times of the theoretical limitation, about more than 8 orders of energy efficient than the most advanced AI chips1.

Hydrovoltaics generate electricity from water-material interactions (e.g., waving, drawing, evaporating potentials), enabling water-harvested energy. This report reviews AI/hydrovoltaics advances—positioning hydrovoltaics as negative thermal emission tech—and confined water's brain role. Drawing on recent findings, it envisions HI, advancing beyond Turing machines from AI to HI, inspiring students to innovate.

Biography

Prof. Wanlin GUO, an Academician of the Chinese Academy of Sciences, a Professor at Nanjing University of Aeronautics and Astronautics, and the Dean of the International Institute for Frontier Science. Prof. Guo has long been engaged in research on digital science and intelligent technology for aerospace, hydrovoltaic science and technology, and physical mechanics. His current research focuses on hydrovoltaic energy, ecology and intelligence; quantum biophysical mechanics; intelligent nanomaterials and devices; and structural strength, durability and reliability. In 2012 and 2024, he twice received the Second Prize of the National Natural Science Award of China as the leading recipient. In 2013, he received the Xu Zhilun Mechanics Prize. In 2019, he was awarded the Ho Leung Ho Lee Foundation Prize for Scientific and Technological Progress and the Eric Reissner Award in International Mechanics. In 2020, he was honored with the title of National Advanced Worker.

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