



Friday, April 21st, 2023, 12 PM – 1 PM
38-138 ENG IV Conference Room

Thermodynamics and light

Shanhui Fan

Joseph and Hon Mai Goodman Professor of
Electrical Engineering and Applied Physics
Senior Fellow Precourt Institute for Energy
Stanford University

ABSTRACT: Light, or electromagnetic waves, is perhaps the most important carrier of energy. The ability to control the flow of light, especially through the use of nanophotonic structures, therefore is of essential importance for the future development of energy technology. Moreover, light carries both energy and entropy, and the understanding of these thermodynamic aspects of light underlies some of the fundamental considerations of light-based energy technology. In this talk, we will illustrate the connections between thermodynamics and light by discussing some of our efforts in designing optical structures for energy harvesting. As examples, we will discuss radiative cooling, a technology that aims to harvest the coldness of the universe. We will also introduce the concept of non-reciprocal thermal radiation, which may hold the key towards reaching the ultimate efficiency limit of solar energy harvesting.

BIO: Shanhui Fan is the Joseph and Hon Mai Goodman Professor in the School of Engineering, a Professor of Electrical Engineering and Applied Physics (by courtesy), and a Senior Fellow of the Precourt Institute for Energy, at the Stanford University. He received his Ph. D in 1997 in theoretical condensed matter physics from the MIT. His research interests are in fundamental studies of solid state and photonic structures and devices, especially photonic crystals, plasmonics, and meta-materials, and applications of these structures in energy and information technology applications. He has published over 600 refereed journal articles, has given over 400 plenary/keynote/invited talks, and holds over 70 US patents. He is a co-founder of two companies aiming to commercialize high-speed engineering computations and radiative cooling technology respectively. Prof. Fan received a NSF Career Award (2002), a Packard Fellowship (2003), the NAS W. O. Baker Award (2007), the OSA Adolph Lomb Medal (2007), a Vannevar Bush Faculty Fellowship (2017), a Simons Investigator in Physics (2021), and the R. W. Wood Prize from Optica (2022). He is a Web of Science Highly Cited Researcher in Physics since 2015, and a Fellow of the IEEE, the APS, the OSA, and the SPIE.