AI-Driven Control of Thermal Emission for Energy Efficiency and Thermal Adaptation

Aaswath P. Raman

Associate Professor of Materials Science and Engineering
University of California, Los Angeles

Bio: Aaswath Raman is an Associate Professor of Materials Science and Engineering at UCLA where his research group pursues fundamental and applied research in nanophotonics, thermal photonics, renewable energy, climate change adaptation and applied machine learning. He is known for the first demonstration of daytime radiative cooling in 2014, which he has since commercialized as Co-Founder and Chief Scientific Advisor of SkyCool Systems. He received his A.B. in Physics, and M.S. in Computer Science from Harvard University, and a Ph.D. in Applied Physics from Stanford University. He has been recognized by several awards including the MIT Technology Review Innovator Under 35 (TR35), DARPA Director's Award and Young Faculty Award, NSF CAREER, Materials Research Society Kavli Early Career Award and the Sloan Research Fellowship, and was recently elected a Senior Member of the National Academy of Inventors.

Abstract: Thermal emission is a ubiquitous form of light emission and heat transfer that plays a central role in how our buildings use energy and how humans experience thermal comfort. Recent advances in optical and photonic materials have allowed us to harness thermal emission in unexpected ways to enable fundamentally new capabilities for energy efficiency, clean energy generation and preserving human health in extreme heat conditions. In this talk I will detail how these material-level advances are enabling new technological capabilities through radiative cooling and other mechanisms, in turn improving building energy efficiency and also enabling new approaches to desalination, water harvesting and power generation. I will argue that AI-driven design of these photonic materials and structures will be essential to continued progress in controlling radiative heat transfer in our built environment and is already emerging as a critical part of researchers' workflows. Additionally, it may serve as a tool for discovery, allowing us to understand that physical behavior of complex metamaterials that provide unprecedented control of both spectral and directional characteristics of thermal emission.