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Special Section Guest Editorial: Thermal Photonics in Energy

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From cooking fire to modern gas turbines and electronics cooling, the ability to control heat has been closely linked with human development and energy utilization. One promising way to manipulate heat is to control the spectrum, power density, and directionality of thermal radiation, which is a primary mode of heat transfer particularly at high temperatures and in vacuum. This capability could unlock breakthroughs in numerous energy technologies ranging from power generation to personalized cooling.

This special section of the *Journal of Photonics for Energy*, titled "Thermal Photonics for Energy," captures ongoing efforts to enhance radiative heat transfer, such that it dominates other modes of heat transfer, and to precisely control its spectrum and direction. New developments in materials, fabrication techniques, and simulation tools over the past few decades have paved the way for the field of thermal photonics where at least one characteristic length is comparable with or smaller than the wavelength of thermal radiation, as highlighted by recent reviews such as "Heat is the new light,"[1] "Heat meets light at the nanoscale,"[2] and "Thermal photonics and energy applications."[3]

The topics in this special section cover a range of fundamentals, including how orientation of 2D materials affects near-field radiative heat transfer,[4] enhancing light absorption in single-layer 2D materials,[5] theory of near-field coupling,[6,7] and control of narrowband emission using nano-antennas[8] and metamaterials.[9] The section also features more application-oriented investigations into metasurface thermophotovoltaic cells,[10] near-field effects in thermoradiative[11] and thermophotonic[12] energy conversion, spectral splitting for space applications,[13] windows for energy-efficiency,[14] and materials for passive radiative cooling.[15,16] Mini-reviews on magnetothermoplasmonics[17] and thermophotovoltaic emitters[18] complete this special section on thermal photonics in energy.

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