Nonreciprocal Thermal Radiation and Solar Energy Harvesting

Shanhui Fan[1], **Yubin Park**[1] **and Bo Zhao**[2]

1. Department of Electrical Engineering, Ginzton Laboratory, Stanford University, Stanford, CA 94305
2. Department of Mechanical Engineering, University of Houston, Houston, TX 77024
E-mail: shanhui@stanford.edu

The Landsberg limit represents the ultimate efficiency limit of solar energy harvesting. Reaching this limit requires the use of nonreciprocal elements. The existing device configurations for attaining the Landsberg limit, however, are very complicated. Here, we introduce the concept of a nonreciprocal multijunction solar cell (Fig. 1). We show that such a cell can reach the Landsberg limit in the idealized situation where an infinite number of layers are used and can outperform a standard reciprocal multijunction cell for a finite number of layers [1]. We also introduce nonreciprocal plasmonic structures that can be used to achieve such non-reciprocal solar cells [2]. Our work significantly simplifies the device configuration required to reach the ultimate limit of solar energy conversion and points to a pathway toward using nonreciprocal plasmonic structures to improve solar energy harvesting.

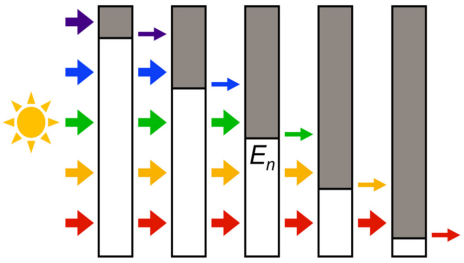

Fig. 1 The configuration of a non-reciprocal multi-junction solar cell

References

[1] Y. Park, B. Zhao, and S. Fan, "Reaching the Ultimate Efficiency of Solar Energy Harvesting with a Nonreciprocal Multijunction Solar Cell," Nano Lett. 22, 448–452 (2022).
[2] Y. Park, V. S. Asadchy, B. Zhao, C. Guo, J. Wang, and S. Fan, "Violating Kirchhoff's Law of Thermal Radiation in Semitransparent Structures," ACS Photonics 8, 2417–2424 (2021).