Giant interatomic energy-transport amplification with nonreciprocal photonic topological insulators

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We show [1] that the energy-transport efficiency in a chain of two-level emitters can be drastically enhanced by the presence of a photonic topological insulator (PTI). This is obtained by exploiting the peculiar properties of its nonreciprocal surface plasmon polariton (SPP), which is unidirectional, and immune to backscattering, and propagates in the bulk band gap. This amplification of transport efficiency can be as much as 2 orders of magnitude with respect to reciprocal SPPs. Moreover, we demonstrate that despite the presence of considerable imperfections at the interface of the PTI, the efficiency of the SPP-assisted energy transport is almost unaffected by discontinuities. We also show that the SPP properties allow energy transport over considerably much larger distances than in the reciprocal case, and we point out a particularly simple way to tune the transport. Finally, we analyze the specific case of a two-emitter chain and unveil the origin of the efficiency amplification. The efficiency amplification and the practical advantages highlighted in this work might be particularly useful in the development of new devices intended to manage energy at the atomic scale.

[1] Phys. Rev. Lett. 119, 173901 (2017).