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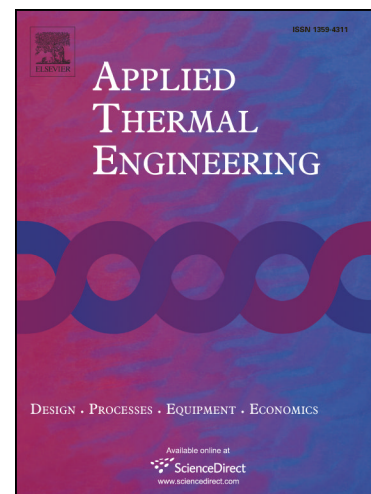
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## Super-Planckian thermal radiation enabled by coupled quasi-elliptic 2D black phosphorus plasmons

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**Abstract:** New-joined 2D layered material – black phosphorus (BP), due to strong in-plane structural anisotropy, has exhibited exotic electrical, optical, and thermal properties while its thermal radiative properties are still largely unexplored. Here, we investigate near-field thermal radiation of mono/multilayer BP, and find that monolayer BP can support three-order-of-magnitude enhanced heat exchange over blackbodies, even exceeding optimized graphene sheets by around 18.5%. We derive the dispersion relation of coupled anisotropic BP surface plasmon polaritons (SPPs), which is found to have a good agreement with the energy transmission contour of evanescent waves. The prominent thermal radiation rate thus can be attributed to the excitation of quasi-elliptic BP SPPs enabled by its unique structural anisotropy and doping. With increasing number of layers, near-field radiative heat flux decreases monotonously. The underlying mechanism lies in the increased imaginary part of optical conductivity but weak coupling with high-wavevector photons. This work helps elucidate the near-field thermal radiation mechanism of mono/multilayer BP, and paves the way for the application of emerging BP in noncontact thermal management and energy conversion.

**Keywords:** near-field thermal radiation, black phosphorus, quasi-elliptic surface plasmon polaritons, optical conductivity

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