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Efficient near-field energy transfer and relieved Casimir stiction between sub-wavelength gratings XIANGLEI LIU, BO ZHAO, ZHUOMIN ZHANG, Georgia Institute of Technology — The promising applications of near-field heat transfer in thermophotovoltaic devices, thermal imaging, thermal rectifiers, and local thermal management have motivated the search for nanostructures capable of supporting higher efficiency or greater heat flux than simple planar substances. In this work, efficient and delocalized radiative heat transfer between two aligned 1D sub-wavelength gratings is demonstrated based on the scattering theory using the rigorous coupled-wave analysis (RCWA). It is shown that the heat flux can be greatly enhanced and the accurate prediction may differ significantly from that of the geometry-based Derjaguin's proximity approximation (PA). The underlying mechanism is attributed to the excitation of hyperbolic modes that increase the energy transmission by supporting propagation of waves with large parallel wavevectors and. Besides efficient energy transport, the performance is robust, insensitive to the relative lateral shift. In addition, the Casimir stiction considering both quantum and thermal fluctuations is found to be relieved compared with bulks.

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