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Nanoscale Radiative Heat Transfer between Graphene Ribbon Arrays[1] ZHUOMIN ZHANG[2], XIANGLEI LIU[3], Georgia Institute of Technology — Near-field radiative heat transfer between two graphene sheets can exceed that between blackbodies due to surface plasmons excited by the graphene sheet. This study shows that, by patterning a single layer of graphene sheet into ribbons, a giant enhancement of the near-field radiative heat flux, by more than one order of magnitude higher than that between two graphene sheets, can be achieved. The mechanism lies in that when the graphene sheet is patterned into an array of ribbons, the closed circular dispersion of graphene plasmons is opened to become hyperbolic, leading to broadband singularities of density of states. Extremely high-k evanescent waves can now couple with hyperbolic graphene plasmons. Exact numerical simulations are used by combining the scattering theory and rigorous coupled-wave analysis. Furthermore, effective medium calculations are used to support the arguments and provide clear physical insights. The findings from this study may open promising pathways for highly efficient thermal management, energy harvesting, and subwavelength thermal imaging.

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