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Bright visible light emission from suspended graphene structures

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We present bright visible-light emission from electrically biased suspended graphene structures. As a gapless material, graphene is thought to be not efficient to be applied as bright and broadband light-emitters. Nevertheless, graphene and related two-dimensional material systems are promising as atomically thin, flexible, and transparent basis for optoelectronics applications. Graphene, with superior mechanical strength and high-temperature stability, may enable efficient thermal light emission. Thus far, electrically biased graphene on SiO_2 substrates have been found to be highly inefficient and in the mid-infrared range. By suspending the graphene, we find significant efficiency gains as well as increase in operational temperature, due to minimizing heat dissipative paths. Thus, hot electrons (~2800 K) become spatially localized under modest electric fields with a three order of magnitude increase in thermal radiation efficiency. We also find that depending on the distance between the suspended graphene and the substrate interference effects can be utilized to tune the emission spectrum enabling bright visible emission. We will also demonstrate the scalability of this technique by realizing arrays of graphene-based bright-visible emitters.