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Near-Field Thermal Radiation: Fundamentals and Applications

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Photon tunneling and surface waves can result in significant enhancement of the radiative transfer, beyond the limit of Stefan-Boltzmann law, for closely spaced objects. Nanoscale thermal radiation holds promise in near-field energy conversion as well as nanomanufacturing and surface thermal mapping. The fundamental of near-field thermal radiation will be present along with the predicted results for various materials. An algorithm that is consistent with the fluctuational electrodynamics is developed to trace the energy streamlines, representing the direction of energy flow, inside the emitter, receiver, and the vacuum gap. An overview of recent development and future directions in near-field thermal radiation will be given with an emphasis on engineering applications.

Biographic Sketch: Zhuomin Zhang is a professor of mechanical engineering at Georgia Tech. He received his Ph.D. degree in mechanical engineering from MIT. Professor Zhang's research interests are in the areas of micro/nanoscale heat transfer, with applications to energy conversion and micro/nanoelectronics. He has written a textbook on *Nano/Microscale Heat Transfer* and authored/co-authored over 130 journal papers and 8 book chapters, received 2 patents, and given over 120 invited and 140 contributed presentations. Professor Zhang is a Fellow of AAAS and ASME. He was a recipient of the Pi Tau Sigma Outstanding Teacher Award for 1997, the Sigma Xi Junior Faculty Research Award for 1999, the Presidential Early Career Award for Scientists and Engineers (PECASE) for 1999, the Heat Transfer Division Best Paper Award for 2000, the AIAA Thermophysics Best Paper Award for 2005, and the ICHMT's Hartnett-Irvine Award for 2010. He is an associate editor of the ASME *Journal of Heat Transfer*, *Journal of Quantitative Spectroscopy & Radiative Transfer*, and *International Journal of Thermophysics*.