DIRECT CALCULATION OF ENERGY STREAMLINES IN NEAR-FIELD THERMAL RADIATION

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ABSTRACT. This work concerns the direction of energy flow during near-field heat transfer between two parallel plates separated by a vacuum gap. An improved formulation, fully consistent with fluctuational electrodynamics, is developed to correctly trace the energy streamlines inside the emitter, receiver, and the vacuum gap. The influence of surface waves on the direction of energy propagation as well as on the lateral shift of energy streamlines is elucidated. Using the new formulation, it is found that a large lateral shift may exist inside the emitter, depending on the dielectric function of the material used as the emitter or receiver. Accurate prediction of the energy propagation direction and the associated lateral shift is very important for the design of efficient energy conversion devices and sensors based on near-field thermal radiation.