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MANY-BODY INTERACTION ON NEAR-FIELD RADIATIVE HEAT TRANSFER IN THREE-PARTICLE SYSTEM: ENHANCEMENT AND INHIBITION

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ABSTRACT. Near-field radiative heat transfer (NFRHT) in particulate system is complicated due the existence of the multiple scattering of the thermal excited electromagnetic wave caused by the many particles (namely, many-body interaction), which can not only enhance but also inhibit NFRHT. Many-body interaction on NFRHT in three-particle system is analyzed by means of many-body radiative heat transfer theory. A influencing factor ψ is defined to numerically figure out the border of the different many-body interaction regimes.The whole space near the two nanoparticles can be divided into three zones, enhancing zone, inhibiting zone and forbidden zone, respectively. Enhancing zone is relatively smaller than the inhibition zone, so many particles can lie in the inhibiting zone that the inhibition effect of many-body interaction on NFRHT in many-particle system is common in literature. We try to understand the many-body interaction causing by insertion of a third particle by analyzing the radiative thermal energy in the many-particle system. Insertion of a third particle will significantly enhance the radiative thermal energy by several orders of magnitude when the third particle lies in the center of the two particles and will slightly inhibit the radiative thermal energy when the third particle lies in proximity of the receiver particle. This work may help for the understanding of the thermal radiation in the many-particle system.

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