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Linear Behavior of the Kapitza Jump at Liquid/Solid Interfaces
SANDRA TROIAN, California Instiute of Technology, MC 128-95, Pasadena, CA 91125 — At macroscale dimensions, it is normally assumed that two distinct materials maintain equal temperature across the surface of contact. Even in the presence of a thermal flux across the interface, the contacting boundary is assumed to maintain thermal equilibrium so long as the interfacial resistance is negligible in comparison to that of the bulk. This has long been assumed an excellent approximation for liquid/solid (L/S) interfaces since liquids conform in shape even to roughened surfaces. Recent molecular dynamics simulations of nanoscale films, however, have revealed the existence of intrinsic temperature jumps at L/S interfaces. While previous studies have shown how stronger interaction potentials between the liquid and solid will diminish temperature jumps, they cannot be altogether eliminated due to commensurability mismatch. Here we show how the magnitude of the thermal jump also is controlled by the applied thermal flux. This finding suggests that temperature jumps across an L/S interface are not simply a local effect due to density mismatch. These jumps are also controlled by the actual rate of heat transfer, underscoring the importance of thermal resistance effects in nanoscale hydrodynamic systems. We thank P. Thompson for assistance in optimizing the simulations.

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