Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Role of molecular phonons in water evaporation[1] CHARLES WARD, Department of Mechanical Engineering. University of Toronto, Toronto, Canada — The conditions existing at the interface of water and its vapor during evaporation have been controversial. Earlier thermocouple measurements of the temperatures in the liquid and vapor phases indicated the interfacial vapor temperature was as much as 7.8 °C greater than that in the liquid. In more recent studies, when the vapor was heated electrically, interfacial temperature discontinuities of as much as 27.83 °C were reported. Only thermocouple measurements have indicated temperature discontinuities. The validity of the reported temperature discontinuities has been investigated using the quantum-mechanically based statistical-rate theory (SRT) to predict the temperature discontinuities found in three different experimental investigations. It is found that from SRT the temperature discontinuities are correctly predicted up to 15.69 °C, but larger values cannot be confirmed because of uncertainties in the pressure measurements. By taking the limit of $\hbar\omega/k_bT$ going to zero for all of the molecular phonons, SRT can be reduced to the classical result, but it no longer gives a valid prediction of the temperature discontinuities.

[1]The author thanks the Canadian and European Space Agencies for their support.

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Date submitted: 02 Aug 2008 Electronic form version 1.4