Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Mechanism of sessile water droplet evaporation HADI GHASEMI, CHARLES WARD, University of Toronto — The energy transport mechanisms during the evaporation of sessile water droplets have been investigated. Steady-state evaporation experiments were conducted on substrates of Cu, Au(111) and PDMS. The buoyancy-driven convection was suppressed by maintaining the droplets' base temperature just less than 4°C while evaporation cooled the liquid-vapor interface to lower temperatures. The temperature fields were measured in solid (only in Au(111) experiments), liquid and vapor phases. On all three substrates, the energy balance at the liquid-vapor interface showed that thermocapillary convection transported the major portion of the energy required for the evaporation. It transported up to 98% for Cu, up to 87% for Au(111) and up to 72% for PDMS. The role of thermocapillary convection is dominant close to three-phase contact line where most of the evaporation occurs. The experiment on Au (111) showed that of the energy supplied by the solid substrate, only a small portion is transported perpendicular to the solid-liquid interface to the bulk liquid phase. A much larger proportion is conducted through the adsorbed layer at the solid-liquid interface to the three-phase contact line where it is distributed by thermocapillary convection over the liquid-vapor interface and consumed by the phase change process.

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Date submitted: 05 Jan 2012 Electronic form version 1.4