Formation of nanoscale water bridges\textsuperscript{1} ELISA RIEDO, Team 1, ROBERT SZOSZKIEWICZ, Team 1, TAI-DE LI, Team 1, JIANPING GAO, Team 2, UZI LANDMAN, Team 2, SCHOOL OF PHYSICS, GEORGIA INSTITUTE OF TECHNOLOGY TEAM — The water bridges provide stability to sand castles, act as transport channels for dip-pen nanolitography and increase adhesion and friction in micro- and nano- devices such as MEMS. The kinetics of capillary condensation and growth at the nanoscale is studied here using friction force microscopy and molecular dynamics calculations. At 40\% relative humidity we find that the meniscus nucleation times increase from 0.7 ms up to 4.2 ms when the temperature decreases from 332 K to 299 K. The nucleation times grow exponentially with the inverse temperature $1/T$ obeying an Arrhenius law. We obtain a nucleation energy barrier of $7.8 \times 10^{-20} \text{J}$ and an attempt frequency ranging between $4-250 \text{GHz}$, in excellent agreement with theoretical predictions. These results provide direct experimental evidence that capillary condensation is a thermally activated phenomenon.