



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) Peiran Gao	Project Number S1506
Project Title Effect of Electric Fields on the Heat of Vaporization of Water	
Abstract Objectives/Goals The objective of this project is to study the effects of an external electric field on the heat of vaporization of water through both computer simulations and experiments. Methods/Materials Using the molecular model of the dipolar water molecules, a program was written in Java to simulate the effect of a static electric field on the translational and rotational movements of water molecules as well as the interactions among water molecules. The average translational velocity, rotational velocity and kinetic energy of water molecules after each step of the simulation were plotted against time. The program was run at different strengths of electric fields from 0V/m to 1400V/m. The heat of vaporization of water was measured using Clausius-Clapeyron equation experimentally under electric field strength from 0V/m to 1400V/m. Results The heat of vaporization of water increased by about 5% as the result of a static electric field. Based on the consistent results from both the simulation and the experiment, the increase of the heat of vaporization underwent exponential decay as the strength of the electric field increased. Conclusions/Discussion Due to the overall neutral charge of water molecules, a static electric field had no effect on the translational movements and the translational kinetic energies of water molecules. However, the torques created by a static electric field on water molecules tended to reorient water molecules towards the direction of the E field. The rotational movements of water molecules underwent damping oscillation in which the average rotational kinetic energy decreased. Water molecules with lower KE then needed more energy to be freed from their liquid state, thus resulting in the increase of the heat of vaporization of water in an external static electric field.	
Summary Statement Study of the effect of external electric fields on the heat of vaporization of water	
Help Received Used DC power supplies and electric thermal sensor at UCI under the supervision of Dr. Yoo; Used beakers and graduated cylinders provided by Ms. Bunch; Both parents helped make the display board	