Measuring Reflectivity of Gold Nanoparticles

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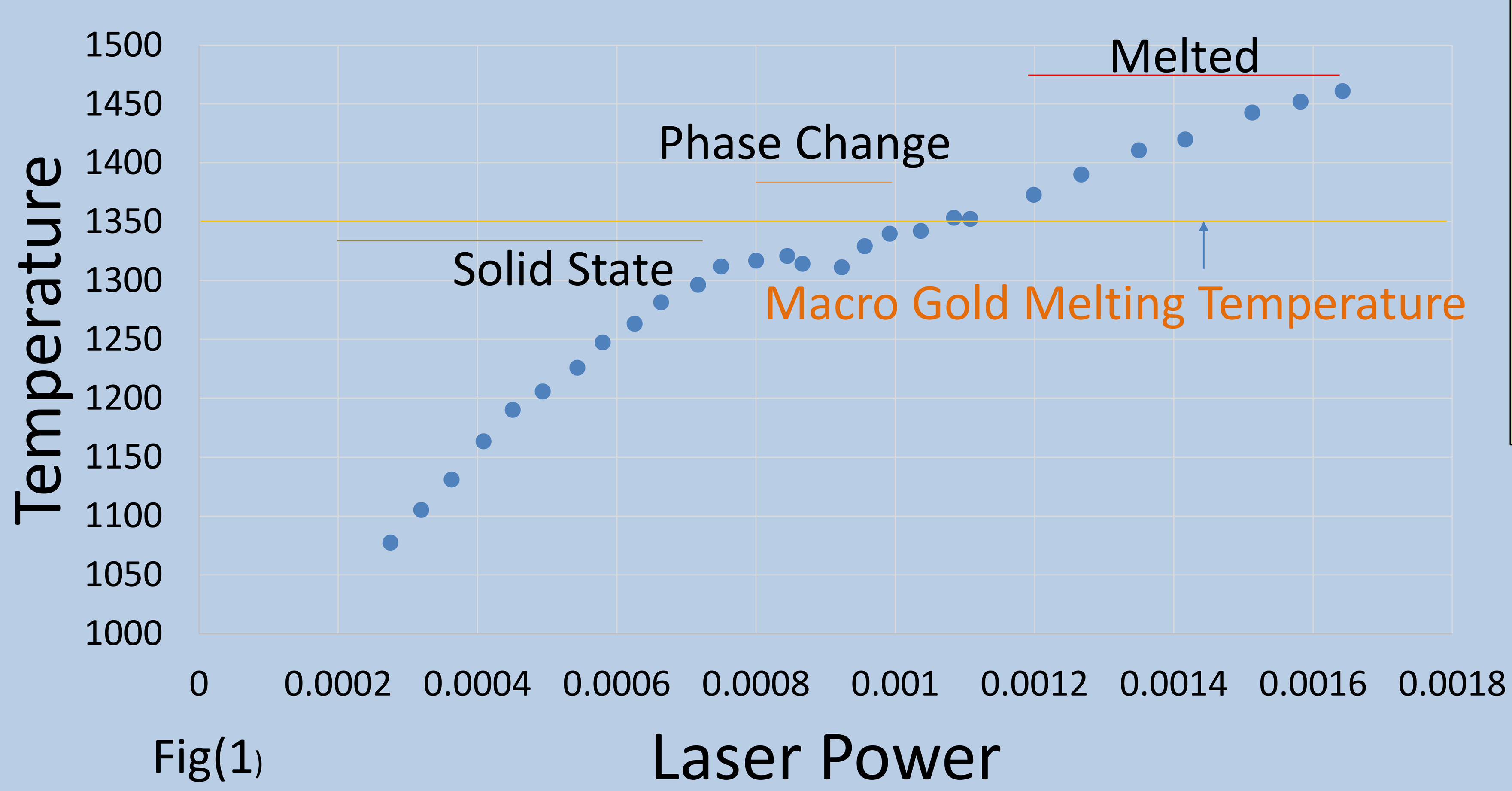
Introduction

My Advisor, Bruce Kane has conceived and designed a way to levitate charged particle using an oscillating electric field generating trap. This trap allows for a single nanoparticle to be isolated in a controllable and inert environment. At this size on the order of tens of thousands of atoms, properties of elements differ from what we know of them at the macro scale.



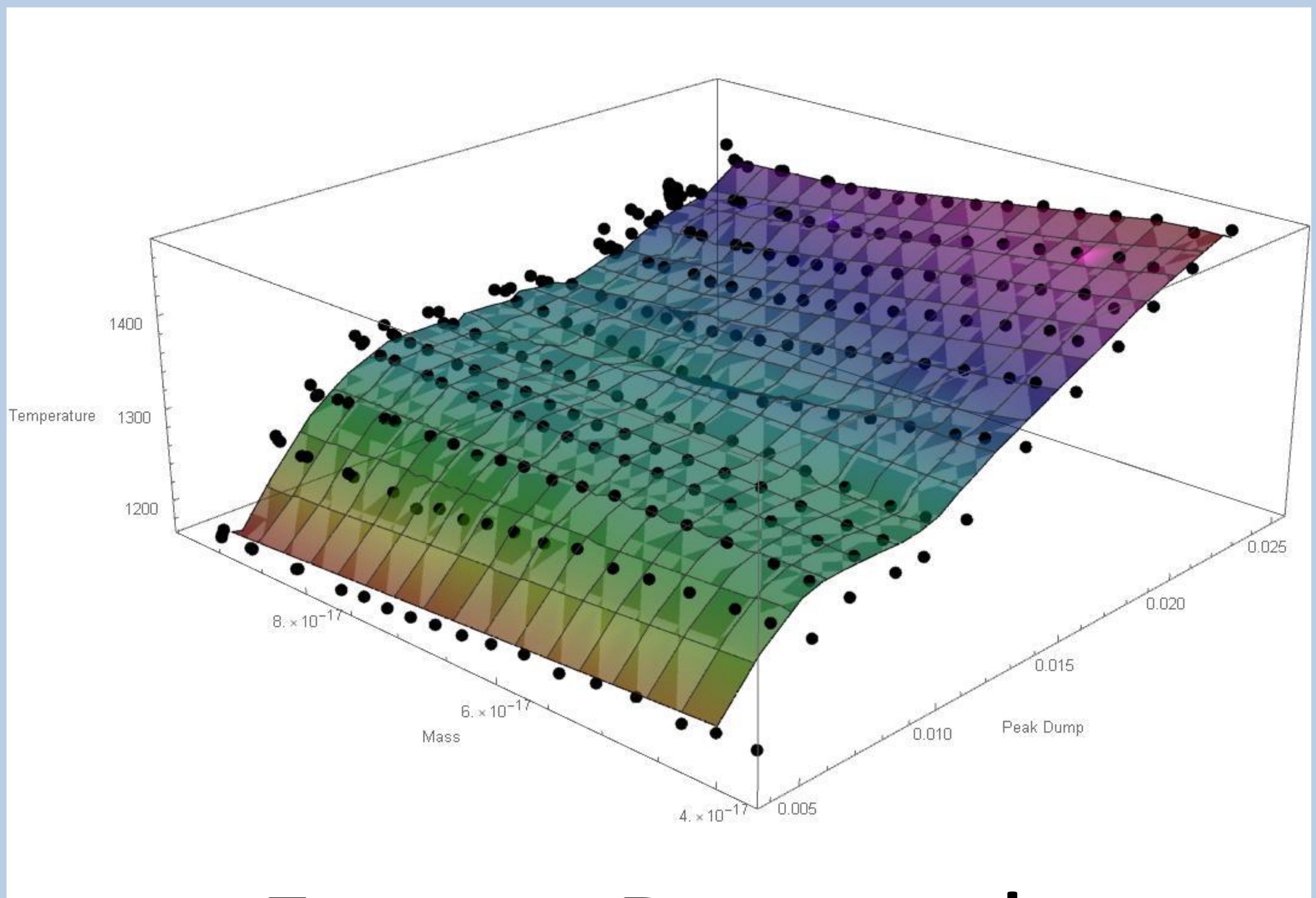
Fig(1)

More Effects

In figure(1) it can be seen that the melting temperature of the gold nanoparticle is lower than the melting temperature of gold at a macroscale. This effect is due to a weakening of the coupling force in a solid as it gets smaller. This effect is unnoticeable at macro-scales but can be seen in this experiment as the particle evaporates due to heating and the melting temperature is lowered further. Fig(2) shows the relationship between mass temperature and laser power pulse. The flat phase change can be shown to decrease in temperature as the mass decreases

Findings

Particles in the trap can be heated up by pulsing a laser directed at the particle in the trap. By exploring this method with gold, we have been able to create a phase change diagram not unlike those found in chemistry classes. The particle can be shown to undergo this phase transition by monitoring its temperature response to a varying intensity of light. Over a certain range of laser intensities we have shown that the particle stays at the same temperature. This is due to the particle being in a coexisting state between frozen and melted. Energy is being used to break the bonds of the solid instead of increasing the temperature. This can be seen in figure (1).



Future Research

We have been able to see a decrease in the melting temperature of gold particles of decreasing mass at a nanoscale. The next research step should be to model this effect on a function of their radius assuming the particle is a perfect sphere.

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