



CALIFORNIA STATE SCIENCE FAIR 2005 PROJECT SUMMARY

Name(s) Alden D. Deran	Project Number J0710
Project Title How Can I Build a Nitrogen Laser and Prove that It Can Lase?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The purpose of this project was to construct a Nitrogen laser, determine which types and arrangements of components work best, and prove that it can lase. There are two types of Nitrogen lasers: the TEA, which operates at atmospheric pressures, and the low-pressure, which operates at lower than atmospheric pressures. I hypothesized that the TEA laser would work better with stiff aluminum plates as capacitors, rounded edged electrodes, and about 7000 Volts of power. I expected it to be more difficult to achieve lasing with the TEA laser.</p> <p>Methods/Materials I first built the TEA laser with materials I had on hand and tested it with only 3,000 Volts. I observed the arcing at the spark gap and between the two electrodes in the laser channel, modified components to improve the arcing #- I wanted to see as much arcing between the electrodes as possible -- and retested until I saw evidence of lasing. Then I attempted to prove lasing by photographing the dot, attempting to diffract the dot through a grating, and watching what happened to the dot when I moved the paper further away.</p> <p>After many tests and modifications to components, the TEA laser finally worked. I used most of the components from the successful TEA laser in the first test of the low-pressure laser, but I used a sealed electrode channel in place of the TEA electrodes and connected the channel to an old refrigerator compressor. The low-pressure laser worked during the first test.</p> <p>Results The TEA required sharp electrodes, a transformer that produced 7000 volts, and large aluminum foil capacitors. The beam from the low-pressure laser was smaller and brighter than the beam from the TEA laser. There was more arcing all along the sealed electrode channel.</p> <p>Conclusions/Discussion The results disproved my hypothesis that the best TEA electrodes would have rounded edges and that the best capacitors would be stiff aluminum plates. Aluminum foil made a better capacitor, because static electricity caused the top plate to stick to the bottom plate without leaving air pockets. I think that the rounded electrodes did not work because the arcing could happen anywhere along the height of the electrode edges. Since there was less gas in the low-pressure tube, the arcing was able to excite a higher percentage of it.</p>	
Summary Statement The purpose of this project was to construct a Nitrogen laser, determine which types and arrangements of components work best, and prove that it can lase.	
Help Received My Mom helped with the tables of my report and reviewed my written work. My Dad supplied the variac, taught me techniques for building some of the components, and supervised the operation of the laser.	