



# CALIFORNIA STATE SCIENCE FAIR 2011 PROJECT SUMMARY

<b>Name(s)</b> <b>Benjamin O. Shultz</b>	<b>Project Number</b> <b>S1827</b>
<b>Project Title</b> <b>A Comparison of Red and Green Laser Pointer Light Diffraction on CDs and DVDs</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> The main research question addressed the issue of how the wavelength of a laser pointer (red versus green) affects the diffraction of the laser beam reflecting off a CD versus DVD in measuring the width of the data tracks. The hypothesis that was addressed was, If the wavelength of the laser beam is narrower (green versus red), then the diffraction measurements will be more consistent (i.e., less variable) for both a CD and DVD.</p> <p><b>Methods/Materials</b> The primary materials needed for this experiment included, a red (650 nm wavelength) and green (532 nm wavelength) laser pointer, a CD, a DVD, a protractor, and a digital camera to record images. The procedure for this experiment was to first place the CD or DVD label side down on the workspace. Next, I attached a protractor to an index card at the bottom of a sturdy box on top of the CD or DVD in order to measure the diffraction angles. I then directed the laser pointer beam down the face of the index card. When the indicated beams became visible I marked their locations and took a digital photo. I then entered the values into an Excel spreadsheet in order to compute the width of the data tracks. I repeated these steps for both the red and green laser pointers for both the CD and DVD for five trials each.</p> <p><b>Results</b> The variability was relatively high across the five trials for each of the various diffraction angles. In general, the red laser pointer was more consistent (i.e., had a smaller standard deviation) in measuring M1 and neg M1 angles, while the green laser pointer was more consistent in measuring the M2 and neg M2 angles. The results of the Levenes test for the equality of variances indicated that of the eight comparisons made, the red laser pointer was significantly less variable for CD neg M1 and DVD M1 distance measurements, while the green laser pointer was significantly less variable for the DVD M2 measurements.</p> <p><b>Conclusions/Discussion</b> The results were consistent with the hypothesis only for M2 and neg M2 measurements, while just the opposite occurred for the M1 and neg M1 measurements. If I were to conduct this experiment again, I would use a mechanical device to hold the pointer at the exact angle at which it was programmed to be at in order to obtain more precise results and also have two observers measure the diffraction angles and average the two observers values, thus reducing individual level measurement errors.</p>	
<b>Summary Statement</b> Comparing the variability of red and green laser pointers in measuring data tracks on CDs and DVDs	
<b>Help Received</b> Father helped with data collection and analysis: Both mother and father proofread final report and provided suggestions	