



**CALIFORNIA STATE SCIENCE FAIR  
2012 PROJECT SUMMARY**

<b>Name(s)</b> <b>Jason Qu</b>	<b>Project Number</b> <b>S1812</b>
<b>Project Title</b> <b>Testing and Calibrating an Off-plane Diffraction Mount for Soft X-ray Analysis</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> The goal of this project is to modify and make use of a diffraction grating Belly Band with the original purpose of mounting and calibrating diffraction gratings, which focuses X-rays onto a CCD in a very precise arc for image analysis. If successful, this device may be used as part of an actual sub-orbital rocket payload to collect images of X-rays for analysis in launches. Off-plane diffraction gratings have been used in X-ray spectrometers on the sub-orbital rockets in the NASA missions CyXESS and EXOS, successfully capturing high-resolution data from soft (low-energy) X-rays originating from supernova remnants in the Cygnus Loop.</p> <p><b>Methods/Materials</b> First I decided the appropriate substitutions to be made for each component, and designed, built, and set up the experiment. Then to insure the best result, I had to develop a quick algorithm for collecting, analyzing, and interpreting the data, as by the virtue of the experiment, real-time feedback was of the utmost importance.</p> <p><b>Results</b> Using a 3D histogram, I found that the Belly Band was an accurate grating mount to an accuracy of 2-3 pixels, a tolerance of only 0.019 degrees on the angle of the grating, well within our 5 degree goal. We found that the Belly Band was not an effective precise grating calibrator, because even the tiny 1/256 inch set screws were too cumbersome for this design.</p> <p><b>Conclusions/Discussion</b> In this experiment, I developed methods and algorithms that set a precedence and foundation for future, follow-up experiments to fine-tune the Belly Band. Furthermore, I proved that the concept of this experiment is viable, and once this Belly Band is fully fine-tuned it will be integrated on an actual suborbital payload scheduled to launch within the next two years.</p>	
<b>Summary Statement</b> To improve a device called the Belly Band, for mounting and positioning diffraction gratings, which can be used to align and focus incoming X-rays to look at the stars, constellations, and even supernova remnants.	
<b>Help Received</b> Used lab equipment in Belin-Bank Center at University of Iowa	