



**CALIFORNIA STATE SCIENCE FAIR  
2006 PROJECT SUMMARY**

<b>Name(s)</b> <b>Courtney J. Shipp</b>	<b>Project Number</b> <b>J0726</b>
<b>Project Title</b> <b>Gun Power: Experiments with a Gauss Rifle</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> The purpose of this project is to determine if a smaller or larger spacing between the magnets on a Gauss Rifle will maximize the distance the projectile travels. It is hypothesized that when the magnets are brought closer together, the distance the projectile travels will increase. This hypothesis is based on the assumption that when the magnets are closer together, the balls will lose less energy as they travel from one magnet to the next and therefore transfer more energy to the projectile.</p> <p><b>Methods/Materials</b> A Gauss Rifle is a linear accelerator that uses a magnetic chain reaction to launch a steel marble at a rapid speed. The experiment involved making a Gauss Rifle, firing it and recording the distance of each shot fired. The intervals were then changed and the process was repeated with uniform intervals between the magnets of 3, 4, 5, 6, 7, 8 and 9 inches.</p> <p><b>Results</b> The four-inch spacing was the optimal spacing of the tested intervals with the distance declining with spacings greater than and less than 4 inches. The four-inch test had the longest average results and the nine-inch test had the shortest average results. Therefore, the hypothesis was mostly supported.</p> <p><b>Conclusions/Discussion</b> The equation for kinetic energy is <math>Ke = \frac{1}{2}mv^2</math>. The four-inch spacing is optimal because each moving ball has reached its full speed before impacting the next magnet thereby transferring the most kinetic energy. At spacings of 5 inches and above each moving ball has already reached its maximum speed and has begun to slow down when it impacts the next magnet, thus transferring less kinetic energy. At the three-inch spacing each moving ball has not yet reached its maximum speed and therefore does not have as much kinetic energy to transfer.</p>	
<b>Summary Statement</b> This project tested 7 different spacings of magnets on a Gauss Rifle to determine which spacing would yield the farthest shot and found that 4 inches was optimal.	
<b>Help Received</b> I would like to thank my parents for supporting me and helping me with my experiment. My dad helped me understand Newton's Second Law and the kinetic energy equation and my mom helped me arrange my display board.	