



**CALIFORNIA STATE SCIENCE FAIR  
2002 PROJECT SUMMARY**

<b>Name(s)</b> Collin N. Cronkite-Ratcliff	<b>Project Number</b>  22100
<b>Project Title</b> As Time Goes By: A Study of Relativistic Time Dilation	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> Einstein's Special Theory of Relativity predicts that time will dilate at very high speeds. In particular, a rapidly moving clock will "slow down". The objective of this project is to observe this effect and compare it with the predictions of Einstein's Theory.</p> <p><b>Methods/Materials</b> The "clocks" used in this experiment are rapidly moving K-shorts observed with the SLD detector at the Stanford Linear Collider. Since K-shorts decay rapidly, their average lifetimes can be used as the "ticking rate" of a standard clock. These "clocks" are grouped in velocity bins so that the average ticking rate can be measured versus velocity.</p> <p><b>Results</b> Time was observed to "slow down" by the factor <math>\gamma = \frac{1}{\sqrt{1-v^2/c^2}}</math>, where <math>v</math> is the velocity of the clock and <math>c</math> is the speed of light. The very high clock velocities (up to 0.9998 times the speed of light) available in the data allow large time dilation effects to be seen.</p> <p><b>Conclusions/Discussion</b> Time dilation is directly observed in this project, and is shown to agree with the prediction of Einstein's special theory of relativity.</p>	
<b>Summary Statement</b> This project is a study of time dilation, a relativistic effect in which the ticking rate of a clock (i.e., time itself) is observed to "slow down" as the clock speed approaches the speed of light.	
<b>Help Received</b> Data was obtained from the SLD experiment with help from the SLD staff, particularly Drs. David Muller and Ken Baird; my father helped me understand how to analyze the data.	