



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Blake A. Bergstrom	Project Number S1896
Project Title Visual and Photometric Classification of a Sample of Low to Intermediate Redshift Galaxies in the COSMOS Field	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Morphological types of galaxies are one of the most fundamental properties of galaxies, and yet it is still not completely understood why such diversity exists. This experiment is designed to classify 1,000 galaxies from the COSMOS survey, done by the Hubble Space Telescope, by their visual appearance and color, seeing what redshift each type of galaxy is located in. This will tell us which galaxies are older and newer, helping support theories about the evolution of such shapes. The hypothesis is if late-type galaxies (spiral and irregular) are young and contain star-forming gas, then they will be blue and will be found at higher redshifts. If early type galaxies (elliptical and lenticular) contain older stars with less forming gas, then they will be red and found at lower redshifts.</p> <p>Methods/Materials The 1,000 galaxies were divided into 500 bright and 500 faint galaxies. Both groups had ten categories of redshift, with 50 galaxies in each category. Using DS9, all galaxies were classified (elliptical, lenticular, spiral, or irregular). Data about frequency length was given by the grad student, and each galaxy was classified by color also.</p> <p>Results Early-Type galaxies (elliptical and lenticular) proved to have a trend of increasing numbers with higher redshifts, meaning they appear later in the universe. Late-Type galaxies (spiral and irregular) had an increasing trend with decreasing redshift, meaning they appeared more in the early universe.</p> <p>Conclusions/Discussion As a result, the hypothesis was confirmed in the visual classification aspect. This backs up the hierarchical theory and Cold Dark Matter theory of how the universe was formed, and also supports the evolutionary theory of spiral galaxies first colliding and forming ellipticals as a result, making irregulars as an intermediate stage. Color did not show such trends, since look back time is not the only thing that affects color, as composition does too. These results help to fill in the gap of one of the most highly debated topics in modern astronomy.</p>	
Summary Statement This project has many different aspects, but the central purpose of it is to answer why there are different types of galaxies and how they formed into the types they are today through visual and photometric analysis.	
Help Received Dr. Bahram Mobasher of UCR and grad-student Behnam Darvishi provided guidance and consultation on analysis of the COSMOS Field.	