



**CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY**

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| Name(s) Devin Ross; Sadie Stout | Project Number J1810 |
| Project Title How Fast Is the Universe Expanding? | |
| <p style="text-align: center;">Abstract</p> <p>Objectives/Goals The goal of our experiment is to use spectrographs to find how fast the universe is growing. We hypothesize that the universe is expanding at a rate of 80 km/sec/Megaparsec because past results have shown an increase over time, so we predict there should be a proportional increase.</p> <p>Methods/Materials Using spectrographs from the Las Cumbres Observatory (LCO) database, we found observed and rest H, Fe, O spectra of Type 1A supernovae; calculated redshift to find the radial velocity; used distance modulus equation to find distance; made a Hubble Diagram indicating the expansion rate of the universe.</p> <p>Results We found the expansion rate is around 55 km/second/Megaparsec. Also, we discovered that the farther away the supernovae, the faster it is moving away from us.</p> <p>Conclusions/Discussion Our results did not support our hypothesis. To improve significance, we are continuing to find more supernovae to measure. If our results are accurate, then the expansion rate of the universe is decreasing, and will eventually stop. By showing galaxies are moving away from each other, our results also support the idea of the Big Bang. Future research could compare spectra between distant (therefore older) stars vs closer stars. We hope to continue this or other work on the FLOYDS Telescope in Haleakala, Hawaii.</p> | |
| Summary Statement We used various internet resources to find and analyze the expansion rate of the universe. | |
| Help Received In progress - searching for astrophysicists to help use a spectroscope at UCSB, used FLOYDS spectroscope in Haleakala, Hawaii under the supervision of Mrs. Miller (science teacher) and Herbert Puhlinger (astronomy teacher in Austria), visited Curtis McCully (astrophysicist) at the LCO | |