

Siemens Competition

Math : Science : Technology

Regional Finalist

Names: Jason Chu and Lea Sparkman

High School: The Harker School and Castilleja School

Mentor: Dr. Elisa Toloba and Prof. Puragra Guhathakurta

Project Title: *Comparing Chemical Compositions of Dwarf Elliptical Nuclei and Globular Clusters (Astrophysics)*

Because of their abundance in cluster environments and fragility due to their low mass, dwarf elliptical galaxies (dEs) are excellent specimens for studying the physical processes that occur inside galaxy clusters. These studies can be used to expand our understanding of the process of galaxy (specifically dE) formation and the role of dark matter in the Universe. To move closer to better understanding these topics, we present a study of the relationship between dEs and globular clusters (GCs) by using the largest sample of dEs and GC satellites to date. We focus on comparing the ages and chemical compositions of dE nuclei with those of satellite GCs by analyzing absorption lines in their spectra. To better view the spectral features of these relatively dim objects, we employ a spectral co-addition process, where we add the fluxes of several objects to produce a single spectrum with high signal-to-noise ratio. Our finding that dE nuclei are younger and more metal rich than globular clusters establishes important benchmarks that future dE formation theories will consider. We also establish a means to identify GCs whose parent galaxies are uncertain, which allows us to make comparisons between this GC group and the satellite GCs.