A Search for Exoplanets in High Metallicity Open Clusters Using a Large Scale Photometric Algorithm

Modi, Ashini (School: Caddo Parish Magnet High School)

Open clusters are a group of about 100 to 1,000 gravitationally bound stars in close proximity to each other. However, because the stars in open clusters are very close in proximity, gravitational interactions can be common and cause planet-forming materials to be ejected out of the cluster. These unsuitable conditions are why astronomers have not widely looked for exoplanets in clusters of stars before. Furthermore, although all stars once existed in a cluster, very few exoplanets have been discovered in open clusters. Therefore, the purpose of this project was to observe whether exoplanets can form and remain in open clusters with high solar metallicity, to further the understanding of planetary formation and evolution in overpopulated environments. For my research, I operated the 0.4m optical telescopes affiliated with the Las Cumbres global telescope network (LCO) and the telescopes located at the University of Dallas. With these telescopes, I have taken observations of the three open clusters NGC 6791, NGC 2112, and NGC 6253. Furthermore, from these images, I created a lightcurve for every star in the image using a photometric algorithm in python and the software Peranso. My analysis of the lightcurves has shown that exoplanets can form and remain around stars in an open cluster, and may even be more prevalent there, contrary to the common belief. The high metallicity of the stars in the open clusters provide elements and materials needed to form exoplanets. My research has led to the discovery of 7 new exoplanet candidates and has shown that exoplanets can exist in clusters of stars furthering the scientific understanding of planetary formation in crowded environments.

Awards Won:

National Aeronautics and Space Administration: First Award of $2500