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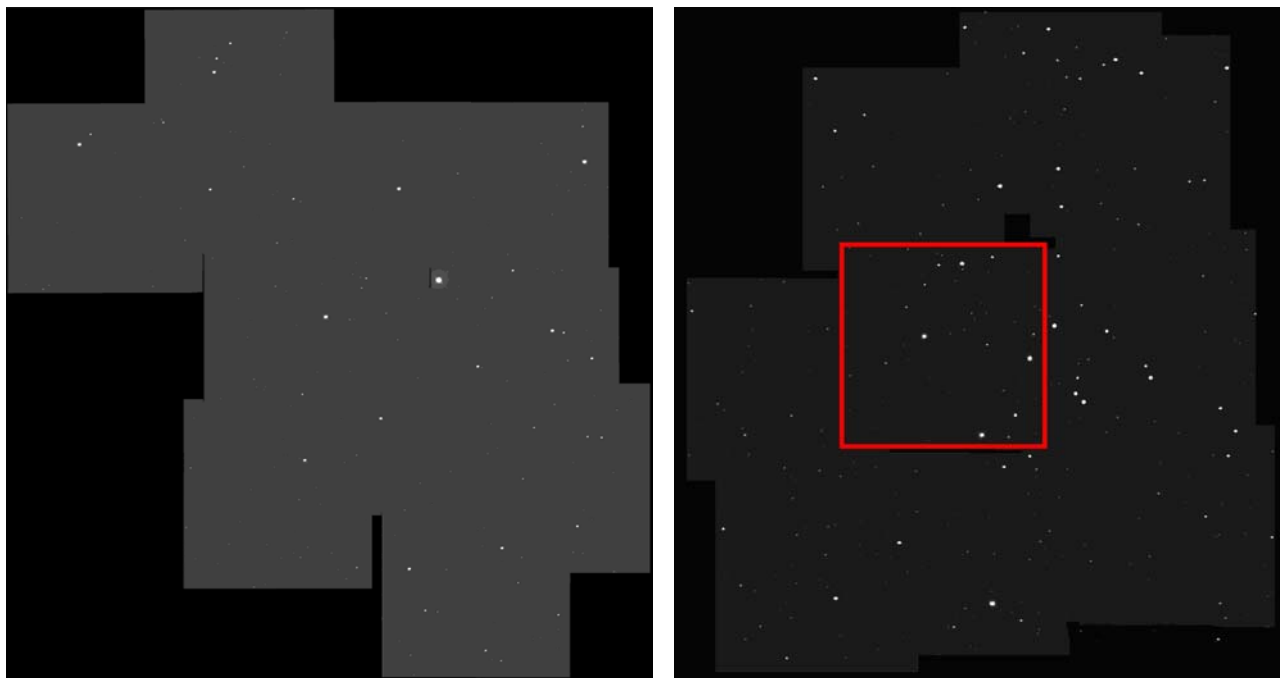
Open Star Clusters Alessi 10 and Dolidze 27

My internship this summer has been devoted to studying two open star clusters with the help of Michael Castelaz. In picking the two clusters, they needed to be up in the night sky during the summer (a Right Ascension of 14 to 22 hours), and needed to be able to be observed in both the northern and southern hemispheres (a Declination of 0° to -15°) so we could observe the clusters from both here at PARI and using the Panchromatic Robotic Optical Monitoring and Polarimetry Telescopes (PROMPT). They also needed to be in the PARI Astronomical Photographic Plate Archive. Lastly, one of the clusters was to be well-observed, with fairly accurate data on record to test the accuracy of our methods, while the second cluster was supposed to be unknown and poorly documented. The unknown cluster selected was Dolidze 27, and the known cluster picked was Alessi 10. Dolidze 27 is at 16h 36m 30s and -08d 57m 00s, and is estimated to have a diameter of 25 arcminutes. Alessi 10, located at 20h 04m 46s and -10d 28m 42s, has from 12 to 17 members, a diameter of 36 arcminutes, and is about 513 parsecs away. The goal of my internship is to determine cluster membership, the spectral types of the stars in the two areas, sizes, reddening, distance moduli, and distances to the two clusters using spectral and photometric analysis.

I used spectral plates to determine the spectral types for the stars in the clusters. The two objective prism plates that I used came from the Catalogue of Blue Sky Objective Prism Plates 1967-1984 in the North American Astronomical Photographic Plate Center developed at PARI. Thurburn Barker, a volunteer here at PARI in charge of the preservation and digitization of the plates, helped me scan the two plates with my clusters into digital formats onto my computer. He

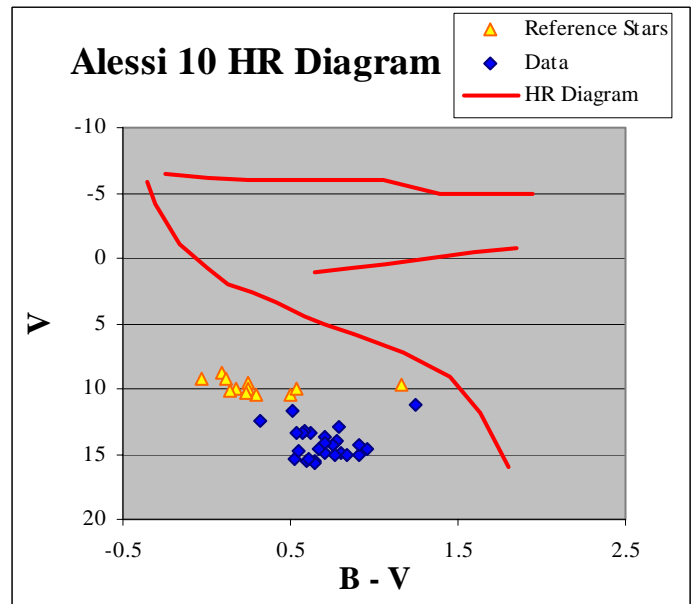
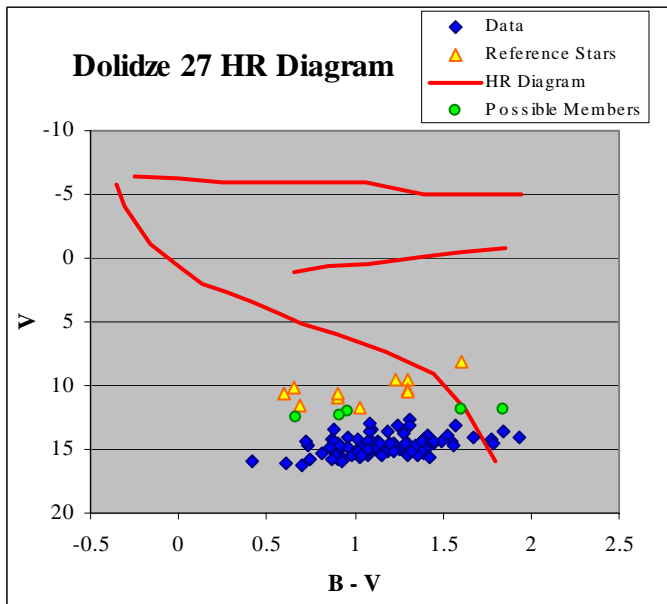
then taught me to use IRIS and VSPEC to analyze the spectra of my clusters. I also used PhotoDraw to manipulate the images in various ways. Alessi 10 has many late B and early A type stars nearby, while Dolidze 27 contains many K type stars.

For photometric analysis, I used B and V images taken by PROMPT in Cerro Tololo, Chile. The images of Dolidze 27 were taken in B and V on July 8, 10, and 14 on PROMPT 2, 4, and 5. Alessi 10's images were taken on July 14 and 16 in B and V by PROMT 5. The field of view of those 16-inch telescopes is about 10 arcminutes by 10 arcminutes. I was planning to use the Image Reduction and Analysis Facility (IRAF) to process the images taken, but due to computer problems, I instead used MaximDL to calculate the magnitudes and coordinates of all of the stars in all of the images with magnitudes smaller (brighter) than 16.5. The mosaic of the area of Dolidze 27 that I analyzed, composed of 12 adjacent frames in the B filter, is the left image. The mosaic has, at its widest points a width of 35 arcminutes and a height of 35 arcminutes. During the summer I also took and calibrated images of 11 adjacent fields of Alessi



10, but time only permitted me to measure the magnitudes of one of the fields, shown by the red border on the mosaic above on the right. The mosaic is in B, and at its widest points it is 30 arcminutes wide and 35 arcminutes high. I used the B and V magnitudes to create color magnitudes diagrams (CMDs). Shown below are the CMDs for Alessi 10 and Dolidze 27 with the reference stars (bright stars with known magnitudes and proper motions) as yellow triangles,

possible cluster members from my data as green circles, other measure stars from my data as blue diamonds, and the red lines representing the three main trend lines from the HR diagram (main sequence, giant branch, and supergiant branch). Shifting the HR lines around to fit the data (with an emphasis placed on fitting to the reference stars) allowed the calculation of the reddening and the distance modulus for each cluster, and from there the calculation of the distance to each cluster from formulas (see charts below). Dolidze 27 had a reddening of 0.55 magnitudes, a distance modulus of 9 magnitudes, and a distance of 288 parsecs. Alessi 10 had a reddening of 0.22 magnitudes, a distance modulus of 9.4 magnitudes, and a distance of 550 parsecs. Known proper motions for the brighter reference stars in the regions were also used to determine cluster membership and the average proper motions in the clusters. The stars of



Dolidze 27 had average proper motions of -7.50 milli-arcsecond per year (mas/yr) (Right Ascension) and -13.94 mas/yr (Declination), while the stars of Alessi 10 had average proper motions of 3.06 mas/yr (RA) and -6.84 mas/yr (Dec). This summer I learned a lot, discovered new information on two star clusters, and had a blast! I am going to be presenting a poster on the

two star clusters and my new information at the Spring 2007 American Astronomical Society conference.

