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SIMULTANEOUS MULTI-COLOR PHOTOMETRY SURVEY FOR SPACE DEBRIS IN GEO REGION

**Abstract**

Optical survey is one of the main techniques for monitoring and catalog space debris in Geosynchronous Earth Orbit (GEO) region. For object classes identification and space environment models development, besides the orbits additional information like physical properties are required. Non-resolving observation techniques like color photometry can provide such knowledge. Here a simultaneous multi-color survey for GEO region is performed. The CHanging Event Survey (CHES) system of Purple Mountain Observatory which includes a twelve- telescope array is utilized, and raw data in g'r'i' bands are acquired. The survey is completed in 6 nights of 3 months. Based on the large amounts of images, the object detection, catalog correlation and multi-color photometry are performed consecutively. Due to the extremely wide field of view of CHES system, 13887 tracklets with g'r'i' photometric measurements from 1697 objects are obtained. Based on the large amounts of multi-color data, the distribution of various classes in the color-color diagram is analyzed. The results indicate that different object classes show various cluster behaviors in the color-color diagram, and useful information can be provided in identifying object class. There is no consistent relation between satellite color and launch age regarding reddening just based upon our data. Due to the fact that the color of object is attributed to the type of materials, manufacturer and geometric shape, without other information, the exploration of the connection between color and age is limited. Further investigations of COSMOS show that the series of satellites cause variations on the color-color plots, which affects the research of color evolution but provides additional possibility to distinguish various classes and improve object classification. It is also demonstrated that even for the same object class the distribution of color index may be different, and for various objects of the same class multiple clusters of color index are found. It indicates that the color photometry can help to classify object classes and provide useful information for correlating new observations with catalog.