

Colors of Centaurs observed by the Subaru/Hyper Suprime-Cam

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Centaurs have orbits between Jupiter and Neptune. They are thought to originate from the trans-Neptunian region, but the actual mechanism of delivery into their current orbits is not well known. Also, it is not clear which dynamical group of trans-Neptunian objects (TNOs) are the source of Centaurs. Colors of small solar system bodies obtained by multi-band photometry provide us with clues to their origin and evolution. Comparison between the colors of Centaurs and TNOs would provide constraints on the origin and dynamical evolution of Centaurs. In the present work, we analyzed the imaging data of nine known Centaurs observed by the Hyper Suprime-Cam (HSC) installed at the prime focus of the 8.2-m Subaru Telescope with the g (0.4-0.55 μm) and i (0.7-0.85 μm) band filters by the end of June, 2017. The data we used are those available in the public data archive as well as those obtained by the Hyper Suprime-Cam Subaru Strategic Program (HSC-SSP), which is a three-layered imaging survey using 300 nights with the Subaru Telescope. Using these data, we obtained their g-i colors, and compared with those of TNOs obtained by Terai et al. (2018), who also used the HSC-SSP data. We found that the color distribution of the above nine Centaurs is similar to that of those TNOs with high orbital inclinations (larger than 6 degrees). This suggests that these Centaurs likely originated from TNOs with high orbital inclinations. We also examined correlations between colors and orbital elements for these Centaurs, and found no strong correlations with any orbital elements. This is consistent with the fact that Centaurs have a short dynamical lifetime and their current orbits do not represent their birth places.

Keywords: Centaurs, Subaru telescope, trans-Neptunian objects