

Size distribution of Jupiter's Trojan asteroids in the L5 swarm obtained by the Subaru/Hyper Suprime-Cam

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We obtained the size distribution of asteroids in Jupiter's L5 Trojan swarm using the Hyper Suprime-Cam (HSC) attached to the Subaru Telescope. Observation was carried out on January 9, 2016 (UT). The survey covered about 18 square degrees of sky area near the opposition and around the ecliptic plane with 240-sec exposure with the r -band filter. We detected 189 L5 Jupiter Trojans (JTs) with the detection limit of $m_r = 25.6$ mag. Out of these detected objects, 90 objects with absolute magnitude $H_r < 17.08$ mag and heliocentric distance $R < 5.5$ au were selected as our unbiased sample to derive the size distribution. Assuming a geometric albedo of 0.07, which is a mean albedo of JTs, the size range of our unbiased sample corresponds to 2–20 km in diameter. We fit a single-slope power law to the cumulative distribution for the absolute magnitude H (i.e., $dN/dH \propto 10^{\alpha H}$) and found the best-fit index α to be 0.37 ± 0.01 . This value agrees well with the one for L4 JTs obtained by Yoshida & Terai (2017) also through a survey with the Subaru/HSC. Combining the cataloged magnitude distribution for larger objects, we obtained a magnitude distribution of L5 JTs for $8 < H_v < 17$, and found that the obtained broken power-law distribution agrees well with the one obtained by Yoshida & Terai for the L4 swarm in the same size range. This suggests that the L4 and L5 populations have the same origin. On the other hand, according to Fraser et al. (2014), comparison of the size distributions of still larger objects (diameter larger than about 100 km) showed that the distributions of JTs and hot TNOs are indistinguishable, which supports the model that JTs were captured from scattered TNOs. Our results are consistent with the model that both L4 and L5 JTs were originated from the scattered TNOs.

Keywords: Jupiter Trojans, size distribution, Subaru Telescope