Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

MIS35-P04 Room:Convention Hall Time:May 24 18:15-19:30

Dynamical evolution of captured Trojan asteroids

OHTSUKI, Keiji[1*] ; OKAYAMA, Hiroaki[1]

[1]Kobe University

The Trojan asteroids orbit the Sun about the L4 and L5 Lagrangian points of Jupiter. These objects have a wide range of eccentricities and inclinations, and are thought to be captured planetesimals. Since the origin of the Trojan asteroids is expected to provide clues to the dynamical evolution of the planets and small bodies in the Solar System, various models have been proposed, e.g., capture due to gas drag from the solar nebula, capture during Jupiter's mass growth, or capture during smooth migration of Jupiter. However, such models failed to reproduce some important characteristics of the present Trojan asteroids, such as the total mass of the Trojans, the distribution of orbital elements, or the distribution of the libration amplitudes. On the other hand, recent models for the formation of the Solar System suggest that the giant planets likely experienced significant radial migration and orbital instability after their formation. Recent studies of capture of Trojan asteroids based on such models of giant planet migration show that icy planetesimals (or KOBs) originally in the outer Solar System can be captured into Jupiter's Trojan regions. Such models successfully explain the present total mass as well as the observed orbital characteristics of the Trojan asteroids.

However, in such studies of capture of the Trojan asteroids, planetesimals were treated as test particles, thus gravitational interactions between planetesimals are not taken into account. Also, effects of mutual gravity among asteroids are also neglected in the studies of the stability of the Trojan asteroids after their capture into the Lagrangian points. Although effects of gravitational interactions between sufficiently small asteroids may reasonably be neglected, there may have been significantly large objects in the original swam of Trojan asteroids immediately after their capture. In the above-mentioned recent models of capture, Trojan asteroids likely originated from the outer region of the Solar System, including the Kuiper belt. Among the current KBOs, there are many objects that are much larger than the largest of the present Trojans, some of them being as large as 1,000km across in diameter. If such a large body is captured into the Trojan regions even temporarily, it may have a significant influence on the stability of other Trojan bodies, and some of them would be scattered out of the Trojan regions.

In the present study, we assume that a large body was captured into Jupiter's Trojan region, and examine its dynamical influence on other Trojan asteroids using orbital integration. From the results of our orbital integrations, we derive constraints on the mass of bodies existed in the Trojan swarm in the past.

Keywords: asteroids, Trojan