International Research Team Led by NTHU's Chang Hsiang-Kuang Breaks New Ground in Astronomy

In a joint project with the Paris Observatory, a research group headed by Professor Chang Hsiang-Kuang of the Department of Physics has discovered 13 miniature trans-Neptunian objects (TNO). This is the first time such a large number of TNOs have been discovered; in fact, it is six times more than the number discovered by the only other research team working in this area. The team's findings has been published in the November issue of the *Monthly Notices of the Royal Astronomical Society*, released by the Oxford University Press.

The origin and evolution of the solar system has always been one of the central topics of astronomy. Observations carried out from the Earth and outer space over a long period of time have provided a considerable amount of useful information about the solar system. Yet, due to the great distance involved, relatively little is known about the smaller celestial bodies on the periphery of the solar system. Most of these dark and cold celestial bodies were formed within the solar system itself; some have been on their present orbit for a very long time; others may have migrated from the inner part of the solar system to the periphery due to the gravitational pull of the planets; and still others may have migrated from some other solar system. For astronomers, these TNOs are like a history book of the solar system.

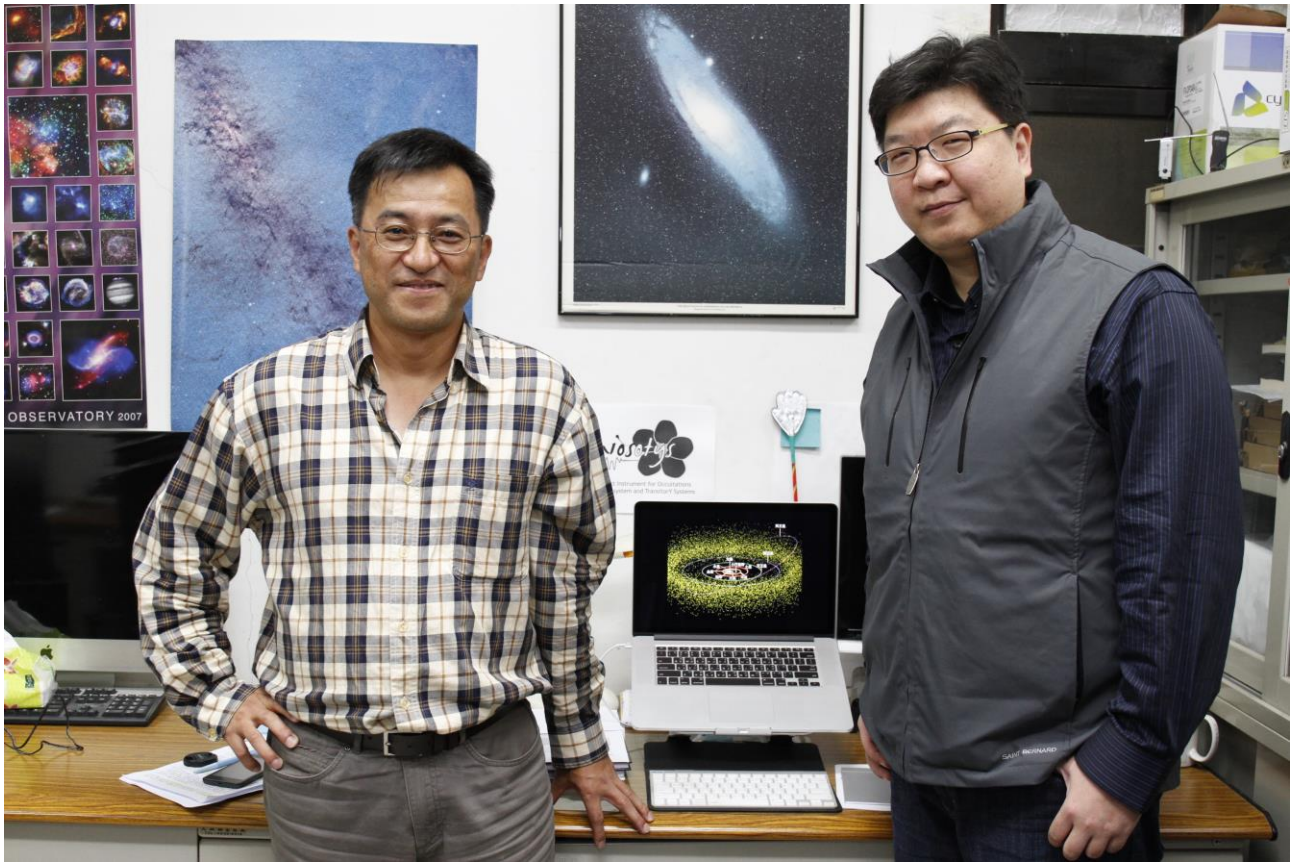
According to Professor Chang, his multinational research team succeeding in finding these small bodies on the periphery of the solar system by analyzing the asteroseismology observations gathered using the "Convection Rotation and planetary Transit" (COROT) space telescope of the European Space Agency and the French National Center for Space Studies. This significant discovery allows astronomers to study the number of small bodies in the outer solar system and gain a more accurate understanding of their distribution, and can also be used to model the evolution of the solar system.

As Professor Chang puts it, "Because these TNOs are very small and dark, we can't directly see them. But when they pass in front of a planet, the planet suddenly darkens a bit, as if it were blinking." In other words, by using the occultation method they were able to infer the existence of these small celestial bodies.

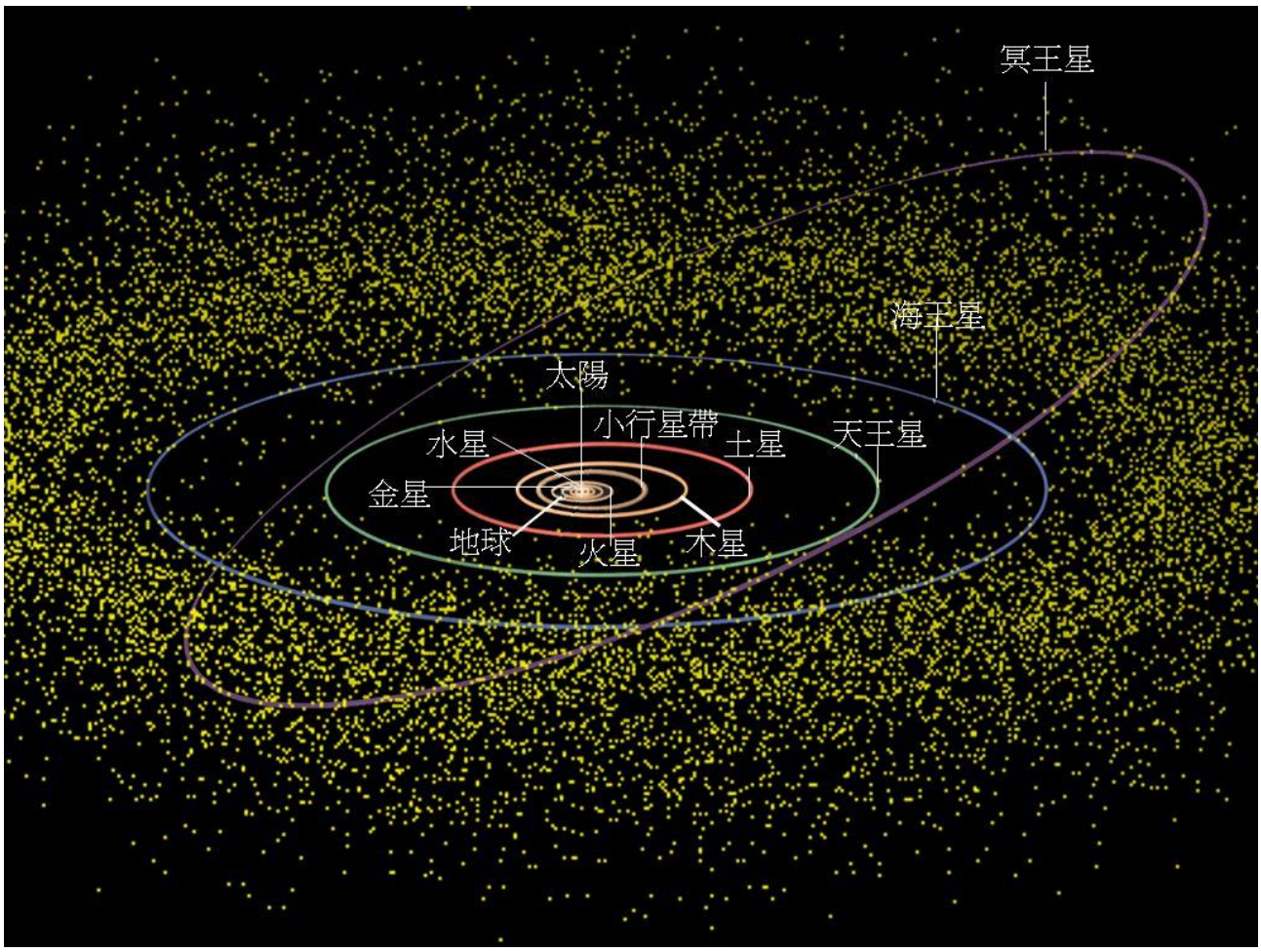
The Taiwan research team used statistical methods to identify unusual decreases in luminosity which suggested the possibility of an occultation event. Afterwards, they collaborated with the astronomers working with the COROT project to test the validity of their preliminary findings. According to Liu zhi-yuan, a Ph.D. student at Institute of Astronomy and the first author of the research report, "Discovering these occultation events caused by such small celestial bodies was really a stroke of luck!" However, since such occultation events occur randomly, they cannot be replicated for verification, so the team has to carefully test every doubtful case and make sure that they weren't caused by the instrumentation.

This long-term research project is jointly sponsored by Taiwan's Ministry of Science and Technology and the French National Research Agency. According to Alain Doressoundiram, senior astronomer at the Paris Observatory, "We are only the second research team in the world to discover these small celestial bodies by using occultation events; in comparison to the first team, the number of celestial bodies we have discovered is six times greater. In addition to confirming the previous findings, these discoveries can be used by theoretical astronomers to correct discrepancies in their models of the development of the solar system."

At present, the joint research team is continuing to analyze the new data made available by the COROT project, and they expect to discover yet more miniature TNOs. Professor Chang points out, “We have recently developed a device for observing occultations called the ‘Multi-object Instrument for Occultations in the SOlar system and Transitor Y Systems’ (MIOSOTYS). We’ve already used it several times at the Observatoire de Haute-Provence in France and the Centro Astronómico Hispano-Alemán in Spain.”



Professor Chang Hsiang-Kuang (left) of NTHU’s Institute of Astronomy with his Ph.D. student Liu Zhiyuan. Working in cooperation with the Paris Observatory, a research team headed by Chang has discovered 13 miniature TNOs.



The Kuiper Belt is a ring-shaped region outside the orbit of Neptune, extending to about 30-50 astronomical units from the sun. An astronomical unit is the average distance between the Earth and the sun. Pluto was the first celestial body to be discovered in the Kuiper Belt.