ILION: A JOVIAN TROJAN ASTEROID ORBITER AND LANDER MISSION CONCEPT.
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Introduction: The Ilion mission is designed to perform the first reconnaissance and detailed examination of the Jovian Trojan asteroids. The Trojan asteroids are thought to be transitional objects between main-belt asteroids and Kuiper Belt objects, and are believed to have primitive, ice- and organic-rich compositions. However, recent dynamical work suggests they might originate from much further from the Sun than their current orbits near 5 AU. The Ilion mission will flyby several Trojans and rendezvous and land on one of them. It carries remote sensing instruments to characterize the asteroid's structure and landed instruments to measure its surface composition. Preliminary orbit calculations have shown that several of the Trojans can be reached by Discovery-class missions with reasonable travel times. The choice of payload, specific target, and the best approach to answering Decadal Survey and NASA goals are all part of the Ilion study.

Ilion is enabled by Advanced Stirling Radioisotope Thermal Generators (ASRGs) as a power source. While solar power is being planned for missions out to 5 AU, large solar panels make it extremely difficult to land on a Trojan and they can not provide the required power during long nights at the landing site. The Ilion study is supported under the NASA Discovery and Scout Mission Capabilities Expansion project.

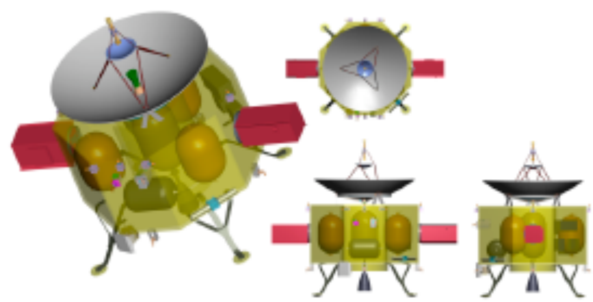
Science Objectives: Jupiter shares its orbit with a host of small bodies. More than 160,000 objects larger than 1 km are librating about the L4 and L5 Lagrange points in the Jupiter-Sun system [1]. Spectra of the largest Trojans are featureless through the visible and near-IR, similar to cometary nuclei [2], [3], [4] implying ice-rich, organics-rich, and largely pristine bodies. Recent observations and models have raised doubts about these expectations [5].

Ilion addresses critical questions about Trojan asteroids:

1. Did the Trojan asteroids originate near Jupiter's orbit, or further out in the solar system?
2. How much ice and organics are present on Trojan asteroids?
3. How do the geological processes, which have occurred on the Trojans, compare to those that have affected other small bodies?
4. What is the relationship between Trojan asteroids and comets, KBOs, and outer planet satellites?

The Ilion mission to a Jovian Trojan is an all-chemical propulsion variant of the PARIS-to-Hektor concept [6]. It uses a powered Jupiter flyby to rendezvous with a Trojan asteroid in the trailing Sun-Jupiter L5 cloud of objects. Preliminary trajectory analysis has shown that a number of the known Trojans can be orbited with this design.

The cruise time from launch to Trojan orbit injection (TOI) varies from about 7.5 years to over 12 years for the targets that have been examined so far. Approximately the final 2 years of the cruise will be spent within the L5 Trojan cloud. This time can be used for observations and flyby encounters of additional targets.



Ilion Spacecraft concept

After TOI, Ilion will observe the target asteroid for several months and a landing site will be identified. After landing, a variety of compositional and physical measurements can be made.

A candidate payload includes imagers, optical spectrometers, along with neutron and gamma-ray instruments for orbital observations. APXS and LAMS or LIBS instruments would make surface composition measurements after landing.

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