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PROPOSAL TO LAUNCH A CONSTELLATION OF HELIOCENTRIC INFRA-RED TELESCOPE SATELLITES (CHIRTS)

Abstract

When peering out into the solar system and beyond, line-of-sight access from Earth telescopes on the ground or in Earth orbit is limited by orbital position relative to the target, restricting access to time-critical transient events. This could be remedied using Boeing's Space Launch System (SLS) program to launch a set of three to six identical space telescopes to distribute in orbit around the Sun to enable continuous long-duration observations of solar system and extrasolar targets. Stationed evenly-spaced in a heliocentric orbit inferior to Venus, each satellite can be equipped with a telescope of aperture about 1m in diameter with a sunshade to maintain electronics at a stable operating temperature and passively cool the optics and detectors to enable infrared observations. Each spacecraft will require sufficient fuel to reach and maintain station and positioning relative to other members of the constellation, with robust communications to transmit astronomical data over 2AU range via direct transmission or by indirect relay through the network to circumvent the Sun. The advantaged position given by these satellites would provide myriad benefits, including enabling stereo imaging by instantaneous parallax to rapidly identify small bodies such as comets and near-Earth objects, improve our understanding of 3D structures like rings at the giant planets, rapid parallax measurements of stars, and continuous detection of extrasolar planet transits. They will also provide us with a reliable ability to observe planets at times that they are encountered by flight missions, opportunities to pursue impact events, access to a greater range of comets, including interstellar objects, and fresh access to stellar occultations by solar system bodies, which enables measuring a planet's atmospheric structure and the size and shape of small bodies. In addition to the expected opportunities, the real power in opening a new observational window lies in discovering unanticipated phenomena. A heliocentric telescope array creates new chances to achieve unbroken observational records that can reveal periodic or transient phenomena that could not previously be identified. Together, the set of satellites could potentially exceed 30,000-lbs at launch, making SLS the preferred candidate for launch due to its heavy-lift capability. It could take up to several years to maneuver the spacecraft into their final flight formation in heliocentric orbit, possibly requiring one or two flybys of Venus for each spacecraft. The individual spacecraft will be capable of providing us with valuable data on a wide array of subjects long before reaching final configuration.