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POSSIBILITIES AND CHALLENGES OF DETECTING EXOMOONS FOR COLONIZATION AND FOR ADVANCED TERRAFORMING

Abstract

Since the dawn of time, mankind has been in search of a way to control nature and a way to reach the stars. Nowadays, with various advancements in space technology, the possibility of colonizing our solar system and beyond looks more and more plausible everyday. Naturally, the final destination would be outside the solar system for the ultimate expansion of mankind. The search for life outside of the Solar System should not be restricted to exclusively planetary bodies; large moons of Extrasolar planets may also be common habitable environments throughout the Galaxy. Extrasolar moons, or Exomoons, may be detected through transit timing effects induced onto the host planet as a result of mutual gravitational interaction. In particular, transit timing variations (TTV) and transit duration variations (TDV) are predicted to produce a unique exomoon signature, which is not only easily distinguished from other gravitational perturbations, but also provides both the period and mass of an exomoon. Using these timing effects, photometry greater or equal to that of the Kepler Mission is readily able to detect habitable-zone exomoons down to 0.2 M and could survey up to 25,000 stars for Earth-mass satellites. We discuss future possibilities for spectral retrieval of such bodies and show that transmission spectroscopy with James Webb Space Telescope should be able to detect molecular species with 30 transit events, in the best cases. Furthermore, the paper will briefly touch the possibilities and the challenges involved in reaching these destinations as well.