Intro2Astro 2025 - Reading Assignment

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4th July 2025

"Which paper proposes a novel method that could be utilized to attract the attention of, and ultimately communicate with, extraterrestrial intelligence?"

The first paper (TRANSIT LIGHT-CURVE SIGNATURES OF ARTIFICIAL OBJECTS) proposes a novel method that could be used to attract the attention of extraterrestrial intelligence.

Paper 1: TRANSIT LIGHT-CURVE SIGNATURES OF ARTIFICIAL OBJECTS

The paper proposes a novel method for detecting intelligent extraterrestrial life via transits of artificial structures across stars. Lightcurves of different non-spherical or multiple artificial objects (e.g., triangles, louver-like structures) are simulated. These artificial structures can produce distinct transit lightcurves. Multiple-object transits could serve as intentional attention-getting signals. Detection is feasible with missions like Kepler or CoRoT. The core idea is similar to SETI missions, i.e. messages embedded in routine astronomical data.

Paper 2: Searching for GEMS: Confirmation of TOI-5573b, a Cool, Saturn-like Planet Orbiting An M-dwarf

The paper confirms and characterizes TOI-5573b, a gas giant planet detected by TESS. The method involves combining TESS transits, ground-based photometry, speckle imaging, and radial velocity data (HPF NEID), using

Bayesian modeling. From the findings, TOI-5573b is a Saturn-like exoplanet with a mass of $112\,M_\oplus$, radius $\sim 9.75\,R_\oplus$, and low density ($\sim 0.66\,\mathrm{g/cm^3}$). It orbits a metal-rich M-dwarf every 8.79 days. This supports the core accretion model for giant planet formation around M-dwarfs.

Paper 3: Parallax Effect in Microlensing Events Due to Free-floating Planets

This paper focuses on observational challenges due to parallax effects. It assesses how unaccounted parallax effects distort microlensing lightcurves from free-floating planets and therefore not related to extraterrestrial life.

Paper 4: Investigating the Effects of Cloud Variability on the Direct Imaging of Atmospheres

The paper studies how cloud variability on Earth-like exoplanets affects the detection of atmospheric biosignatures using real Earth cloud data. This is done using MERRA-2 Earth cloud data to simulate spectra treating Earth as an exoplanet. It finds that cloud coverage and height greatly influence the detectability of biomarkers. Low clouds enhance detectability; high clouds obscure gases. Exposure times for detection vary greatly with cloud type.