# Observing Apophis With Twinkle


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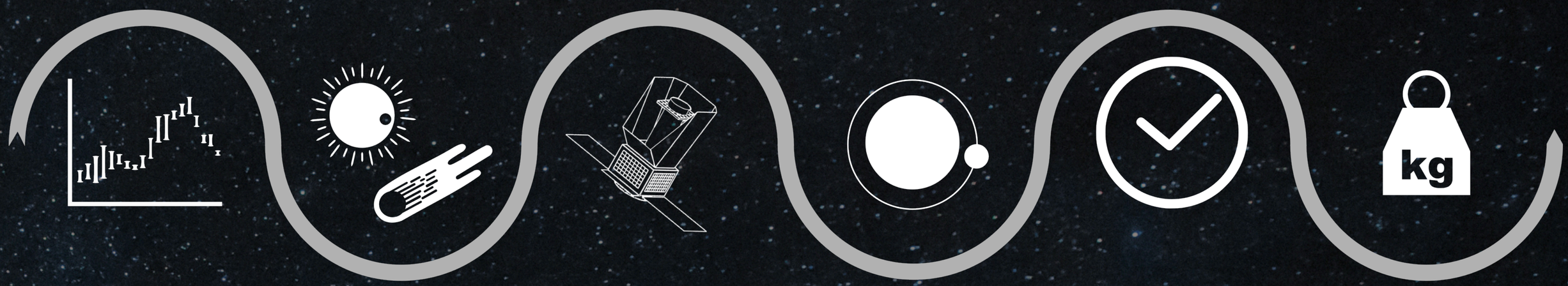


## 1). Asteroid Population

Over a three year survey, Twinkle could spectroscopically characterise 1000's of asteroids with its simultaneous 0.5-4.5 micron spectrometer. The JPL Horizons service has been used to monitor when each asteroid could be observed by Twinkle and the highest visible magnitude achieved has been recorded. Observing 3000 asteroids brighter than Vmag = 15.5 would take around 25% of mission time over three years. The survey is expected to be directed towards characterising a wide variety of asteroid types and families.

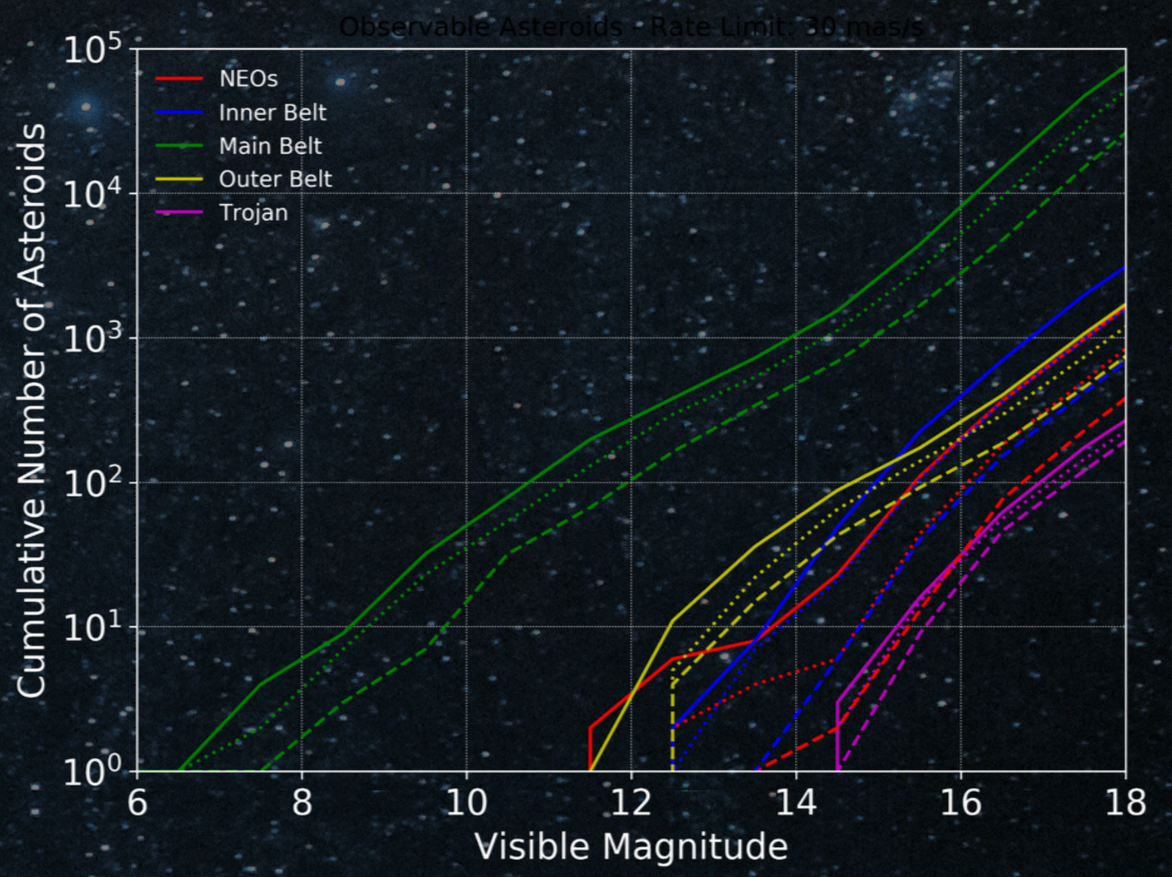


Figure 1: Cumulative number of asteroids that pass into Twinkle's Field of Regard (±40° from the ecliptic) during a year (dotted), three years (dashed) and five years (solid). Thousands of asteroids will be bright enough for study, allowing Twinkle to uncover their surface composition.

## 2). Tracking NEOs

While observation periods for main belt asteroids are periodic, NEOs are more sporadic in their availability. While they are brightest when closest to Earth, they will also be moving fastest relative to the observer. Twinkle will be capable of tracking objects moving at less than 30 mas/s.

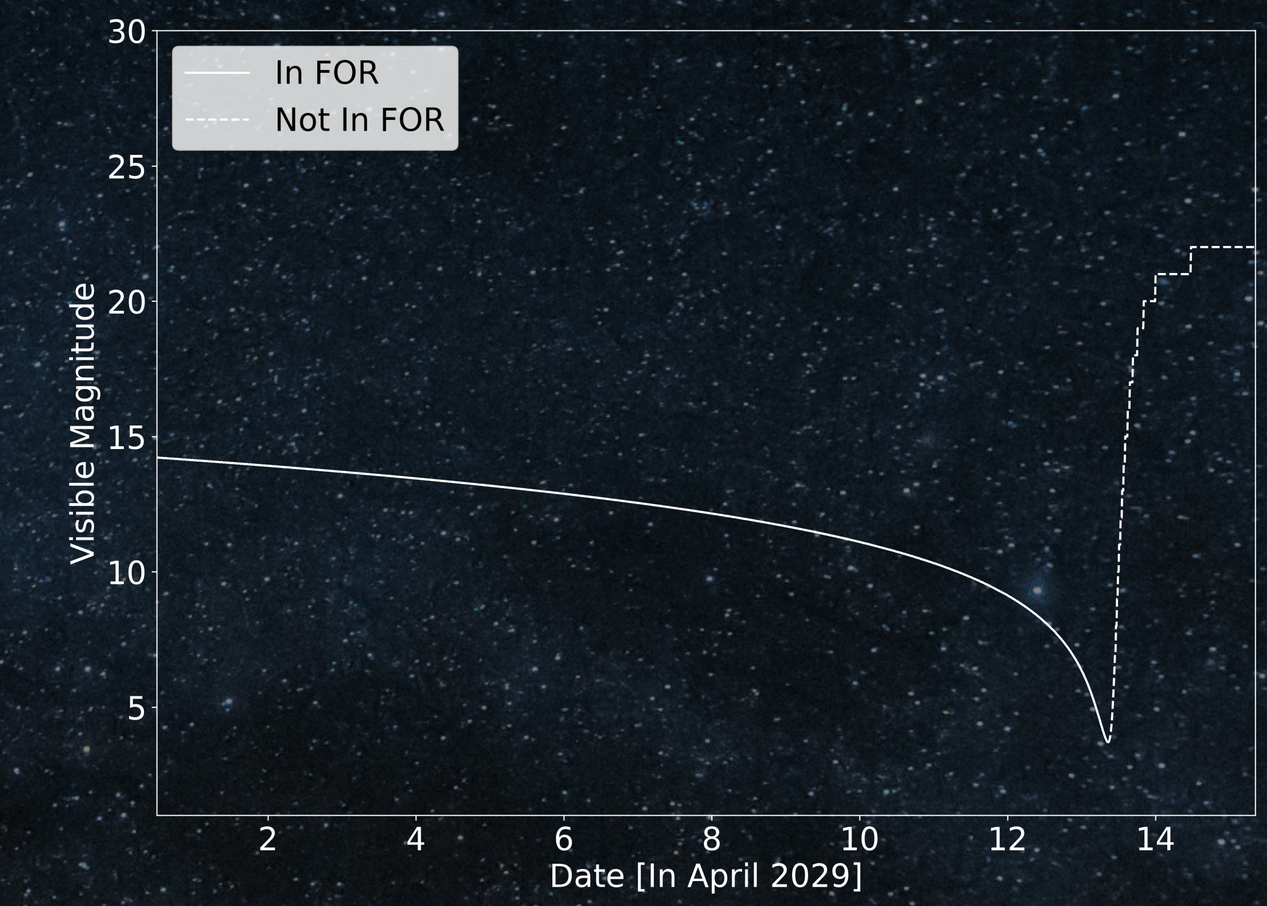


Figure 2: Brightness of Apophis during the weeks before its closest approach. After ~11th April, the asteroid will be moving too quickly to be tracked by Twinkle but will have reach a visible magnitude of ~11 by this time.

## 3). Observing Apophis

Apophis will hit this rate limit on 11th April 2029 but will be bright enough to be characterised by Twinkle for may days beforehand. Figure 3 shows a simulated spectrum when the asteroid is at a visible magnitude of 12. A 5 minute exposure time has been used and the spectrum is that of an LL6 Chondrite, obtained from the RELAB database.

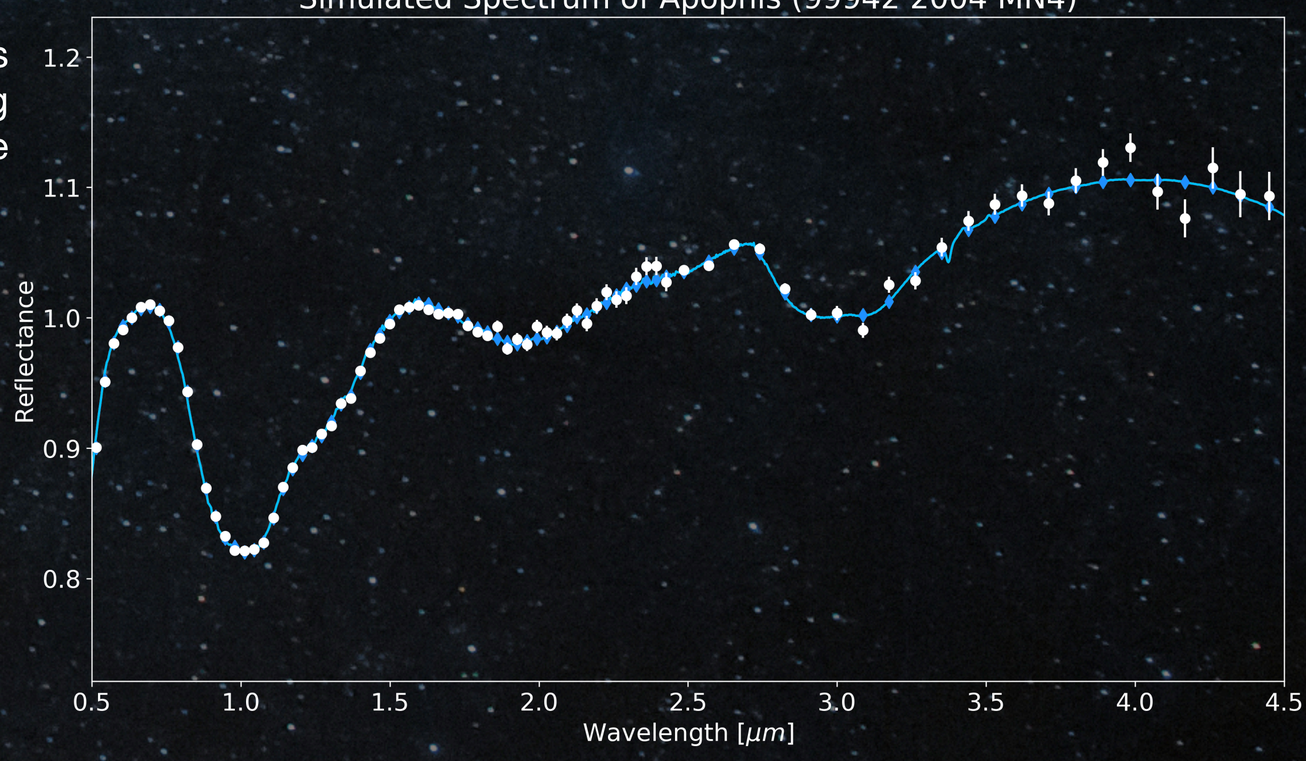


Figure 3: Simulated Twinkle observation of Apophis assuming a 5 minute integration time.

**Further Information: Edwards et al. 2019, Small Bodies Science with Twinkle, JATIS, 5:034004 or visit: www.twinkle-spacemission.co.uk**