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# Twinkle – a Low-Earth orbit visible and infrared exoplanet spectroscopy observatory

Marcell TESSENYI (1,2), Max JOSHUA (1), Giovanna TINETTI (1,2), Jonathan TENNYSON (1,2), Giorgio SAVINI (1,2)

(1) Blue Skies Space Ltd., United Kingdom, (2) Physics and Astronomy Department, UCL, London, United Kingdom

## Abstract

The Twinkle Space Mission is a space-based observatory that has been conceived to measure the atmospheric composition of exoplanets. This cost-effective spacecraft is being constructed on a short timescale in the UK and is planned for launch in 2022. The satellite is based on a high-heritage platform and will carry a 0.45m telescope with two scientific instruments: a visible spectrograph based on UVIS (which is currently flying on the ExoMars Trace Gas Orbiter) and an infrared spectrograph. Together, these spectrographs provide simultaneous wavelength coverage from 0.4 to 4.5μm with resolving power up to R~300. The spacecraft will be launched into a Sun-synchronous low-Earth polar orbit and will have a baseline lifetime of seven years.

Twinkle will have the capability to provide high-quality visible and infrared spectroscopic characterisation of hundreds of bright exoplanets, including at least 100 currently-known exoplanets. It will also be capable of follow-up photometric observations of 1000 or more exoplanets. Photometric measurements, taken simultaneously in the visible and the infrared bands, will allow orbital parameters of systems to be well-constrained and enable precise measurements of transit timing variations present in multi-planet systems. The exoplanet targets observed by Twinkle will be composed of known exoplanets discovered by existing and upcoming ground- and space-based surveys, including TESS, GAIA, K2, CHEOPS, WASP and HATSouth.

Thanks to its pointing and tracking capabilities, Twinkle will also be able to observe solar system objects including asteroids, comets, the outer planets and their moons. Twinkle could provide a spectroscopic population study of asteroids and comets to study their surface composition, following up on the discoveries of LSST. Given that Twinkle's instrumentation has been optimised for observing exoplanets, it will also be able to obtain high-SNR spectra of the outer planets and moons in our solar system within very brief exposure times. Twinkle's wavelength coverage and position above the atmosphere will make it particularly well-suited for studying spectral features that are obscured by telluric lines from the ground, including hydration features, organics, silicates and CO2.

While Twinkle has been designed with these exoplanet and solar system science cases in mind, the spacecraft itself is a general observatory which will provide on-demand observations of targets at the requests of its users. Scientists worldwide can access telescope time on Twinkle through a simple, streamlined process, and then decide freely how to allocate their observing time.

This presentation will provide an overview of the mission, its core science cases and the telescope access model. For more information, visit www.twinkle-spacemission.co.uk.