Small Bodies Science with the Twinkle space telescope

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Twinkle is a small, space-based telescope that has been conceived to measure obtain spectroscopic data of exoplanet atmospheres and Solar System objects. This cost-effective spacecraft is being constructed on a short timescale and is planned for launch in 2022 into a low-Earth, Sun-synchronous polar orbit. Twinkle will carry a 45cm telescope with two instruments, a visible and a near-infrared spectrometer, providing simultaneous wavelength coverage from 0.4 - 4.5μm with resolving powers up to R~250 ($\lambda < 2.42\mu m$) and R~60 ($\lambda > 2.42\mu m$). With the model taken to develop the Twinkle satellite, scientists worldwide will be able to directly use Twinkle to carry out their research.

The minor bodies of the Solar System are the most primitive materials left over from the epoch of planet formation. As such, understanding their composition and surface properties provides insights into what the original building block materials of the Solar System were, the formation and evolution of the small bodies and planets, and the weathering processes of their surfaces. With its wavelength coverage, position outside of Earth's atmosphere, instrument performance and stability capabilities, Twinkle is ideally suited to acquire high fidelity visible and near-infrared (VNIR) spectral data that would be useful to the small bodies community.

While Twinkle is suitable for studying asteroids of all types, the most promising contribution the space-based observatory offers is to investigate the primitive asteroids. Twinkle's ability to fully resolve spectral features related to hydroxyl (OH), water (ice and gas), and hydrated silicates, which are either partially or fully obscured in Earth-based observations due to Earth's water-rich atmosphere, offers the opportunity to collect the best primitive asteroid VNIR data set to date. Currently, telluric (atmospheric) water features in the spectral data prevents a full characterisation of the primitive asteroids and comet comae. Such a characterisation is required to determine the composition and mineralogy of these objects. Without a large database of VNIR spectra free of atmospheric water contamination, our understanding of the composition of the most primitive bodies of the Solar System has been stunted. Our studies show that Twinkle should be capable of obtaining spectra of thousands of asteroids.

Additionally to asteroid science, Twinkle will have the capability of investigating the comae of hundreds of bright comets, providing valuable data sets on CO_2 production and the presence of water-ice and organics in the comae. Further Solar System targets into the outer planets and their moons.

This presentation will provide a summary of the potential for observing Solar System bodies with Twinkle and the approach taken. For more information, visit www.twinkle-spacemission.co.uk.