Atmospheric Characterisation with the Twinkle Space Telescope Following Advancements from JWST Observations

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The Twinkle Space Telescope is a general observatory designed for on-demand spectroscopic observations of a wide range of extrasolar and solar system objects, equipped with a 0.45 m diameter telescope and a spectrometer covering wavelengths from 0.5 to 4.5 μm simultaneously. Twinkle is one of the first in a series of innovative science satellites managed and operated by Blue Skies Space Ltd. Leveraging recent advances from JWST observations, we present updated simulations evaluating Twinkle's observational capabilities in the context of exoplanet atmospheres. Through retrieval analyses of HD 209458 b, WASP-107 b, GJ 3470 b, and 55 Cnc e, we demonstrate how increasing observational investment enhances the retrieval of atmospheric parameters and molecular abundances. Our sensitivity study highlights Twinkle's capability to detect less abundant/detectable molecules depending on the observing strategies adopted. This work provides practical guidance for developing targeted observational strategies, maximisising Twinkle's scientific outcomes, and effectively preparing the community for its upcoming observation planning phase.