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TWINKLE – A BRITISH SPACE MISSION TO EXPLORE FARAWAY WORLDS

Abstract

The study of exoplanets has been incredibly successful over the past 20 years: nearly 2000 planets have been discovered, and along these discoveries fundamental parameters such as mass, radius and semi-major axis have been obtained. In the past decade, pioneering results have been obtained using transit spectroscopy with Hubble, Spitzer and ground-based facilities, which have enabled the detection of a few of the most abundant chemical species, the presence of clouds, and also permitted the study of the planetary thermal structure.

To follow these early successes, we propose to build Twinkle: a Made-in-UK, small dedicated satellite designed to understand these newly found worlds through the measurement of their atmospheric composition. Twinkle would be built quickly and cheaply (£50M including launch) by taking advantage of lowered costs of access to space to deliver ground breaking scientific results. The Twinkle satellite will be built in the UK and launched into a low-Earth orbit within 4 years, using an existing platform designed by Surrey Satellite Technology Ltd and instrumentation built by a consortium of UK institutes. The funding for Twinkle will be provided through a mixture of private and public sources.

Twinkle will analyse at least 100 exoplanets in the Milky Way. Its infrared spectrograph will enable observations of a wide range of planet types including super-Earths (rocky planets 1-10 times the mass of Earth) and hot-Jupiters (gas giants orbiting very close to their suns). Some of the target planets are orbiting stars similar to our Sun and some are orbiting cooler red-dwarfs. For the largest planets orbiting bright stars, Twinkle will even be able to produce maps of clouds and temperature. The Twinkle

instrument will be composed of a visible-IR spectrograph (between 0.5 and 5μm) with resolving power R$\sim$200, and will orbit Earth on a sun-synchronous polar orbit.