Paper ID: 32054
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23rd IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)
Small Space Science Missions (2)

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CONDUCTING COMETARY ASTROPHYSICS WITH THE TWINKLE SMALL-SAT

Abstract

With the recent success of the European Space Agency's Rosetta mission many of the mysteries surrounding comets have been solved, however from these discoveries come more questions and for all the breakthroughs from Rosetta we've only observed several comets in detail. For cometary astrophysics to advance we will need to conduct surveys to get the properties of more of the trillions of comets in the Solar System. Doing this we can learn more about comet families and get a better idea of comet formation conditions and the Solar System's protoplanetary disk.

Conducting ground-based detection surveys has yielded great successes in learning about the orbit properties of comets. However, in order to understand the physical properties of comets better it is beneficial to use space-based telescopes, as the Earth's atmosphere is opaque to many of the key molecules seen in comets. NASA's Infrared Space Observatory and Submillimeter Wave Astronomy Satellite, ESA's Herschel Space Observatory, and the Swedish Space Corporation's Odin Satellite (now OHB Sweden) have had a lot of success in detecting the main constituents of cometary comas in the past 20 years. However, these spacecraft have taken multiple countries decades to build, launch, and operate with huge financial investments. Therefore in order to advance the field of cometary astrophysics through surveys we will need a cheaper, faster alternative, that even allows emerging space nations to conduct space-based astrophysics research.

TWINKLE is an infrared small-sat observatory being mainly developed by University College London and Surrey Satellite Technology Limited due for launch by 2019. It will be equipped with a spectrograph which will observe between 0.5 to 4.5 micrometers with the primary science goal of TWINKLE to be to characterise exoplanet atmospheres. However, there is the opportunity to use TWINKLE to observe comets as some of the main constituents of comets, such as water, carbon dioxide, and methanol, have vibrational transitions in the spectrograph's observational range. Therefore it will be possible to use TWINKLE as a proof of technology that small-sats can be used to conduct cometary astrophysics and use it as a stepping-stone to a future when constellations of small-sats can carry out astrophysics surveys.