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COMPAQS – A COMPACT CONCENTRIC UV/VISIBLE SPECTROMETER, PROVIDING A NEW TOOL FOR AIR QUALITY MONITORING FROM SPACE.

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Under the first phase of the Centre for Earth Observation Instrumentation (CEOI), a breadboard demonstrator of a novel UV/VIS spectrometer has been developed. Using designs from Surrey Satellite Technology Ltd (SSTL) the demonstrator has been constructed and tested at the University of Leicester's Space Research Centre. This spectrometer provides an exceptionally compact instrument for differential optical absorption spectroscopy (DOAS) applications from LEO, GEO, HAP or ground-based platforms.

Measurement of atmospheric compounds with climate change or air quality implications is a key driver for the ground and space-based Earth Observation communities. Techniques using UV/VIS spectroscopy such as DOAS provide measurements of ozone profiles, aerosol optical depth, certain Volatile Organic Compounds, halogenated species, and key air quality parameters including tropospheric nitrogen dioxide. Compact instruments providing the necessary optical performance and spectral resolution are therefore a key enabling technology.

The Compact Air Quality Spectrometer (CompAQS) features a concentric arrangement of a spherical meniscus lens, a concave spherical mirror and a suitable curved diffraction grating. This compact design provides efficiency and performance benefits over traditional concepts, improving the precision and spatial resolution available from space borne instruments with limited weight and size budgets. The breadboard spectrometer currently operating at the University of Leicester offers high throughput with a spectral range from 310 to 450 nm at 0.5nm(UV) to 1.0nm (visible) resolution, suitable for DOAS applications. The concentric design is capable of handling high relative apertures, owing to spherical aberration and coma being near zero at all surfaces. The design also provides correction for transverse chromatic aberration and distortion, in addition to correcting for the distortion called 'smile' – the curvature of the slit image formed at each wavelength. These properties render this design capable of superior spectral and spatial performance with size and weight budgets significantly lower than standard configurations.

In this presentation, the design of the spectrometer is detailed, with results from instrument characterisations undertaken at the University of Leicester, including demonstrations of DOAS fits for key air quality species.