Authors:
Daniel Gerber daniel.gerber@stfc.ac.uk
Brian Ellison brian.ellison@stfc.ac.uk
Peter Huggard peter.huggard@stfc.ac.uk
Alexander Valavanis A.Valavanis@leeds.ac.uk
Edmund Linfield E.H.Linfield@leeds.ac.uk
A. Giles Davies G.Davies@leeds.ac.uk
Giorgio Savini g.savini@ucl.ac.uk
Neil Bowles Neil.Bowles@physics.ox.ac.uk
Simon Calcutt simon.calcutt@physics.ox.ac.uk
Martin Crook martin.crook@stfc.ac.uk
Matthew Hills matthew.hills@stfc.ac.uk
Steve Parkes steve.parkes@star-dundee.com
Stuart Mills stuart.mills@star-dundee.com

Keywords: Upper Atmosphere, Terahertz, Remote Sensing, Quantum Cascade Lasers, ESA Earth Explorer

Title: The ESA Earth Explorer 10 Candidate Mission LOCUS

We present the ESA Earth Explorer candidate mission LOCUS. LOCUS is under evaluation for Phase-0 Study in the current 10th ESA Earth Explorer Call (EE10). It is a UK mission proposal for an upper atmospheric research satellite that uses disruptive receiver technology to make novel atmospheric measurements.

At the core of the LOCUS instrument is a heterodyne Schottky receiver. Such receivers have long been used very successfully for satellite Earth Observation in the millimetre- and submillimetre-wave range. But the desire to extend the observation frequencies into the THz range has been met with fundamental technological difficulties, namely the lack of high-power Local Oscillator (LO) sources to pump the frequency down-conversion process (i.e., frequency mixing) at THz frequencies. This is known as the “THz-Gap”.

The development of novel Quantum Cascade Laser (QCL) local oscillators in the UK would make it possible, for the first time, to build THz and supra-THz heterodyne remote sensing instrument in a very compact, low power implementation, with very moderate cooling requirements (2–3-W heat-lift at ~70 K). This combination of novel technologies is ideally suited to bring down the cost of potential space-borne deployment. The CEOI has played a major role in the past to develop THz Schottky receivers at RAL Space, QCL devices at the University of Leeds, miniature space-coolers at STFC Technology, and high-resolution, wide-band digital spectrometers at STAR-Dundee.

The scientific motivation that drive this UK technology development is captured in the LOCUS missions: To measure the composition of atomic oxygen (O) in the Mesosphere – Lower Thermosphere (MLT). O is the main component of the MLT, but because it can only be measured remotely at two distinct THz frequencies (4.7 & 2.0 THz), its abundance, and particularly its global and temporal variability is still largely unknown.