Novel concept in high resolution spectroscopy

potential for atmospheric measurements and security applications

The UK's Centre for Earth Observation Instrumentation (CEOI) is actively engaged in the development of novel Earth observation instrumentation and acts as a catalyst for the development of technologies for environmental monitoring from space.

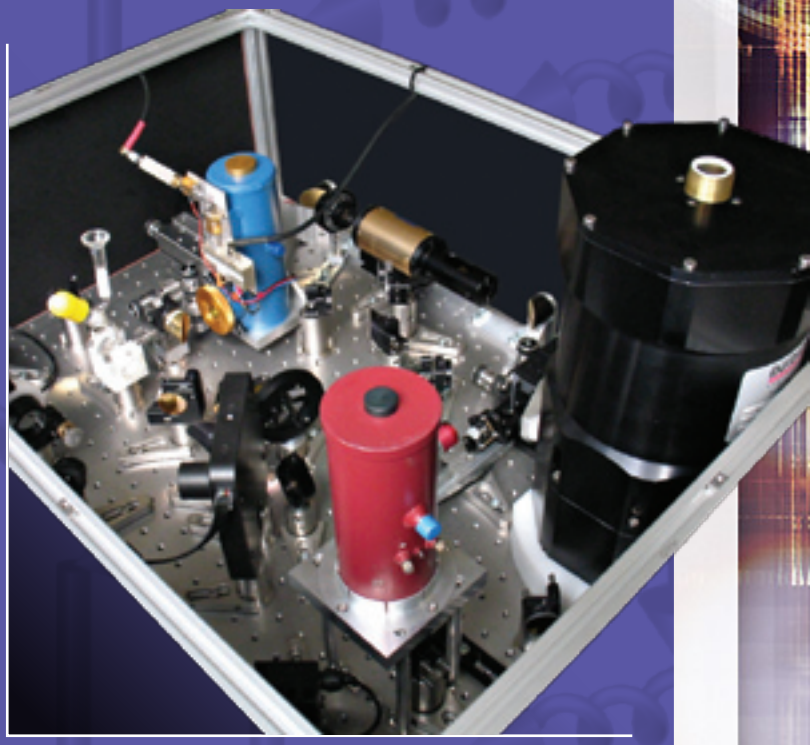
A number of CEOI funded technologies have potential for enabling more effective remote sensing measurements of atmospheric composition and quality. This type of monitoring from space is a vital goal for human health and for understanding climate change. Additionally, there is also the potential of other terrestrial applications for which these technologies could also be suitable.

QUANTUM CASCADE LASER HETERODYNE RADIOMETRY FOR ATMOSPHERIC CONSTITUENT PROFILING

One CEOI funded project, the Laser Heterodyne Radiometer (LHR) brings an innovative new concept in very high resolution spectroscopy for atmospheric monitoring. It is able to provide a unique combination of high sensitivity, high spatial resolution, and high spectral resolution in a very compact package. The high sensitivity ensures that tiny amounts of atmospheric constituents can be detected and high spatial resolution means that the instrument is able to provide information on highly localized distant scenes. This gives the instrument a key advantage to be able to provide information on the atmospheric constituents at high altitude. This passive radiometer, uses a low-power, highly-stable quantum cascade laser (QCL) emitting in the middle infrared to finely analyze the spectral properties (selective absorption and emission of light by molecules) of the incoming signal beam.

The LHR has originally been developed for Earth observation by a team from the Space Science and Technology Department (SSTD) of the STFC's Rutherford Appleton Laboratory with support from the NERC. The current LHR development within CEOI involves QinetiQ, who have developed a novel approach to optical and laser systems integration based on 'hollow waveguide' technology.

The LHR has successfully demonstrated measurement of atmospheric ozone concentration profiles from the ground with a vertical resolution of up to 2km and over altitudes up to 40km. Additionally, in collaboration with Princeton University, the SSTD team has recently demonstrated in the laboratory the very first LHR with a wide spectral coverage allowing the monitoring of several gases rather than a few, thus, greatly increasing the remote sensing capabilities of the instrument. With further funding, the project team will shortly undertake atmospheric demonstration of the multi-species monitoring capabilities.



CHEMICAL DETECTION POTENTIAL FOR SECURITY – REMOTE SNIFFING WITH LHR?

Besides atmospheric sciences applications, investigations are currently underway to examine how a variant of the LHR technology could be used to look for spectral signature of volatile chemicals released by explosive material. There is great potential in areas such as security of civil infrastructure and beyond, for a sensitive stand-off chemical analyzer. Such a technology would be complementary to 'in-situ' detection method like, for instance, sniffer dogs, and would allow unambiguous identification and potentially, quantification of highly specific chemicals.

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Current sensing equipment for remote chemical detection is mainly based on Fourier Transform Spectrometer technology, which have been used for decades. New technologies under development are based on tunable laser absorption spectroscopy and mainly provide in-situ detection capabilities. It is envisaged that an LHR type instrument would work in a complementary way to this, by interrogating a particular location remotely. It could also potentially give much higher spectral and spatial resolution than existing remote sensing technologies, in a more compact package.

In theory, a system could be employed several 100 metres away from the scene to be interrogated (say a departure gate at an airport) and if any pre-determined volatiles are detected, the instrument would precisely show the location of the release. Research is currently underway to explore the potential of LHR related technologies in this field.

Further information about this technology and others funded by the CEOI can be found at **www.ceoi.ac.uk**.

You can also contact the Project Lead,
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FUTURE **EVENTS**

STFC KITE Club: Semiconductor Detectors and Applications Workshop

Tuesday 30th June, (10:00 - 16:00)

Rutherford Appleton Laboratory (STFC)

Semiconductor detectors are a key enabling technology for Research Facilities, Particle Physics, Astronomy and Space Science. This workshop offers an opportunity for companies and academics to learn about recent developments in semiconductor detectors, compare industrial and scientific needs and capabilities and explore possibilities for collaborative projects.

The day will feature presentations from:

Marcus French from Rutherford Appleton Laboratory (RAL) who will introduce the Detector Systems Centre.

Paul Sellin from the University of Surrey:
"Development of X-ray and gamma ray detectors for security applications".

Robert Pfab from the UK Astronomy Technology Centre:
"Submillimetre detector arrays for astronomy".

Trevor Cross from e2v:
"Imaging sensor developments at e2v".

Renato Turchetta from Rutherford Appleton Laboratory:
"CMOS Monolithic Active Pixel Sensors in RAL".

Keith Mathieson from the University of Glasgow:
"Detectors for understanding and repairing the retina".

There will also be an overview of opportunities for interaction at CERN (TBC).

Registration and more details are available **here**

Participation is free and open to all interested parties.
If you would like further information please contact:
Julie Bellingham

Adaptive Optics and Applications

Autumn 2009

Future large astronomical telescopes will rely significantly on the use of 'Adaptive optics' (AO) techniques and systems to achieve their demanding objectives. AO systems comprise of a number of highly interlinked sub-systems, for example, deformable mirrors are critical components which require high speed, high resolution in a highly reliable system. With the improving performance of techniques, once limited by the speed of the real-time processor and standard commercial computers, a real advance in astronomical science using these maturing technologies is being achieved.

The proposed brokering meeting will aim to bring together relevant technology developers from the STFC, ESO funded research communities and members of a broad industrial community as users/integrators. The key objective is to include speakers covering areas emerging in biological imagery and defence & security applications with a vision for collaborative projects.

More information will be available shortly.