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A Static Imaging Fourier Transform Spectrometer (SIFTS) for infrared remote sensing

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A Static Imaging Fourier Transform Spectrometer, SIFTS, has been developed for hyperspectral remote sensing in the infrared. The compact instrument has no moving components and so is insensitive to vibration. It has been optimised for operation from the Near (3 microns) to Mid Infrared (15 microns) through the use of an uncooled, wideband microbolometer detector array. The resolution across this spectral range has been shown to be 8cm-1. This instrument is inherently imaging, whereby spectral information is recorded along the of the detector array whilst imaging information is recorded down the column of the detector array.

The Connes advantage, inherent to the Michelson spectrometer Fourier Transform Spectrometer (FTS), whereby the spectral wavelength accuracy is referenced to a stabilised laser has also been demonstrated in the SIFTS instrument. This has been implemented through the use of an expanded internal laser diode with Distributed Bragg Reflector (DFB) which acts as the calibration source used to maintain the wavelength stability of the SIFTS instrument.
As there are no moving components, the instrument is compact, light and insensitive to mechanical vibration, additionally the speed of measurement is determined by the frame rate of the detector array. Thus, this instrument has a temporal advantage over common Michelson FTIR instruments.

The novel optical design has reduced the optics to only 3 optical components, and the detector array, to generate and measure the interferogram. The experimental performance of the SIFTS instrument is demonstrated in measurements against theoretical and

The technique is based on a static optical configuration whereby light is split into two paths and made to recombine along a focal plane producing an interference pattern. The spectral information is returned using a detector array to digitally capture the interferogram which can then be processed into a spectrum by applying a Fourier transform. As there are no moving components, the speed of measurement is determined by the frame rate of the detector array. Thus, this instrument has a temporal advantage over common Michelson FTIR instruments. Using a wideband Vanadium Oxide microbolometer detector array (sensitive from 3 to 14microns) spectra have been recorded at a rate of 40 Hz.