



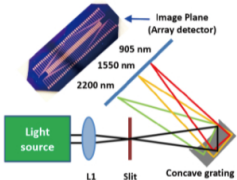
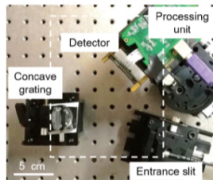
Handheld High-Resolution Short-Wave Infrared Spectrometer

#Screening

#Pollution

#Sensor

#2019

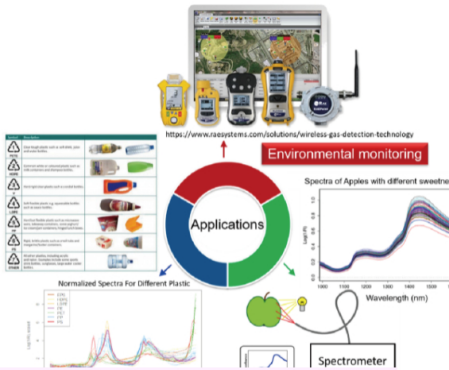



Working mechanism

- Concave grating – collimation and dispersion
- QD d – ser

PROJECT QUICK FACTS

The photography of the SWIR spectrometer system installed in our lab – the white box indicate the size of the system.



Applications

- Environmental monitoring
- Food quality

Principal Investigator
Prof. ZHAO Ni
DEPARTMENT OF ELECTRONIC ENGINEERING

- Funding**
Innovation and Technology Commission
- Collaboration**
– Department of Mechanical and Automation Engineering of CUHK, – Han Kok Technology Co., – Weimu Intelligent System Ltd.

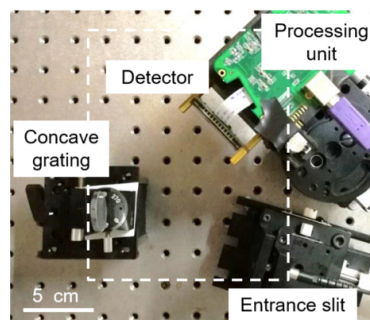
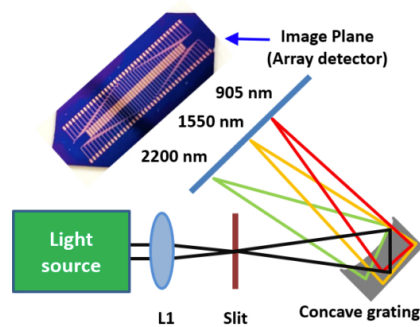
Spectrometers are widely used in many different aspects, such as food and environmental inspection etc. However, it is necessary to have a portable and high-resolution spectrometer for real-time on-site inspection at remote farm or factory. CUHK team invented two new technologies, which broke the traditional boundary. We develop a handheld high-resolution short-wave infrared (SWIR) spectrometer that enables real-time and on-site spectroscopic analysis in the 900–2800 nm wavelength range. Basing on our two technologies, the spectrometer can be fabricated via low-cost processes: (1) vacuum-imprinted varied-line-space concave grating, which simultaneously miniaturizes the optical design and improves resolution, and (2) HgTe quantum dot based detectors, which exhibit high room-temperature sensitivity beyond 2000 nm. This innovative spectrometer system developed by CUHK outperforms the current commercial products no matter in cost, size and performance.

Uniqueness and Competitive Advantages:

1. Miniaturized system (about 20×16×5 cm³)
2. Wide photodetection wavelength range (900–2800 nm)
3. High spectral resolution (5 nm)
4. High detectivity at room temperature (10¹⁰ Jones)
5. Fast response speed (less than 10 ms)

Target Users:

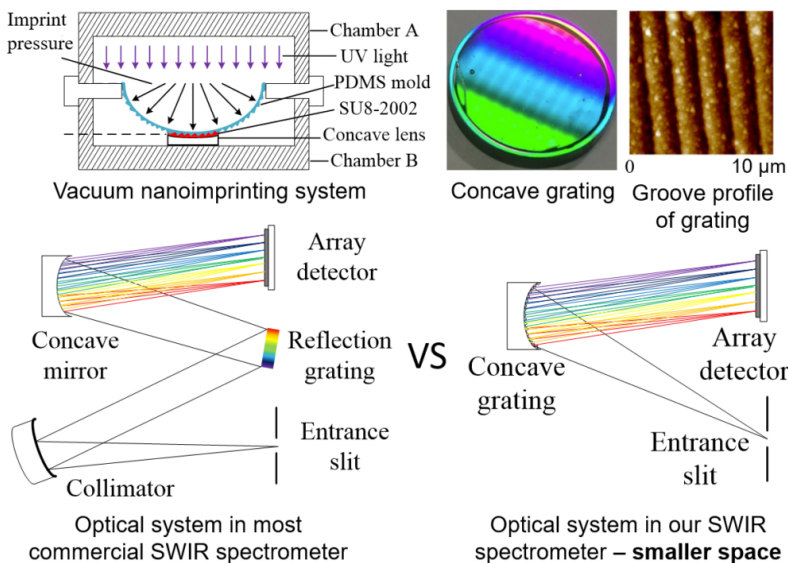
- 01 The buildings (e.g. the apartments, hotels and factories) that require real-time monitor the hazardous gas
- 02 The vehicle interior air quality and exhaust emission monitoring
- 03 Farms that need to classify foods, such as milk fat content and apple sweetness identification, etc.
- 04 Garbage sorting and recycling station, which require efficient plastic recycling sorting



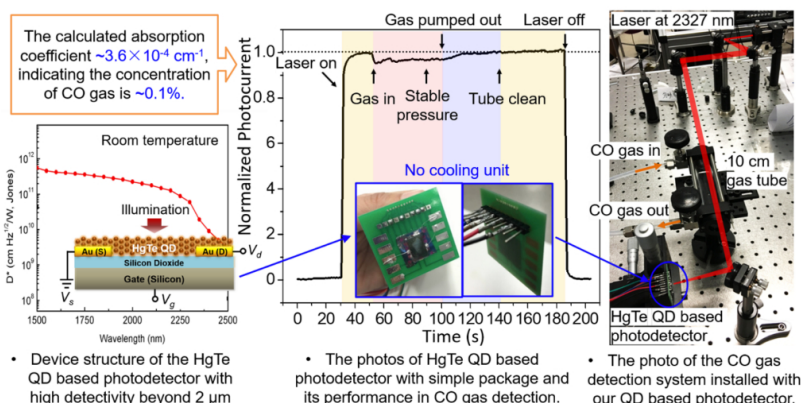
- WORKING MECHANISM**
- Concave grating
 - collimation and dispersion
 - QD detection array
 - sensitive and fast detection

The photography of the SWIR spectrometer system installed in our lab
 – the white box indicate the size of the system.

The working mechanism and the photography of our SWIR spectrometer system installed in our lab.



Up: The schematics of the vacuum nanoimprinting system and the photos of the concave grating fabricated with this system. Below: The comparison between the commercial SWIR spectrometer and our product in the optical system installed.



The room temperature-operated high sensitive HgTe QD based SWIR photodetector and its successful application in testing CO gas content.

Environmental monitoring: <https://www.raesystems.com/solutions/wireless-gas-detection-technology>

Applications (Central Hub):

- Environmental monitoring** (Red)
- Plastic recycling sorting** (Blue)
- Food inspection** (Green)

Plastic recycling sorting: <https://oceanoptics.com/plastic-recycling-nir-spectroscopy/>

Food inspection: <https://oceanoptics.com/chemometric-analysis-of-food-quality/>

Spectrometer (Central Device)

Normalized Spectra For Different Plastic (Graph)

Spectra of Apples with different sweetness (Graph)

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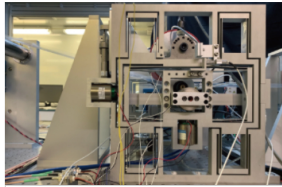
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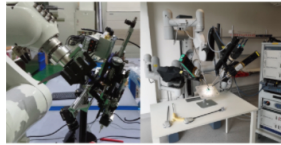
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