

NIR and MID IR Optical Filters for Agri-sensing Challenges

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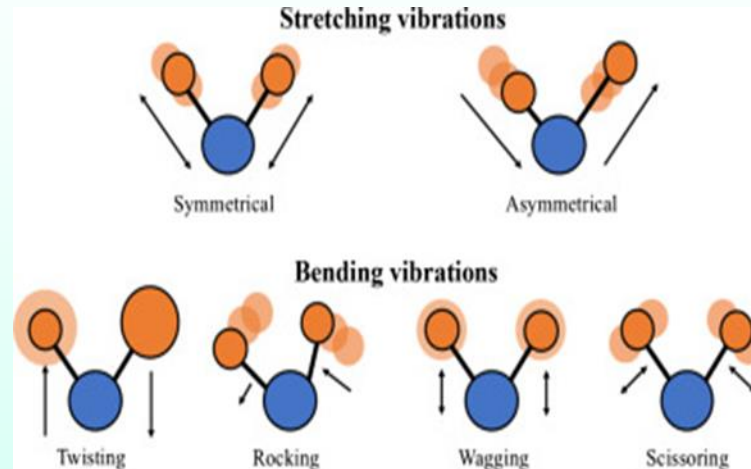
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NIR and MID IR Optical Filters for Agri-sensing Challenges

Obligatory slide on Vortex.

- We design and make ‘feature hugging’ IR Narrow Band Filters 1-6 μm
- Even tricky ones !
- Involved in solving ‘World problems’- that’s our why.....examples...
 - Food integrity
 - Plastics sorting
 - Disease biomarkers
 - Smart Agriculture
 - Reducing Supermarket fruit/veg waste

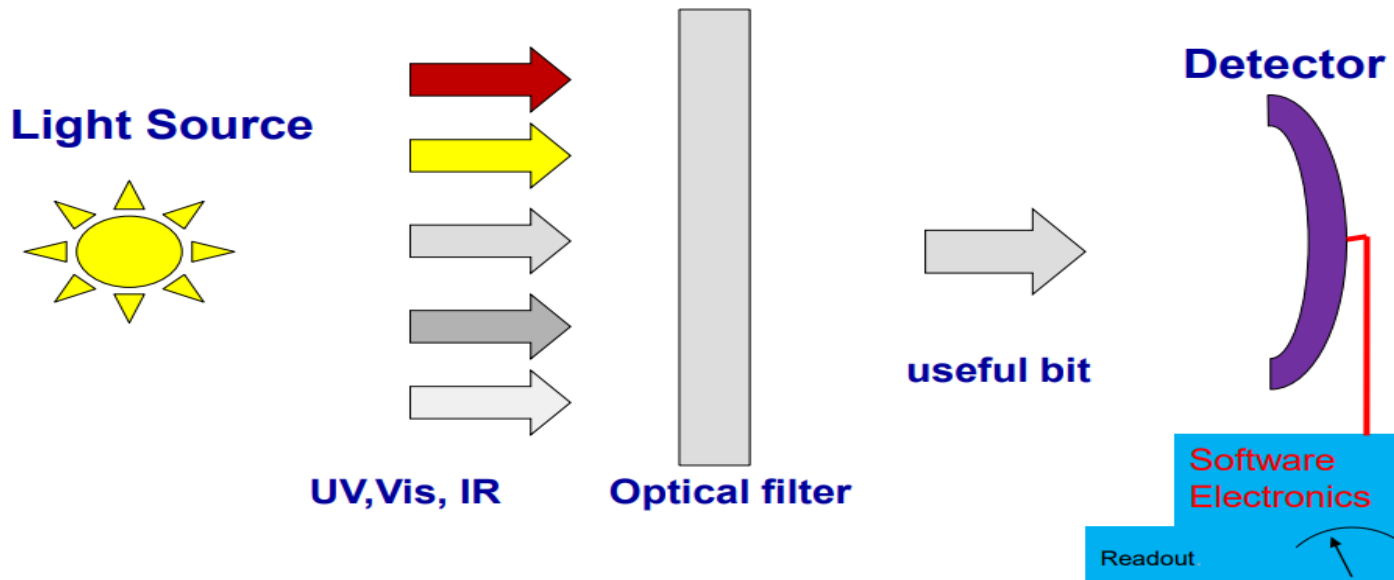
- Why the IR ?



- Many materials have IR absorption... >>visible
- Lots of signal...Stacking the odds in our favour
- Aiming to hit a big target

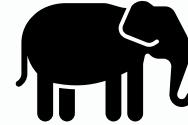
- A filter is a key enabling technology in sensing
It 'sensitizes the system!'
Narrow Band Filters (NBP s)

Basics of a Detection system



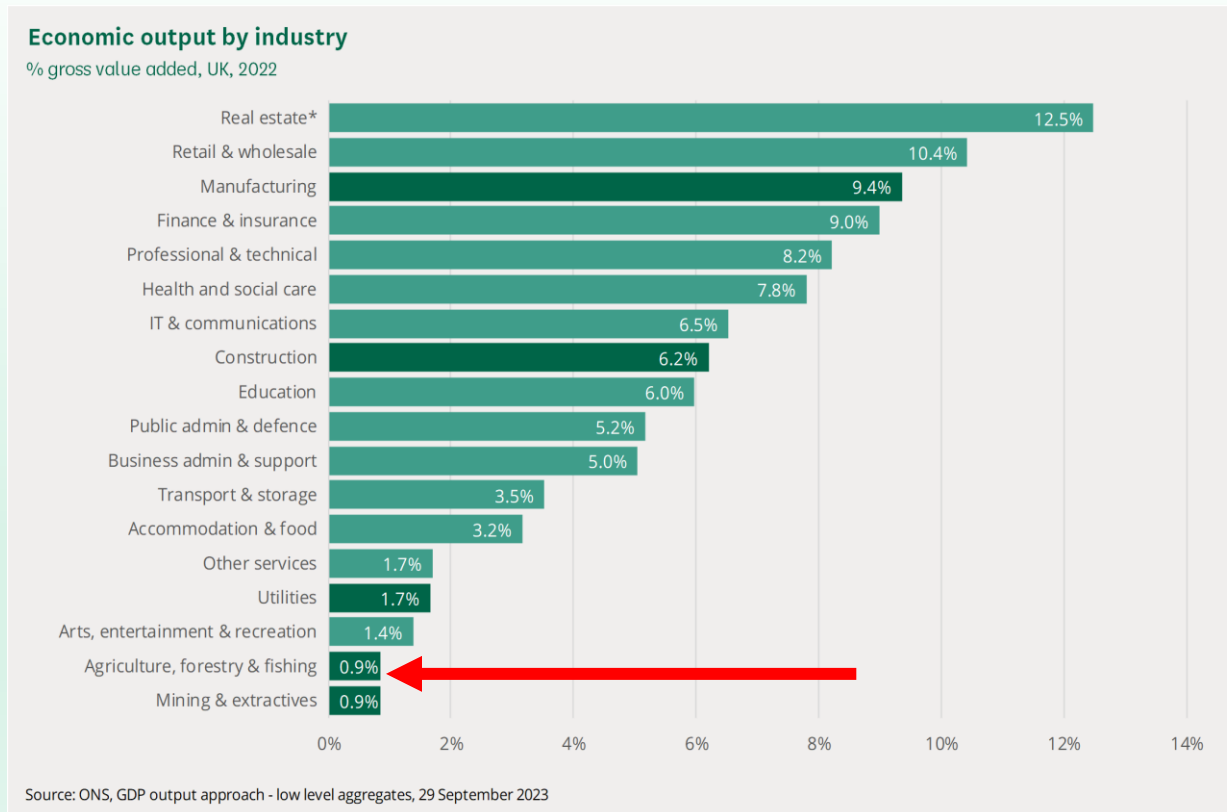
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Elephants in the room.....



1. Investment in Food and Agriculture?

UK Figures.....



Another Elephant 

2. Cost of working in the IR ?

Detector Cost.....

InGaAs & PbS	1000's €
Silicon	<< 100 €

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Investment..Help is at hand

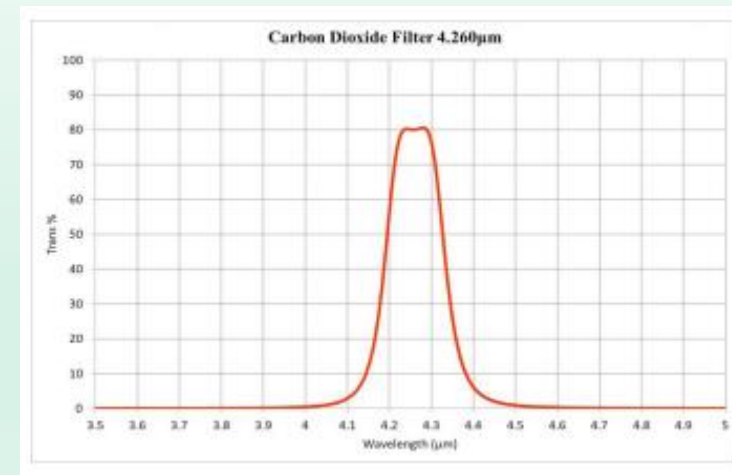
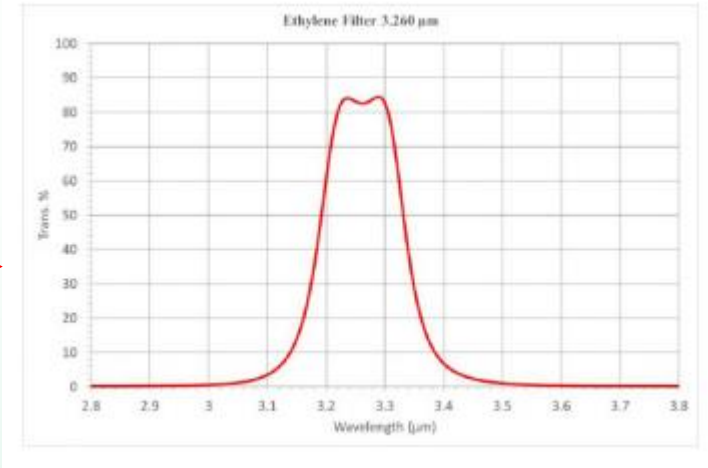
- Public pressure
- More Research now than ever!
- There will be more legislation!

IR Detection...Help is at hand

- Organo/metallic detectors
- New companies.....
 - Senorics 1-1.7 μm
 - Serion Technology 0.4-3.2 μm
- Target < 10 Euro cost!

Historic Filters of interest.
eg Ethylene, CO₂..MID IR.

- NIR/SWIR...Features get narrower but
- Last 10 Years we can make them narrower.
- Avoid water and CO₂ bands...



So Ethylene in SWIR Narrow Band, BW 1510-1540nm

MID IR Spectrum of Ethylene

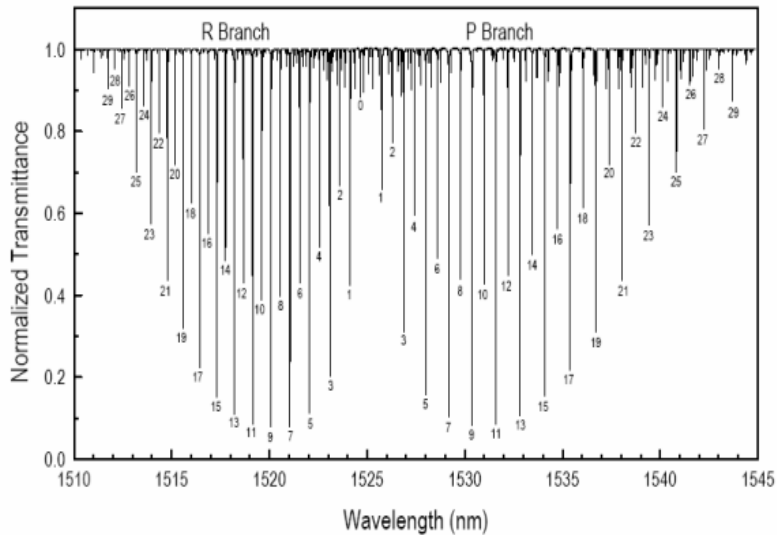
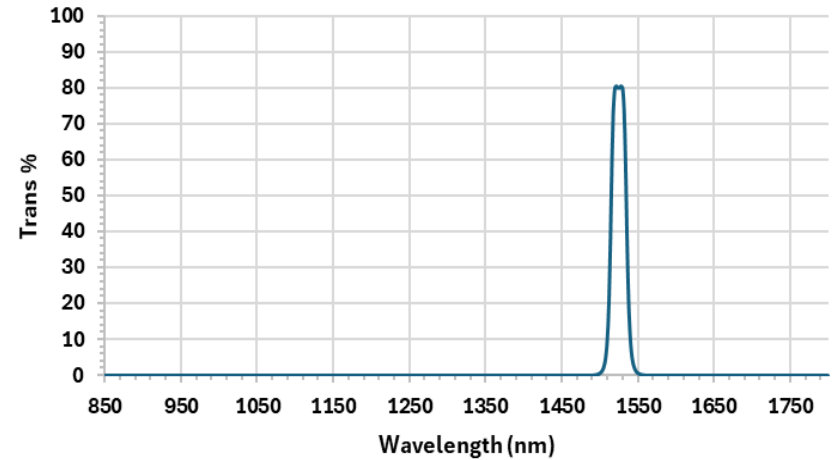


Fig. 1.1. spectrum of $\nu_1+\nu_3$ combination band of acetylene[4].

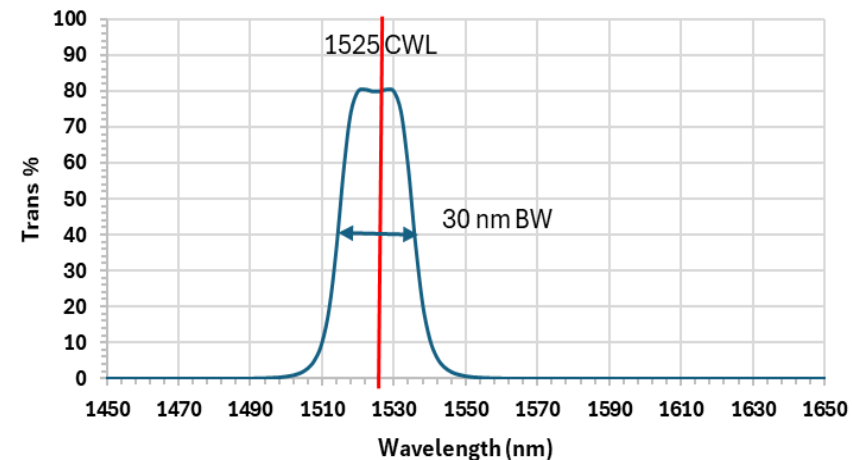
Reference

Sarah L. Gilbert, W.C.S., Acetylene 12C2H2 Absorption Reference for 1510 nm to 1540 nm Wavelength Calibration-SRM 2517a. 2001

Trans 1535-NBP-30



Trans 1525 Centre Wavelength, BWidth 30 nm

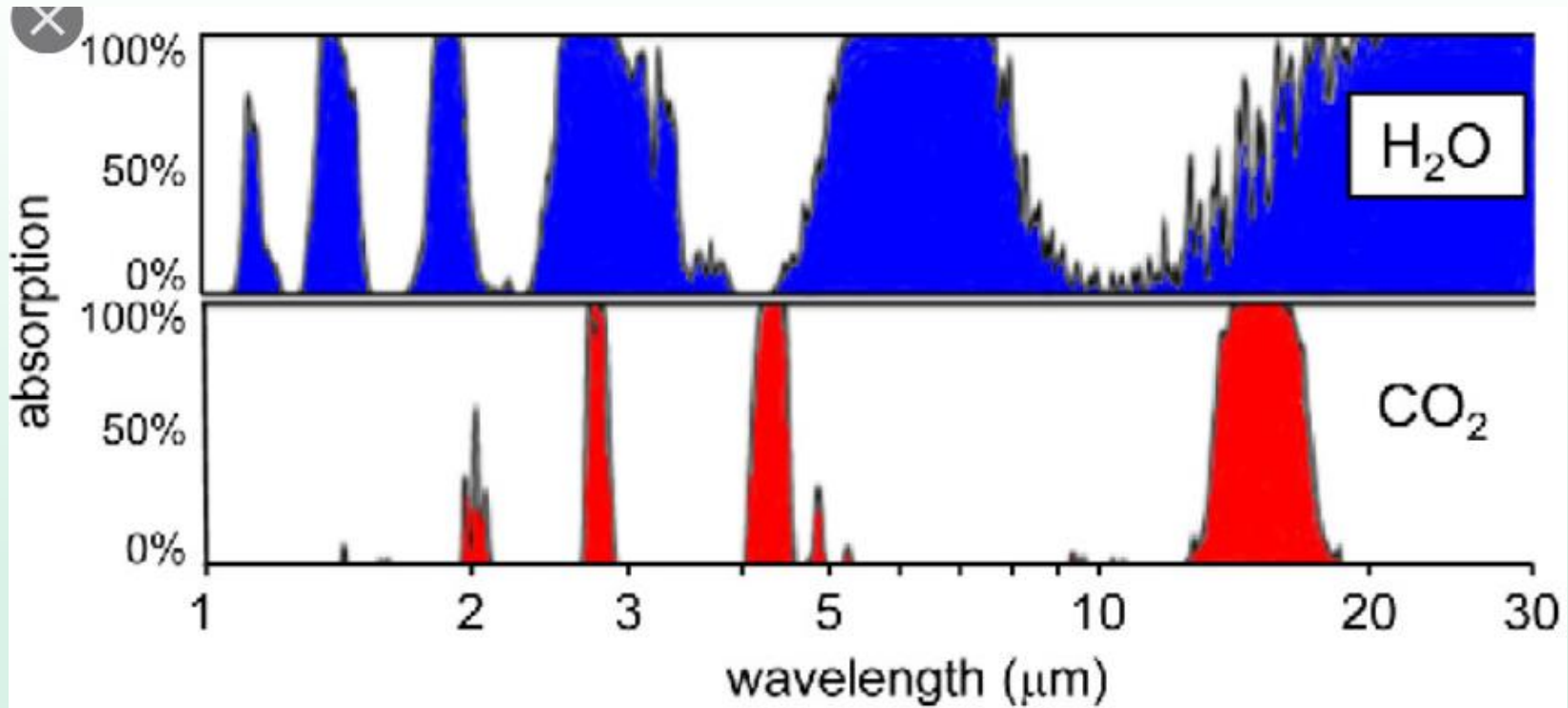


Example given 30 nm wide, 80% T, Blocking >OD 3

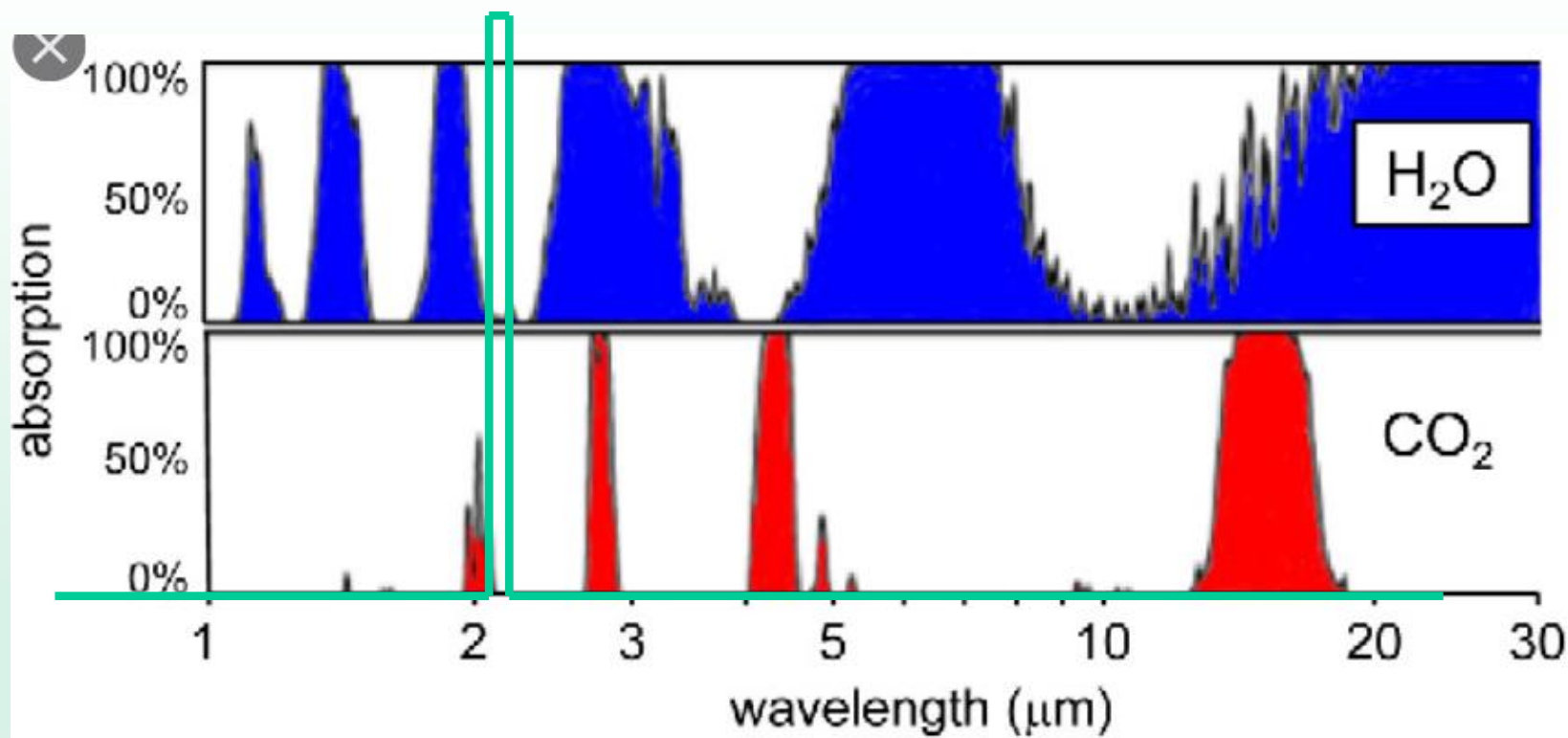
More Recently in SWIR and Near IR

- Bandwidth-10 nm wide +/-2.5nm.
- Centre Wavelength in SWIR +/-4nm
- 75% Transmission
- Blocking >OD 4

CO₂ Detection in SWIR avoiding water band!



CO₂ Detection in SWIR avoiding water band!



Agri-Applications of such filters...

- Adulterated/contaminated foods
- Ripeness of crops/fruit
- Diseases and Early Pest detection in crops
- Farming efficiency, e.g. Reduce Fertiliser use.
- Others...it grows by the month.
- **Detect any material with differences in reflection and transmission**
- **Needs careful measured IR spectra of target material to determine a fingerprint to 'hang the filter'**

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The Epic questions.....

- What we can do for you ?

Work with you to make your detection dreams a reality! Particularly the newer challenges!

What the community can do for us ?

‘Productionising’ lower cost detectors for 1-5um would be a game changer



Thank you for your attention!

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