

Introduction to Optical Gas Imaging

PIOGA Air Quality Compliance Training

October 12, 2017



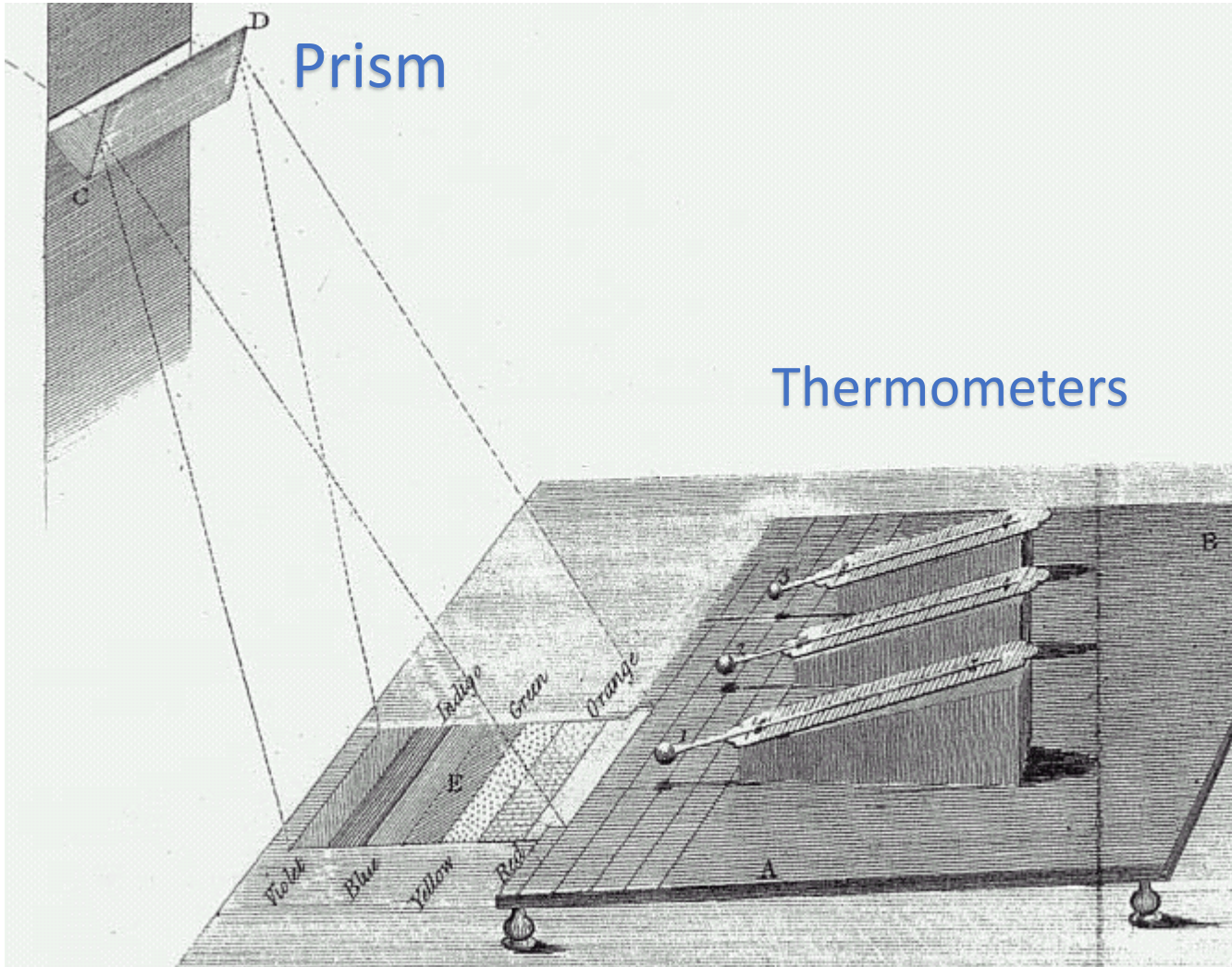
What is Infrared Spectroscopy and how is it used for OGI?

Frederick William Herschel (1738 – 1822)



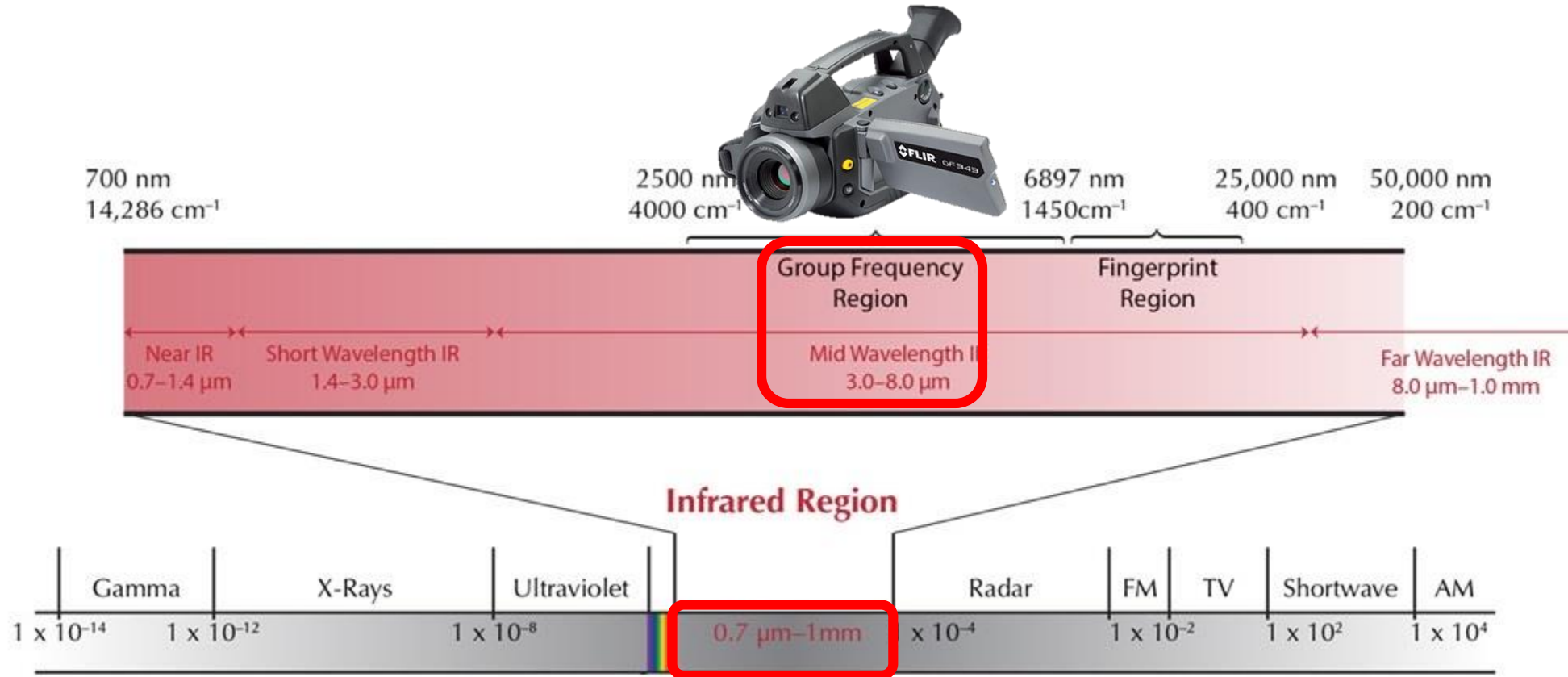
- German-born British Composer, Mathematician and Astronomer
- Built several telescopes in his backyard
- Discovered the planet Uranus in 1781
- Defined IR spectroscopy as the “measurement of light absorption in the infrared”

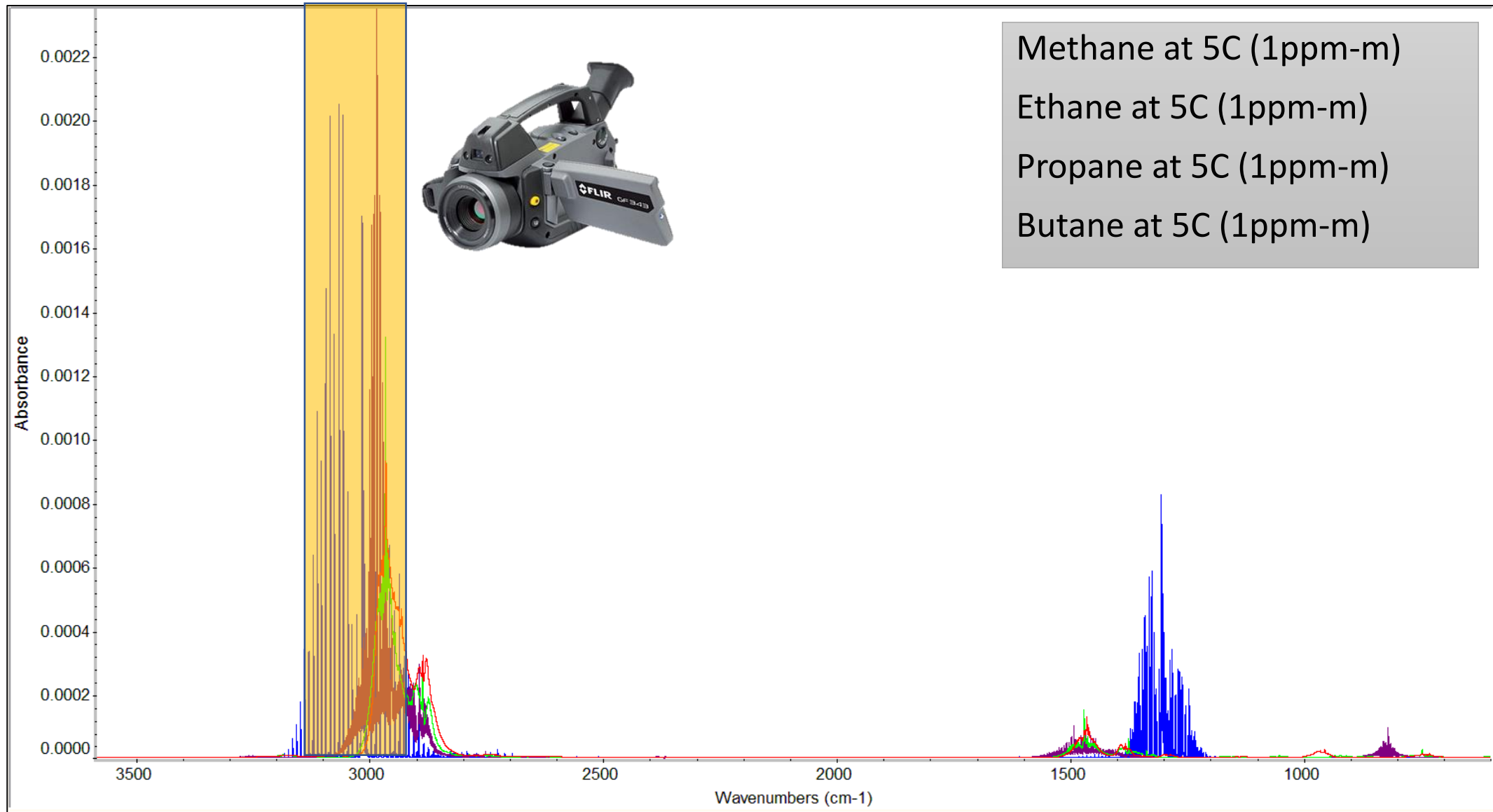
Herschel Experiment (March 1800)



- IR radiation can be felt, but not seen by the human eye.
- The absorption of IR radiation transfers energy and heats the surface (blackened thermometer).

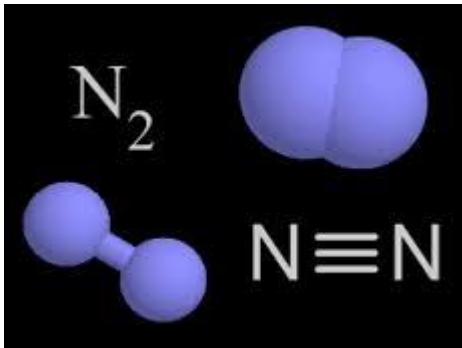
FLIR GF320: 3.2 – 3.4 μm



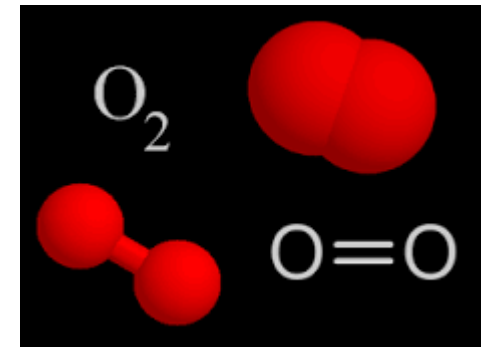
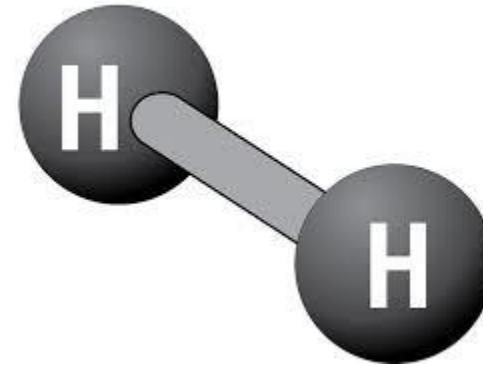


Are there any compounds that do not absorb in the IR?

- Homonuclear molecules



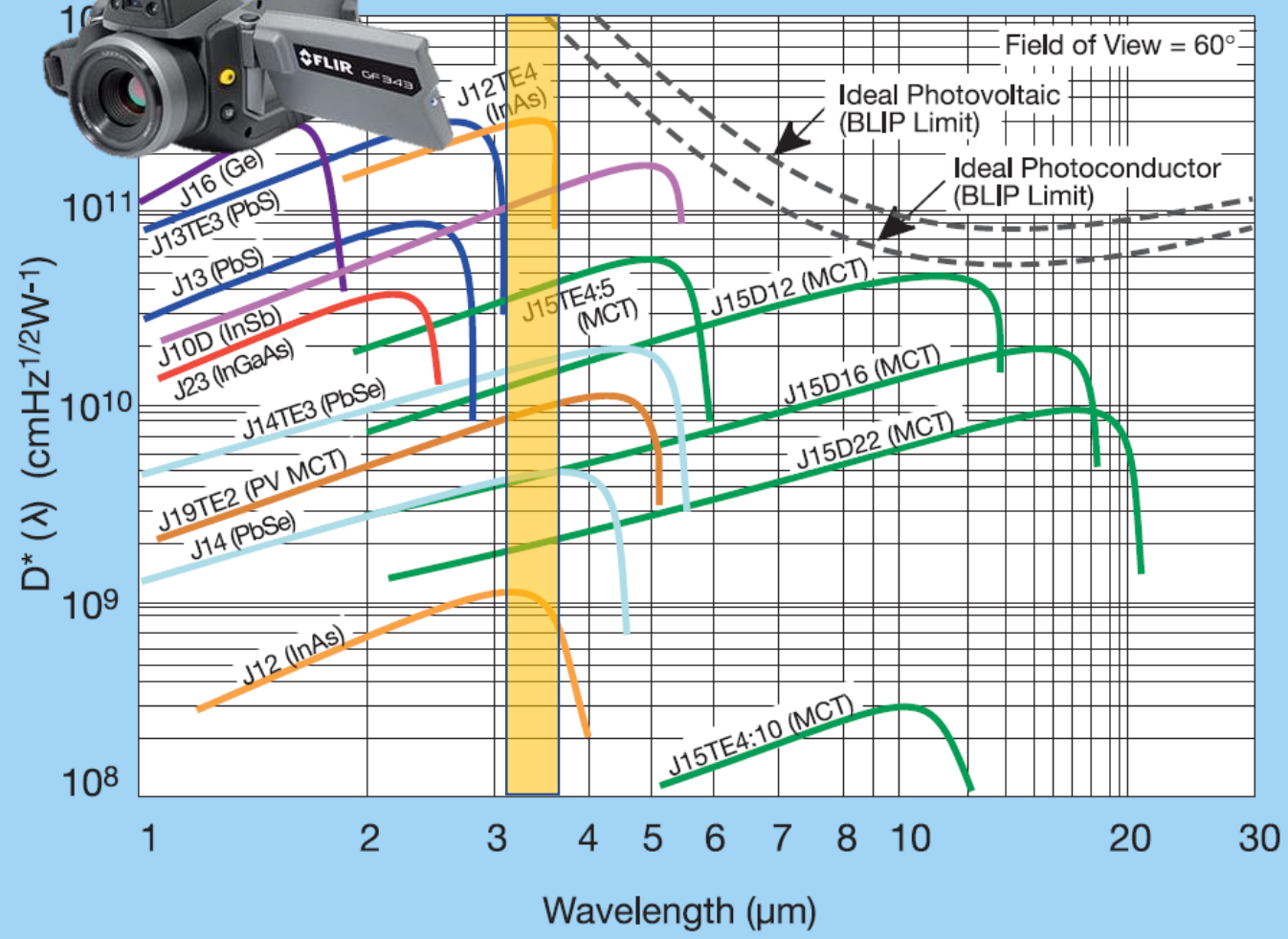
Hydrogen Molecule





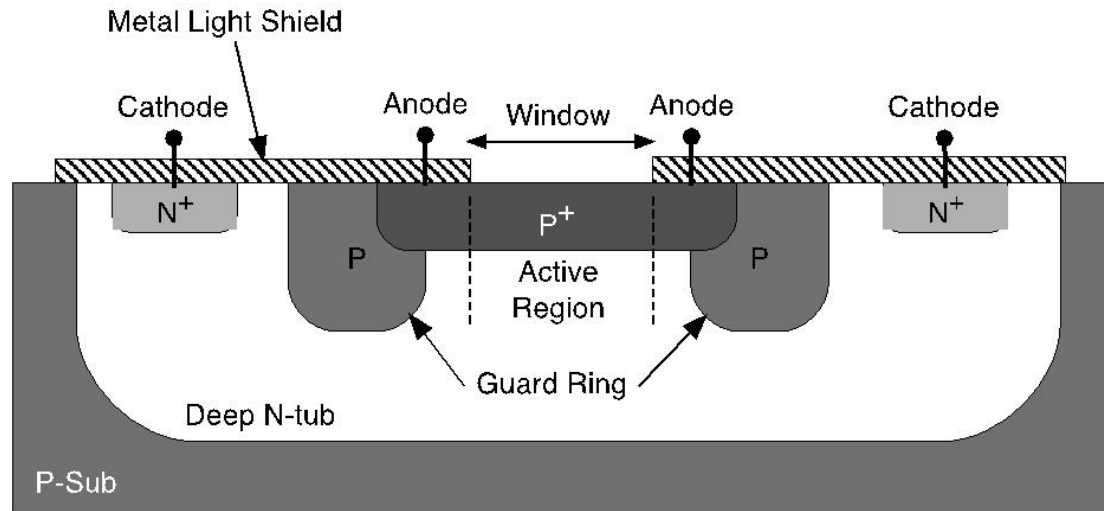
Infrared Detectors

Focused on Infrared



FLIR GasFindIR GF320

- Needs to be cryo-cooled using on board Stirling cooler
- Excellent performance in the 1 to 5.5 μm wavelength region
- Susceptible to IR overdrive damage



How do I determine whether my target gas
can be seen with the FLIR GF320?

FLIR to the rescue.



GAS DETECTION SYSTEMS

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Gases Detected and Minimum Detected leak rate (MDLR)

Independent laboratory (third party) testing confirms that the GasFindIR cameras can see the following gases at the minimum detected leak rate (MDLR):

- 1-Pentene - 5.6g/hr
- Benzene - 3.5g/hr
- Butane - 0.4g/hr
- Ethane - 0.6g/hr
- Ethanol - 0.7g/hr
- Ethylbenzene - 1.5g/hr
- Ethylene - 4.4g/hr
- Heptane - 1.8g/hr
- Hexane - 1.7g/hr
- Isoprene - 8.1g/hr
- MEK - 3.5g/hr
- Methane - 0.8g/hr
- Methanol - 3.8g/hr
- MIBK - 2.1g/hr
- Octane - 1.2g/hr
- Pentane - 3.0g/hr
- Propane - 0.4g/hr
- Propylene - 2.9g/hr
- Toluene - 3.8g/hr
- Xylene - 1.9g/hr

What if my target gas is not on the list?



President Obama Honors Federally-Funded Early-Career Scientists: Three NIST Researchers Among the Honorees



NIST Releases Update to Cybersecurity Framework



Busting Myths about the Metric System



NIST Chemistry WebBook

NIST Standard Reference Database Number 69

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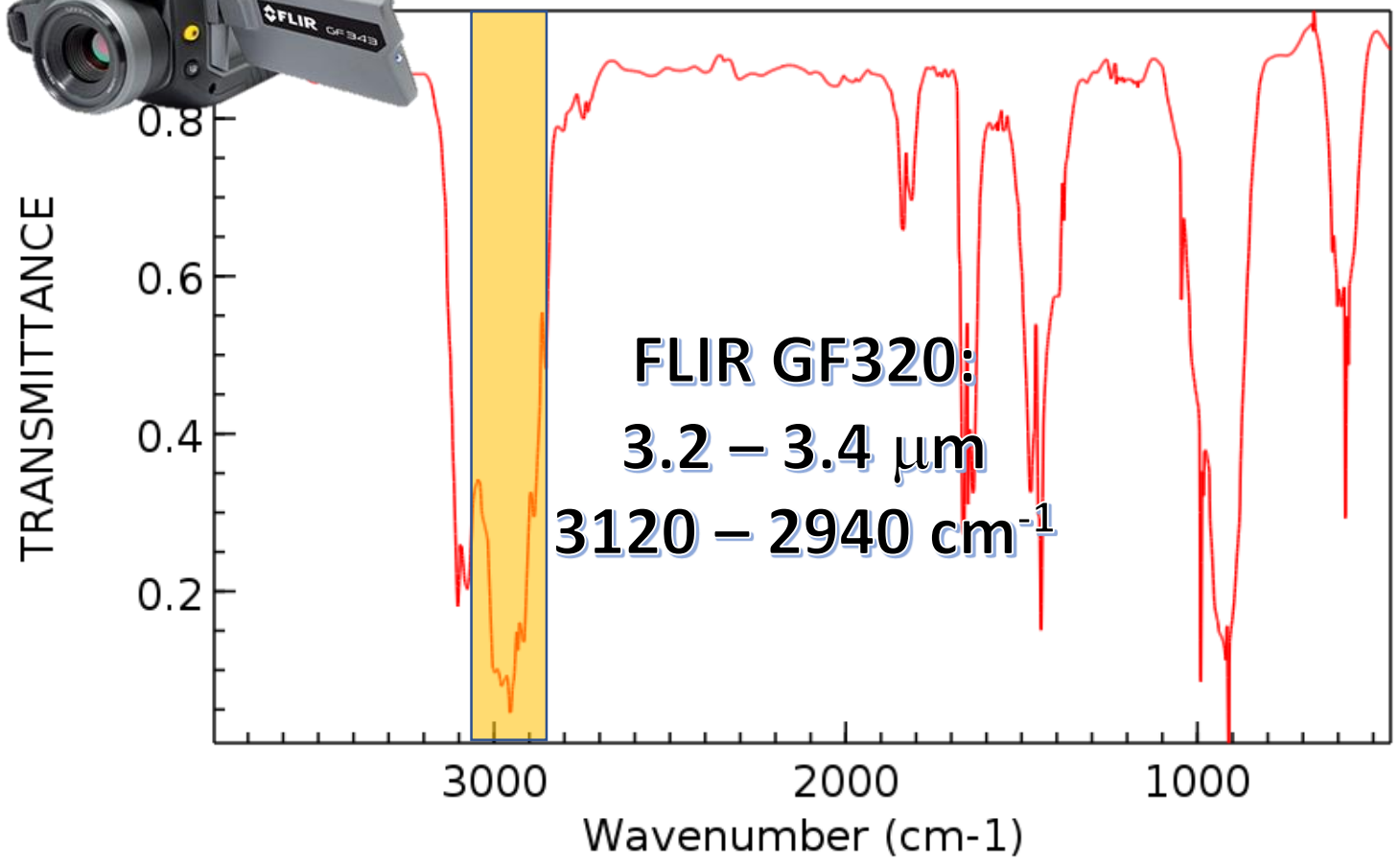
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Physical Property Based Searches

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Propene INFRARED SPECTRUM



NIST Chemistry WebBook (<http://webbook.nist.gov/chemistry>)

General Warnings



- Do not point the camera at any object that has surface or reflected temperature in excess of 662 °F (350 °C)
- Do not point the camera at the sun

Conclusion



- Knowledge of basic thermographic principles can be a valuable advantage in OGI
- Use the NIST website as a reference for detectability

Additional Resources

- NIST: webbook.nist.gov/chemistry
- ITC: www.infraredtraining.com
- Federal Register:
www.federalregister.gov/documents/2006/04/06/E6-5005/alternative-work-practice-to-detect-leaks-from-equipment
- FLIR: www.flir.com/ogi/

