Klar Scientific

Klar Mini Pro Microscope

Your personal instrument for photoluminescence (PL) spectroscopy
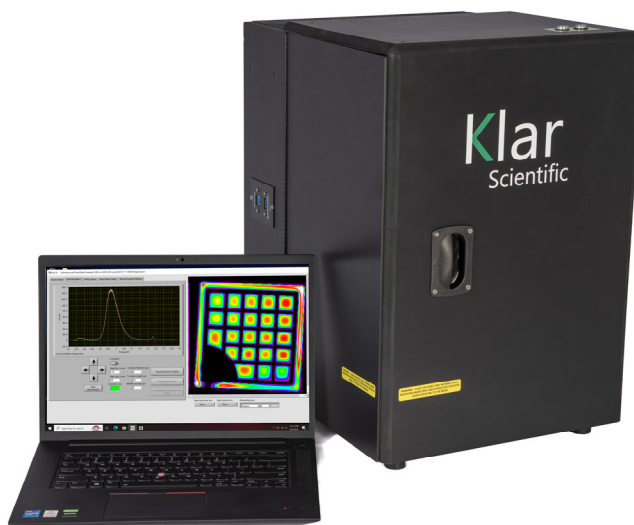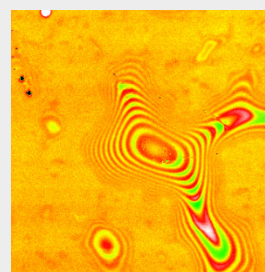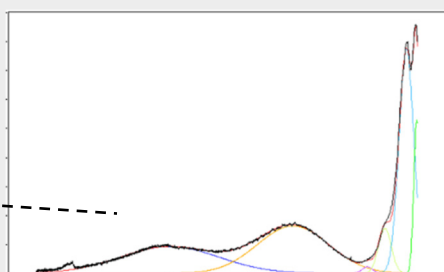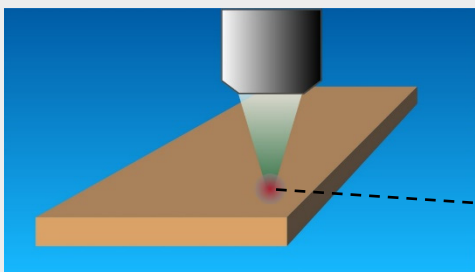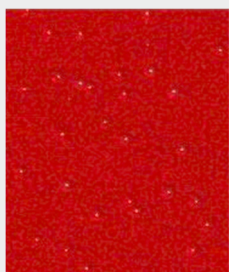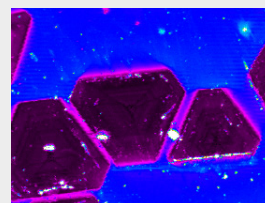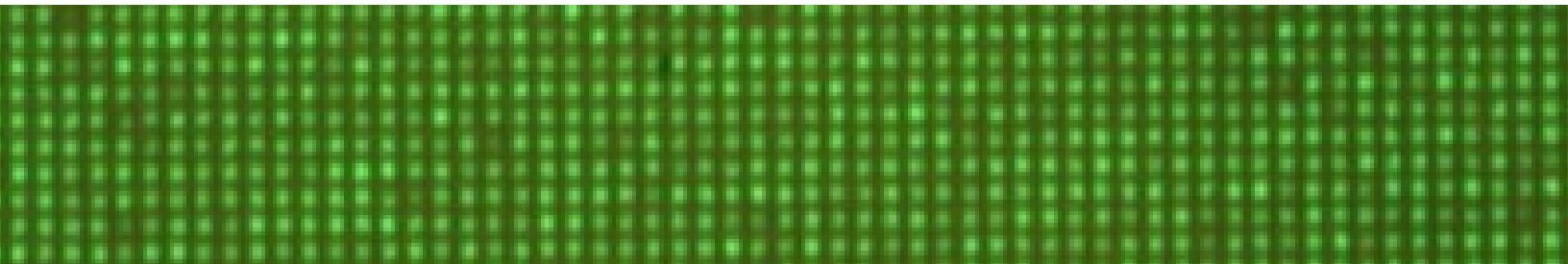
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A spectroscopic microscope for materials analysis

PL microscopy – upgradeable to meet your needs

The **Klar Mini Pro** microscope is a compact, affordable instrument designed for scientists who need spectral information with high spatial resolution.
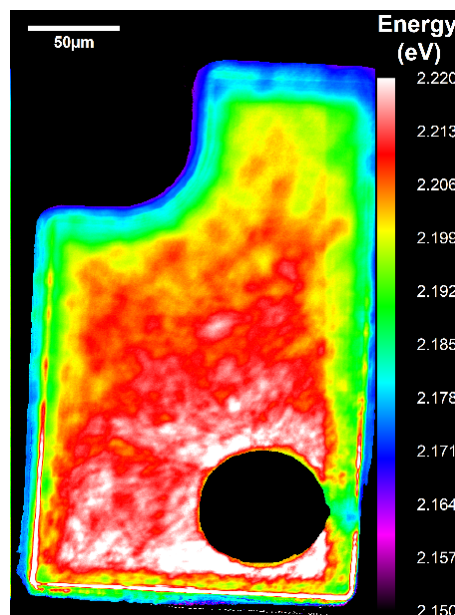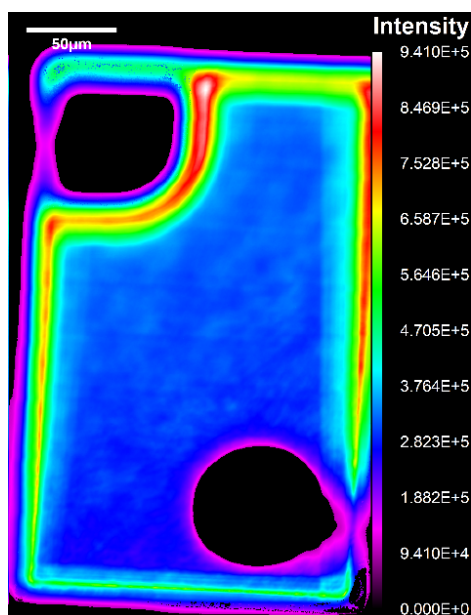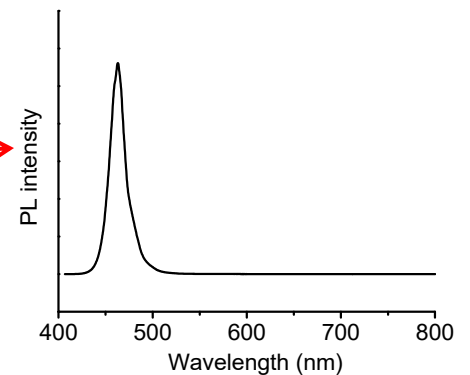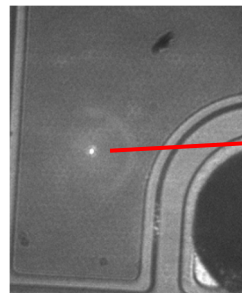
Mini Pro focuses a laser on the sample and a spectrometer collects the emitted light. The sample is scanned and PL spectra are obtained at each (x,y) point. The objective is adjusted in the z direction to maintain focus.

Millions of spectra can be taken this way. Analysis software rapidly determines the peak energy and intensity for each spectrum. This results in physically meaningful images with outstanding resolution and contrast.

The modular design enables researchers to quickly change wavelength ranges and experimental setups. In addition to PL, the microscope can be easily configured to take Raman and reflectivity spectra.

Highlights

- Laser excitation 266–980 nm
- PL spectral range 200–1700 nm
- Submicron in-plane resolution
- Millions of spectra can be collected
- Fast peak-fitting software
- Compact (~1 sq ft)
- Enclosure insulates microscope from temperature variations, dust, light
- Affordable

Applications

- Defect identification in light-emitting diodes and lasers
- PL mapping of wide-bandgap semiconductors
- Luminescence of 2D materials
- Compositional analysis of semiconductor alloys
- Failure analysis and quality control

PL maps of a green LED showing the intensity and peak energy of a defect emission. The measurement was taken through an epoxy bump.

One microscope, many wavelengths

The Mini Pro's universal optical design allows the owner to expand capabilities with user-replaceable wavelength kits.

- Spectroscopy from the near-IR to the deep-UV (1700 – 266 nm).
- Change kits in 5 minutes or less.
- Custom kits available – contact us for info.

Capabilities:

- Photoluminescence
- Raman
- X, Y, Z scanning
- Electroluminescence
- Low temperatures

GaN HEMT structure
Excitation = 349 nm

T = 80 K

PL intensity

Wavelength (nm)
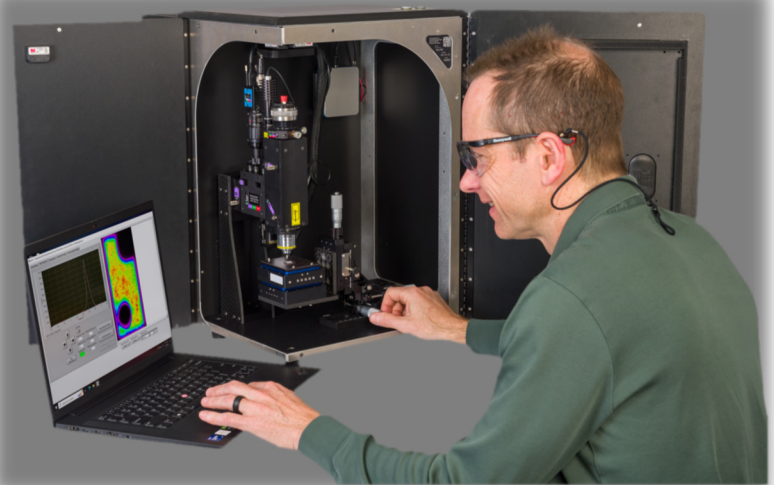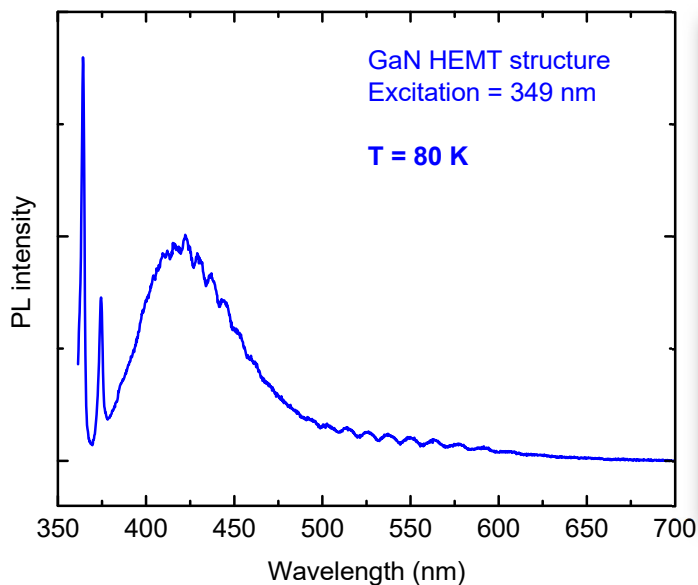
PL spectrum taken with the low-temperature kit.

GPU-accelerated analysis

*A PL map consists of lots of data – each x,y point has a spectrum. **Klar Fit** uses GPU-accelerated peak fitting to analyze spectra quickly. Millions of spectra can be fit in under an hour.*
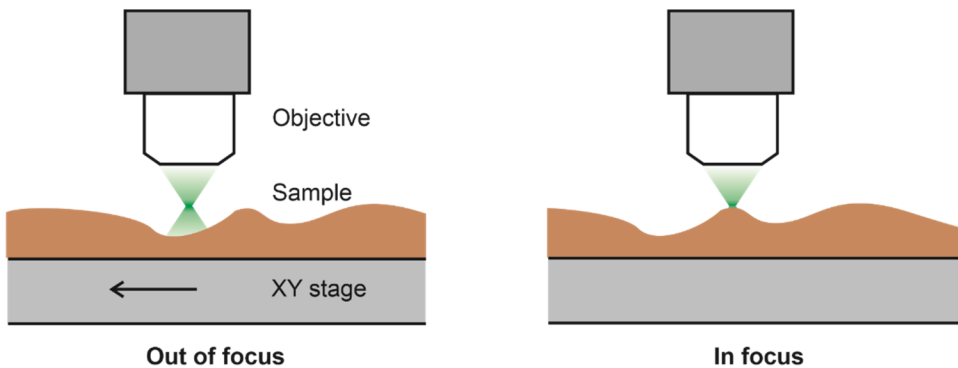

False color image plots a parameter for the selected peak (e.g., energy in eV).
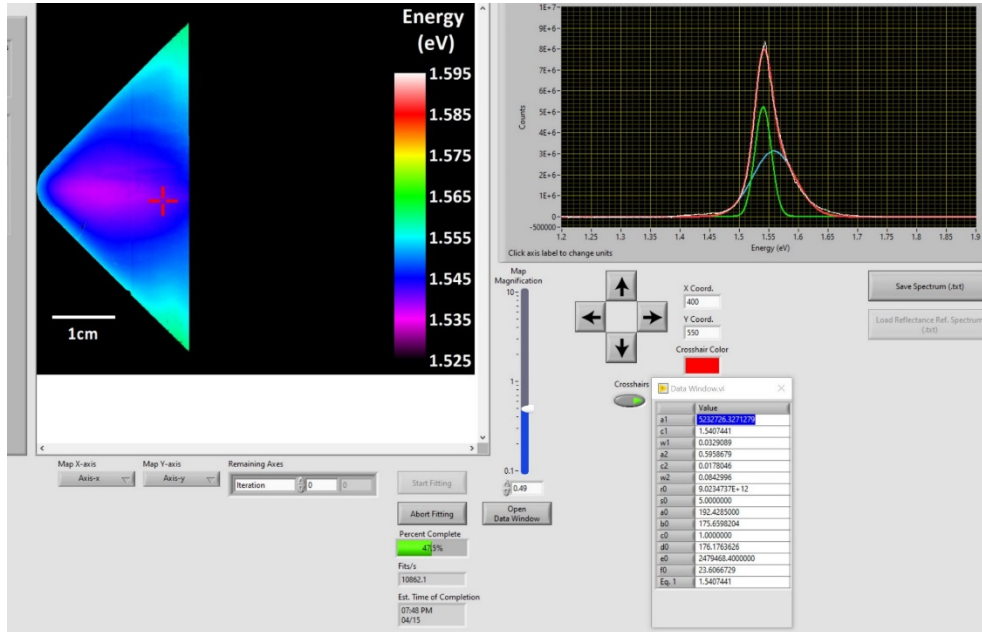
Multiple peaks can be fit with standard or user-defined functions.

Cadmium Zinc Telluride
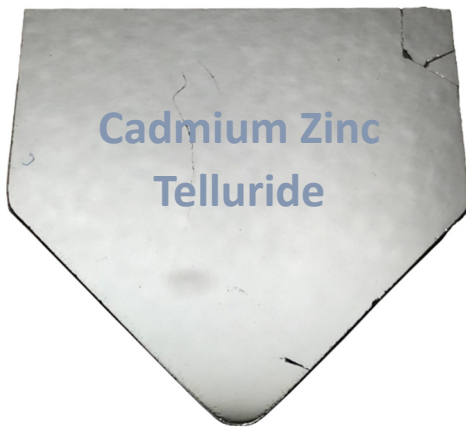
Peak analysis can reveal properties like composition. The figure on the right shows Zn content variations in CdZnTe.

Objective

Sample

XY stage

Out of focus

In focus
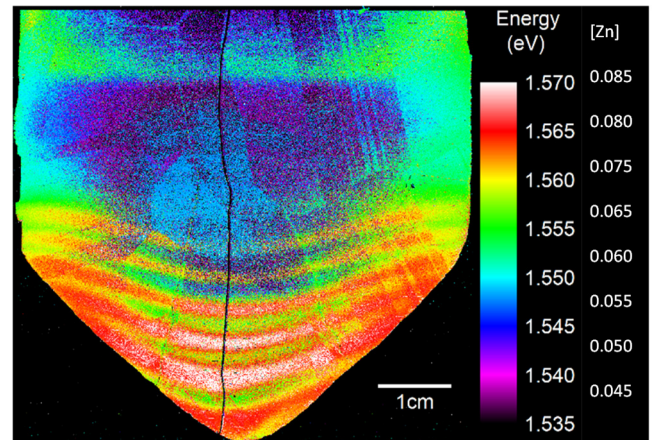
Klar's patented **autofocus** technology keeps the laser spot focused on the sample, even it the surface is rough, tilted, or bowed.

PL and Raman with the same instrument
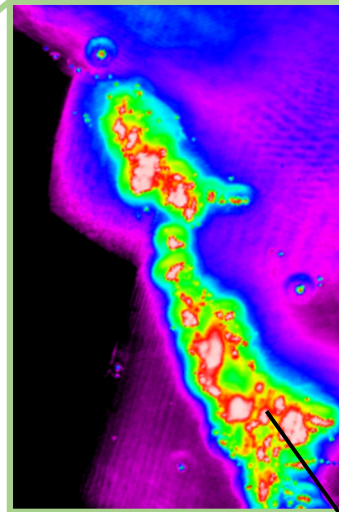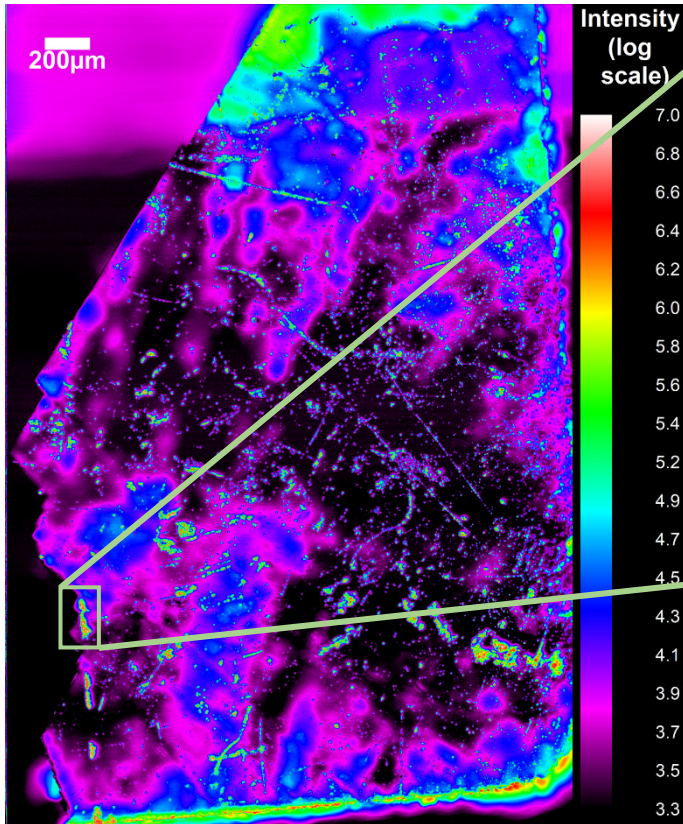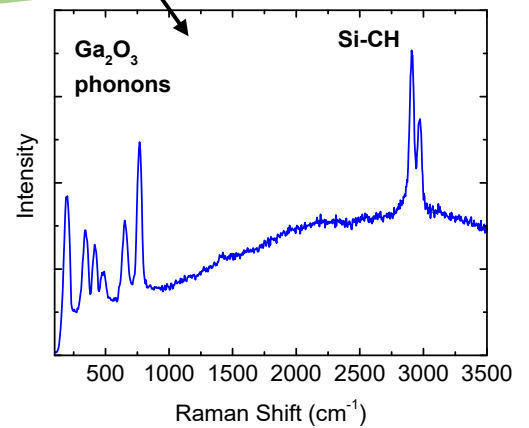
Obtain PL or Raman maps with high spatial resolution over a large sample area.

Raman spectroscopy was performed on a UV emitting region and Si-CH contaminants were discovered.

From "Photoluminescence and Raman mapping of β-Ga_2O_3," AIP Advances (2021).

PL mapping revealed defects on gallium oxide. From "Localized UV emitters on the surface of Ga_2O_3," Scientific Reports (2020).
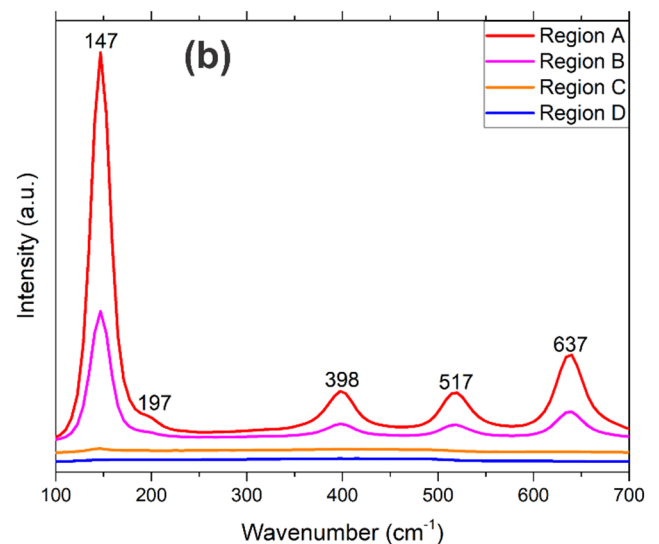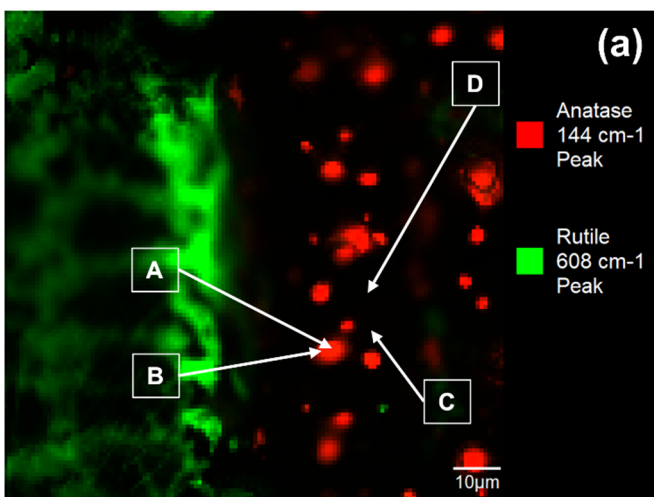
(a) Raman map of titania with regions of anatase, rutile, and amorphous phases. (b) Raman spectra of selected regions. From "Localized phase transition of TiO_2 thin films induced by sub-bandgap laser irradiation," J. Vac. Sci. Tech. A (2021).

Specifications

| Specifications	
In-plane resolution (405 nm excitation)	Laser spot radius is 0.35 µm for a 50x, NA 0.75 objective. Collected area is determined by the fiber diameter.
Sample XY scanner	5 or 10 mm travel range, 20 nm repeatability
Objective Z scanner	400 µm travel range, 5 nm repeatability
Acquisition time	At 10 ms integration time per spectrum, 100 µm × 100 µm, 0.5 µm step size: 6 min 5 mm × 5 mm, 50 µm step size: 2 min 5 mm × 5 mm, 5 µm step size: 3 hr
Sample inspection	LED, monochrome camera
Software	Klar Spec acquisition, Klar Fit peak fitting and analysis
Electrical	120 V, 60 Hz input, USB 3.0 data connection
Dimensions and weight	43 cm × 38 cm × 58 cm, 14 kg (17 in x 15 in x 23 in, 30 lbs)
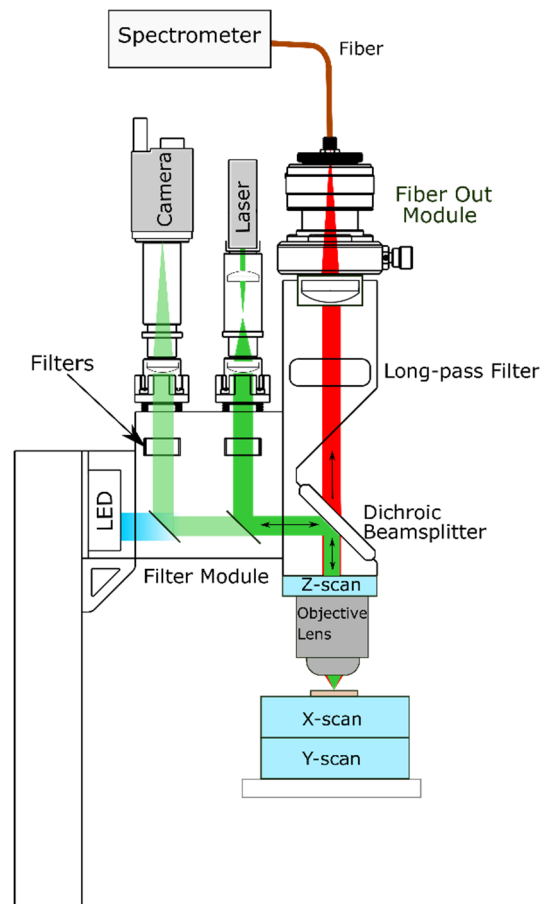
Wavelength kits are supplied as ready-to-use modules that require minimal setup. Custom kits and spectral ranges are available. Ocean spectrometers provide superb sensitivity.

Near IR	
Excitation source	975 nm laser, 30-100 mW
Spectrometer	NIRQuest+, 900-1700 nm

Near IR, Raman	
Excitation source	785 nm laser, 250 mW
Spectrometer	QE Pro, 100-2800 cm^{-1}

Red	
Excitation source	635 nm laser, 1-2 mW
Spectrometer	Maya Pro, 635-1060 nm

Green	
Excitation source	532 nm laser, 4-5 mW
Spectrometer	Maya Pro, 532-960 nm

Green, Raman	
Excitation source	532 nm laser, 30-140 mW
Spectrometer	QE Pro, 90-4000 cm^{-1}

Violet	
Excitation source	405 nm laser, 1-2 mW
Spectrometer	Maya Pro, 405-840 nm

Near UV	
Excitation source	349 nm laser, 0-20 mW
Spectrometer	Maya Pro, 349-780 nm

Deep UV	
Excitation source	266 nm pulsed laser, 5 mW average power
Spectrometer	Maya Pro, 266-700 nm
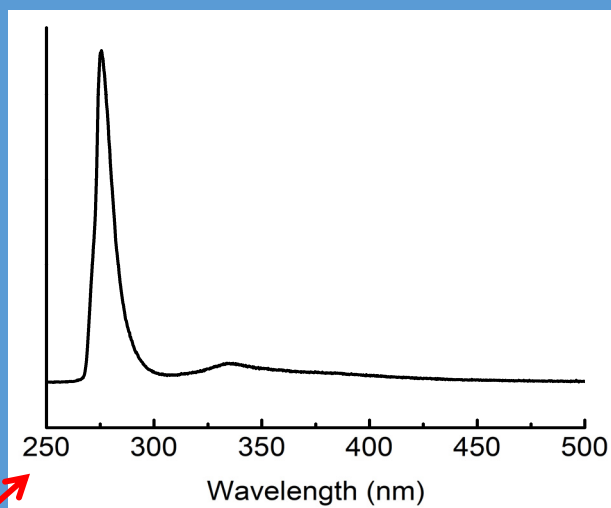
Spectroscopy from near-IR to deep-UV

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