Universal VUV Spectrophotometer

McPherson presents unique systems to meet the requirements researchers across the world. McPherson's Universal VUV Spectrophotometer is a versatile system optimized for Phosphors, but also Reflectance, Transmission or Fluorescence.

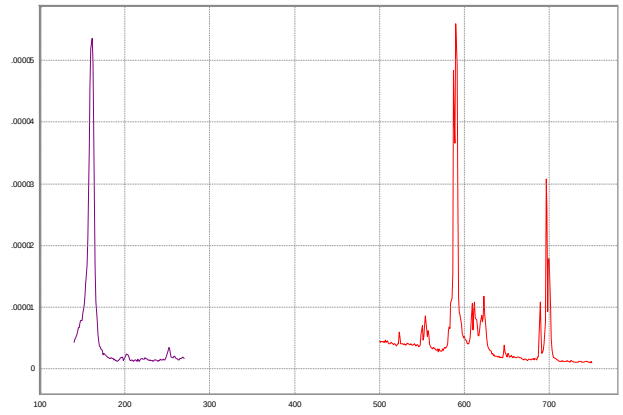
Spectral Emission, Excitation and Luminescence Measurement ~ Optical Characterization

- 120 to 1800nm wavelength range
- 5 sample positions
- Lifetime / Persistence measurement capability
- PMT (optionally cooled) with signal recovery
- Tunable monochromatic Excitation
- Tunable monochromatic Emission - optional CCD

VUV (120 nm - Visible) Excited Phosphor System with VUV Emission (120 nm – Vis)

The McPherson VUV Spectrophotometer is designed for Transmission, Reflection and Emission measurements across a broad wavelength range. The system has a usable wavelength range of 115nm to 930nm - this can be expanded deeper into the Extreme UV or into the IR with addition of sources and detectors.

Interchangeable sample holder(s) accept five 25mm diameter samples in the emission, transmission and reflectance positions. Samples can be indexed under vacuum. The optical, electrical and pumping systems are built into the supporting table for easy transport and set up. The computer sits on a separate table. All cables and lines are quick disconnecting type, labeled for easy set up.



110 – 750 **nm**

Example Excitation/Emission Data: Eu phosphor

Excitation and Emission

The excitation source is either a 30W or 150W CW Deuterium lamp with Magnesium Fluoride (MgF2) window. The lamp window seals the instrument vacuum vessel and all emitted wavelengths from about 120nm to 380nm can be used for excitation. The discrete excitation wavelength is selected by an optimized Vacuum UV McPherson Model 234/302 high through put 200mm scanning monochromator. Monochromatic excitation energy is collected and focused to the sample position. Alternate means of excitation are possible by use of accessory ports in the sample chamber, Excimer laser or x-ray sources for example.

Emission spectrum is detected with a McPherson Model 218 high resolution 300mm scanning monochromator. It can scan from 105nm to far IR spectral region. If emission spectra are always >200nm, we substitute a Model 2035 high resolution scanning spectrometer. The sample emission is collected and focused to the entrance slit. Many types of solar blind and/or cooled photomultiplier detectors can be fitted to the exit as can CCD or intensified CCD detectors.

When measuring reflection or transmission the excitation and emission monochromators can be scanned synchronously or one can be positioned at zero order. Scanning both instruments with an offset to reject fluorescence is also possible.

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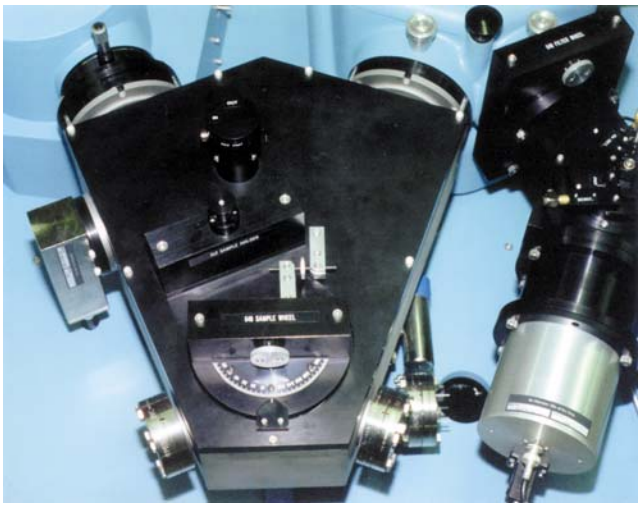
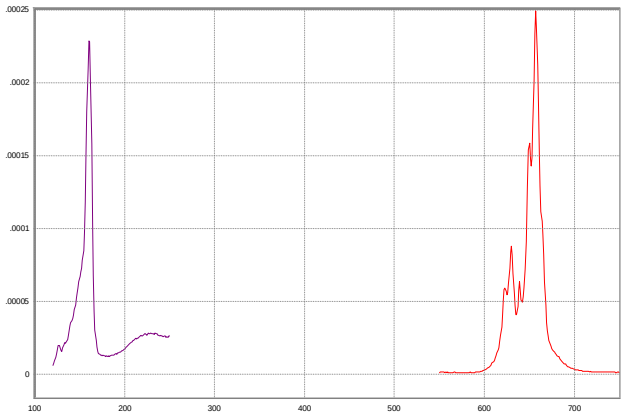


Top View of Sample Chamber



110 – 750 **nm**

Example Emission Data: Emission of red phosphor

Mounting Samples Optics in the sample chamber focus the energy from the excitation monochromator. The focused energy is transmitted through or reflected off the samples within the chamber and refocused into the emission monochromator. The sample chamber has two sample holder positions, a transmission position and a reflectance/emission position.

The transmission position places the samples normal to the excitation beam, a first surface mirror must be placed in the reflectance/emission position during transmission measurements.

The reflectance/emission position places samples in the beam focus and allows the samples to be rotated with respect to the excitation beam angle of incidence. This angle adjustment can be used to exclude the specular component when measuring fluorescent or diffuse samples. The angle adjustment can also be used to optimize the signal when measuring glossy samples such as mirrors or wafers. Emission signal collection optics can be tuned to optimize light collection and focus at the emission monochromators entrance slit while under vacuum.

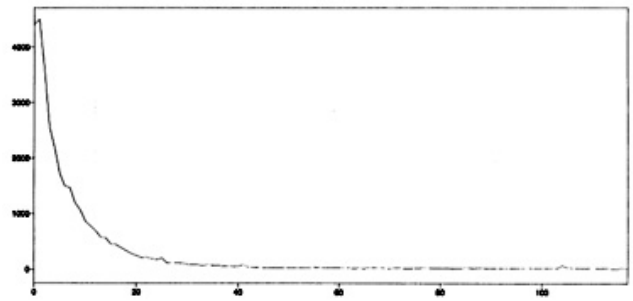
Standard Specifications

Vacuum UV Optical Characterization System	
Excitation Wavelength(s)	Discrete bands selectable from 120 to 380nm using Vacuum Monochromator Model 234/302. Optional filter, excimer or laser sources.
Emission Wavelength(s)	Discrete bands measured from 120 to 1800nm with Vacuum Spectrometer Model 218, or, 185 to 1800nm + with Model 2035 Spectrometer. PMT for lifetime and scanning; optional CCD or ICCD for color and survey work
Sample Size	5 ambient temperature 25mm diameter samples, vertical mounting. Sample cups with window are available for powders.
Sample Environment	Ambient / Room temperature. Cryogenically cooled (single sample) - optional Heated (to 400deg C) (single sample) - optional

Application Example

Time Resolved Spectra / Lifetime

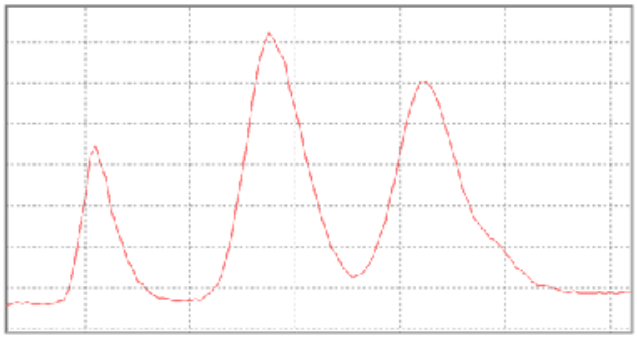
Set the vacuum ultraviolet spectrometer to desired Excitation wavelength. Set the Emission monochromator to 525 nm. Select a (green) emitting sample. Enter 525nm in the GO TO parameter field of the software and then presses GO TO. The monochromator will proceed to 525nm and data acquisition will commence. The McPherson systems use a SR430 Multi-Channel Scalar for measurement of lifetime / decay. The function generator DS335 is set to produce a trigger pulse. The trigger pulse from the DS335 function generator closes a shutter and starts acquisition by the SR430 Multi-Channel Scalar.



Application Example

Spectral Emission, Excitation Measurement

Set the vacuum ultraviolet spectrometer to desired Excitation wavelength. Set the Emission monochromator to SCAN from 350 to 600nm. Select a (green) emitting sample. The McPherson system uses a SR430 Multi-Channel Scalar for measurements during Emission wavelength scans. This mode will take the mean data value and record one data point per wavelength increment. Enter the desired wavelength BEGIN, END and INCREMENT values in software and then SCAN. The monochromator scan will commence and data acquisition will begin. The screen will update until all wavelength increments have been recorded.

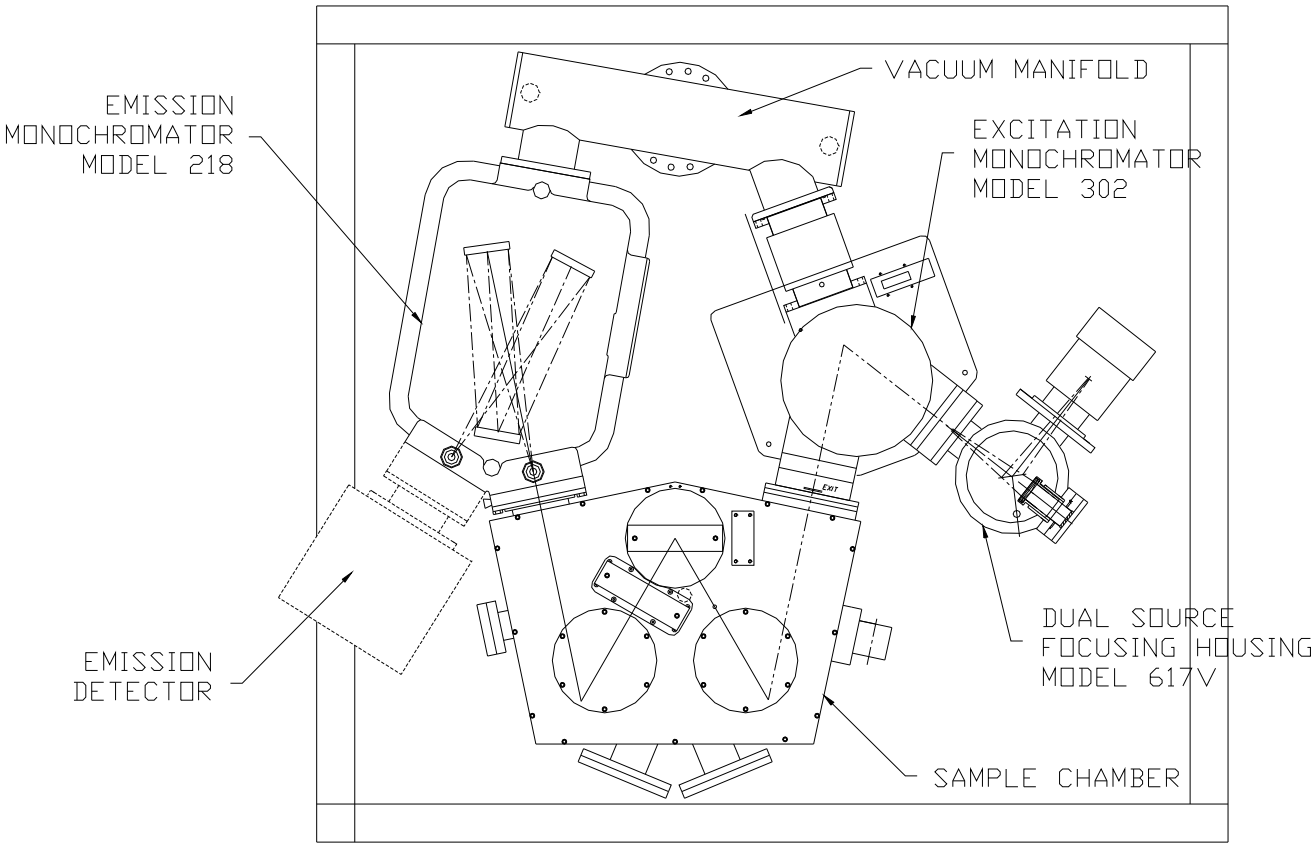


More Features

Reference Detector A small diverter mirror directs a small amount of energy from the excitation monochromator to a scintillated photomultiplier. This detector monitors the intensity of the excitation source. Stability information may be fed back into the data to eliminate source fluctuation from the data. Calibrated PMT detectors can be used in this position. The mirror can be switched in or out of the beam via a lever in the top cover of the sample chamber.

Vacuum Pumping System The system is safety interlocked and designed to shut down all pumps and vent the system in the event of a problem. The main components in the system are two 300 liter/sec turbo pumps backed by two scroll pumps. The vacuum is monitored by inverted magnetron and thermocouple gauges. The vacuum controller has several safety features to protect the system.

Easy to use software for data collection from sample and reference detectors is combined with our Spectrometer Control package. In addition to controlling the scan wavelength range, go to position and wavelengths for the spectrometers all features as used with detection equipment are also controlled. Easy to use, point and click, software for control of SRS400 photon counter, 430 5nsec multi-scaler averager, 830 lock-in amplifier, EG&G PAR 5209 lock-in amplifier, Keithley 4853 picoammeter and ADC16 has been developed and will work with any of our dual spectrometer systems.



Drawing for the Universal Spectrophotometer System with Vacuum Emission