

MICRO-PHOTOLUMINESCENCE FOR OPTOELECTRONIC MATERIAL CHARACTERIZATION

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Photoluminescence (PL)

- Luminescence is emission of photons
- Photoluminescence is a specific type of luminescence where the process is triggered by incident photons



ref [9]

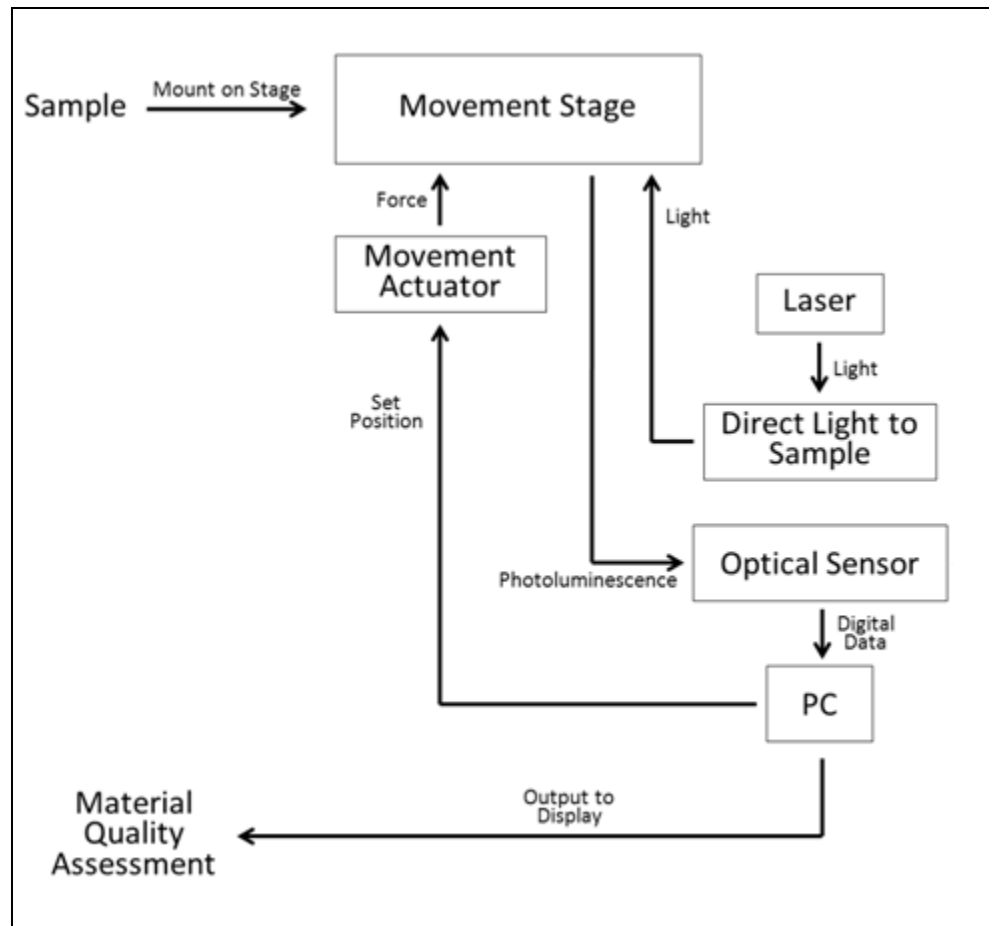
Photoluminescence (PL)

- PL Spectroscopy
 - Nondestructive method for material quality & electronic structure assessment
 - Useful for determining bandgap energy
 - PL amplitude is correlated with minority carrier lifetime
- Micro-PL
 - PL spectroscopy of sample over an area
 - Especially useful for identifying structural defects & profiles

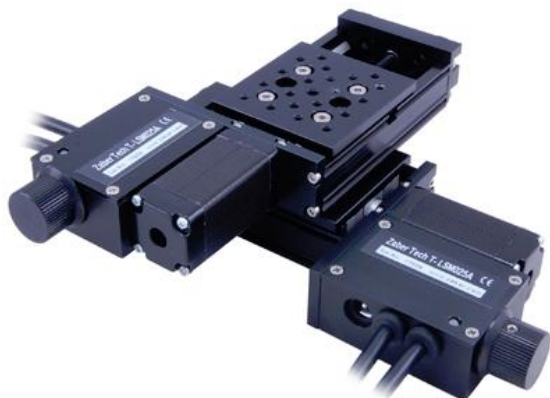


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Operational Description



Capabilities



ref [10]

- Dual axis movement stage
- 5 μm resolution
- 1 inch² range

- 0.5 nm resolution
- 350-1800 nm range

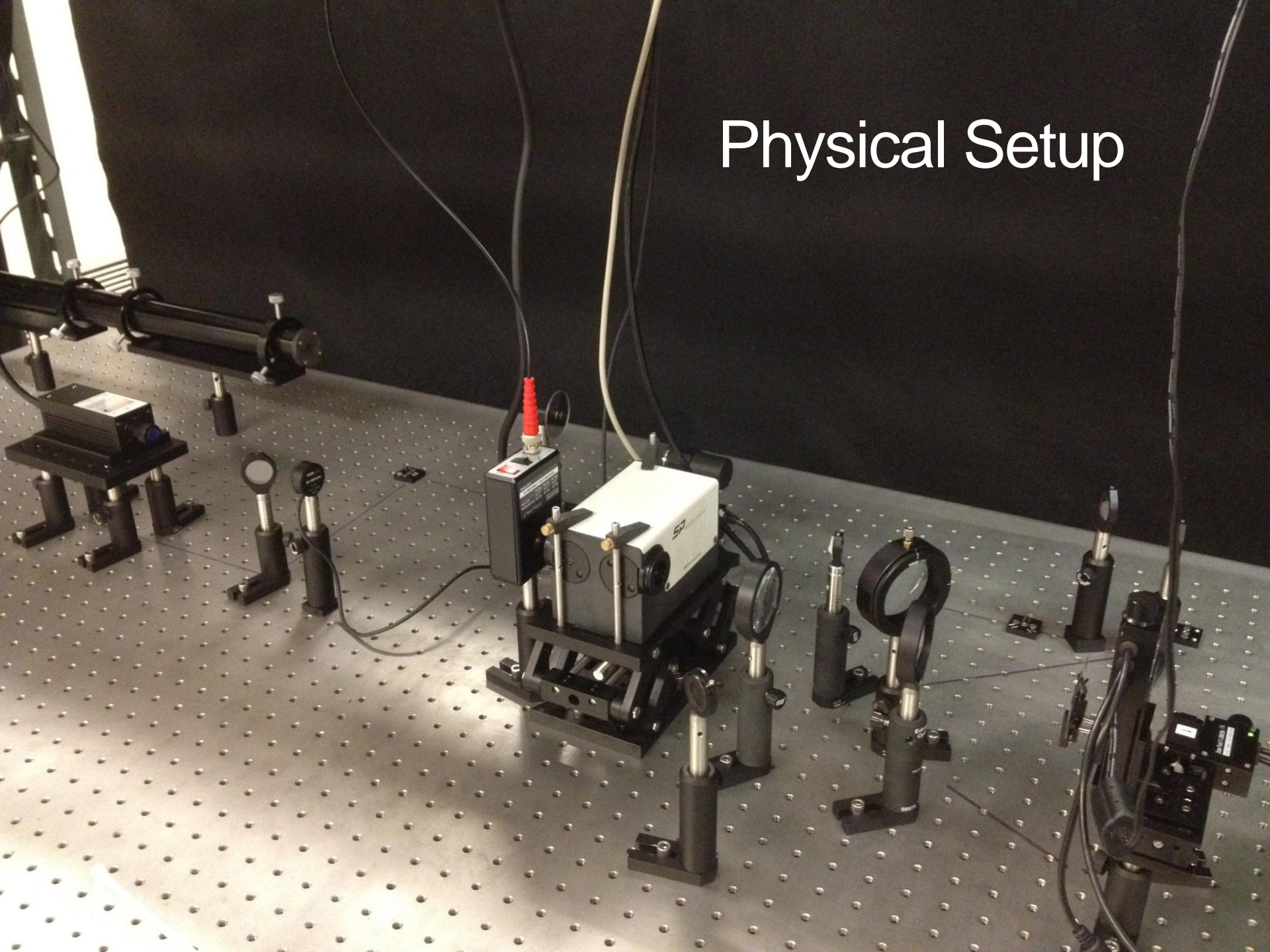


ref [11]



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Physical Setup



User Interface

Top (microsteps): 22627

Bottom (microsteps): 454688

Left (microsteps): 0

Right (microsteps): 392850

Buttons: Set Top-Left Corner, Set Bottom-Right Corner

Status: █

Use measurement count / Use step size:

Measurement count X: 19, Step size X (um): 1000

Measurement count Y: 21, Step size Y (um): 1000

TimeConst.: 20 ms

Slope: 24 db/Oct.

Frequency: 100.00

Baud Rate (9600): 9600

Input Gain: Normal

Number of Samples: 100

Initial Wavelength: 1090

Final Wavelength: 1150

Step Size: 5

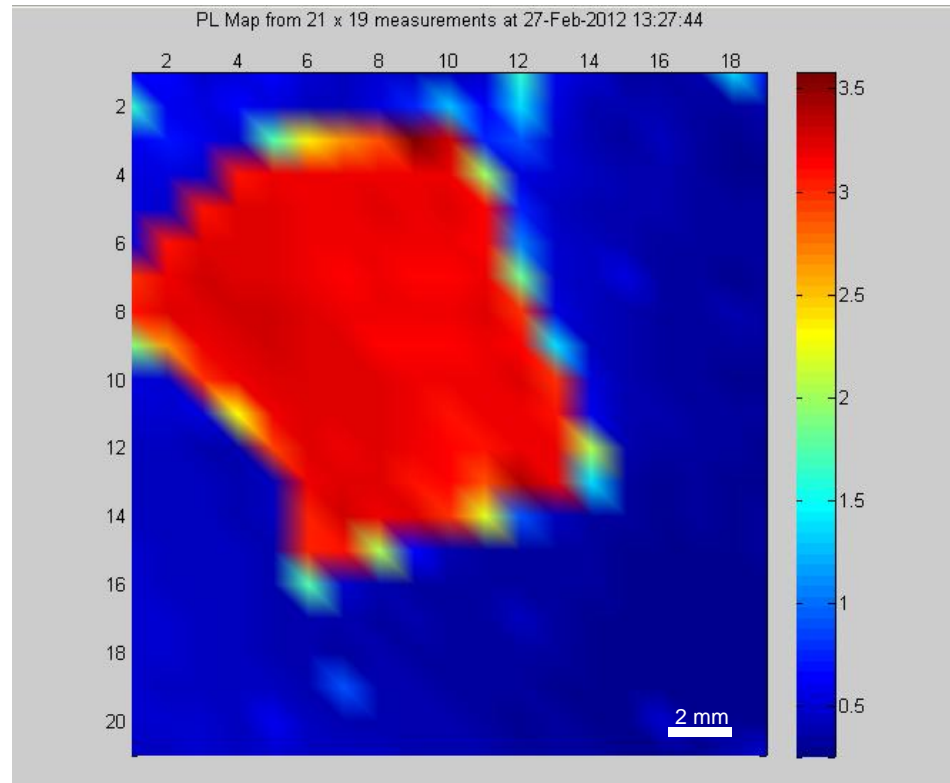
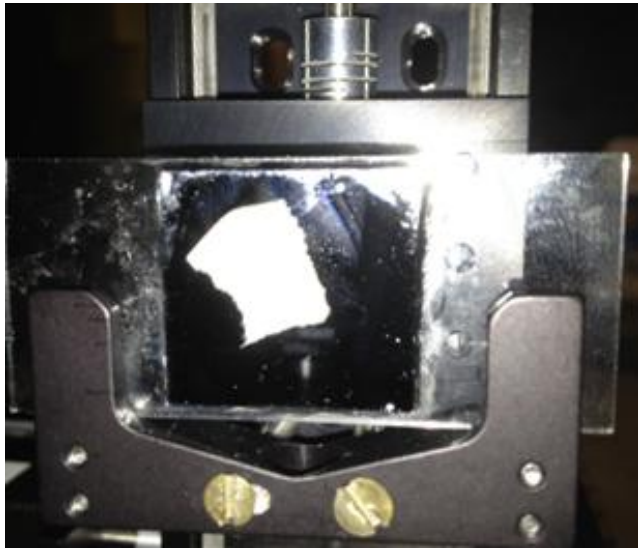
Sample Time (ms): 1000

Buttons: Calculate, Measure

Output Data to File?:



Preliminary Tests

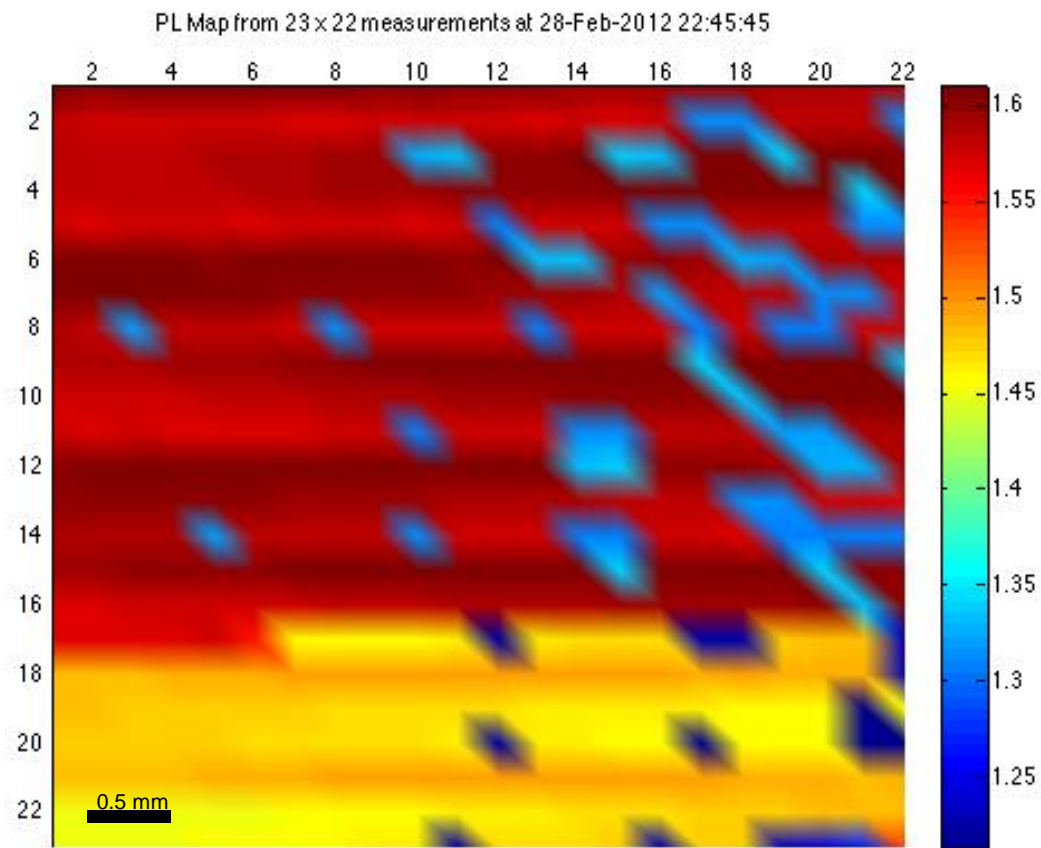


Si over 1090-1150nm



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Demonstration



GaAs over 820-835nm



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Conclusion

- Demonstrated proof of concept
- Slow measurements
 - 20x20 grid measurement requires 1.5 hours
- Moving forward
 - Obtain higher resolution maps of larger samples
 - Validate against samples with known defects
 - Determine normalization scheme for amplitude



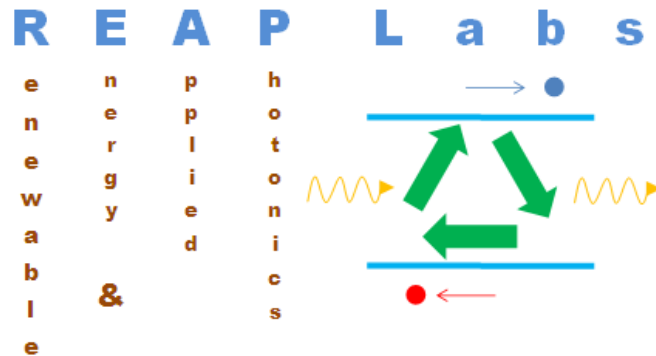
References

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http://www.spectralproducts.com/catalog/product_info.php?products_id=11/CM110_Compact_Monochromator.php



Acknowledgements

- Renewable Energy and Applied Photonics Labs



- Tufts University

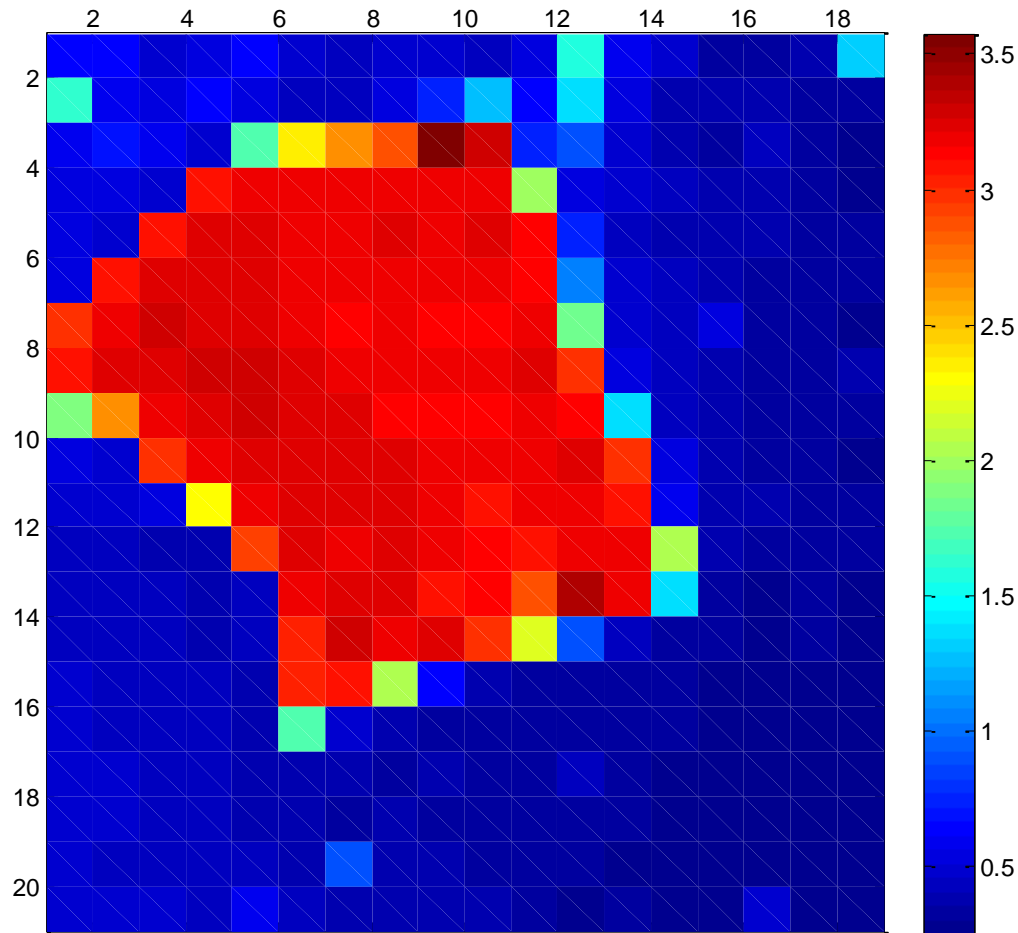


Extra Images



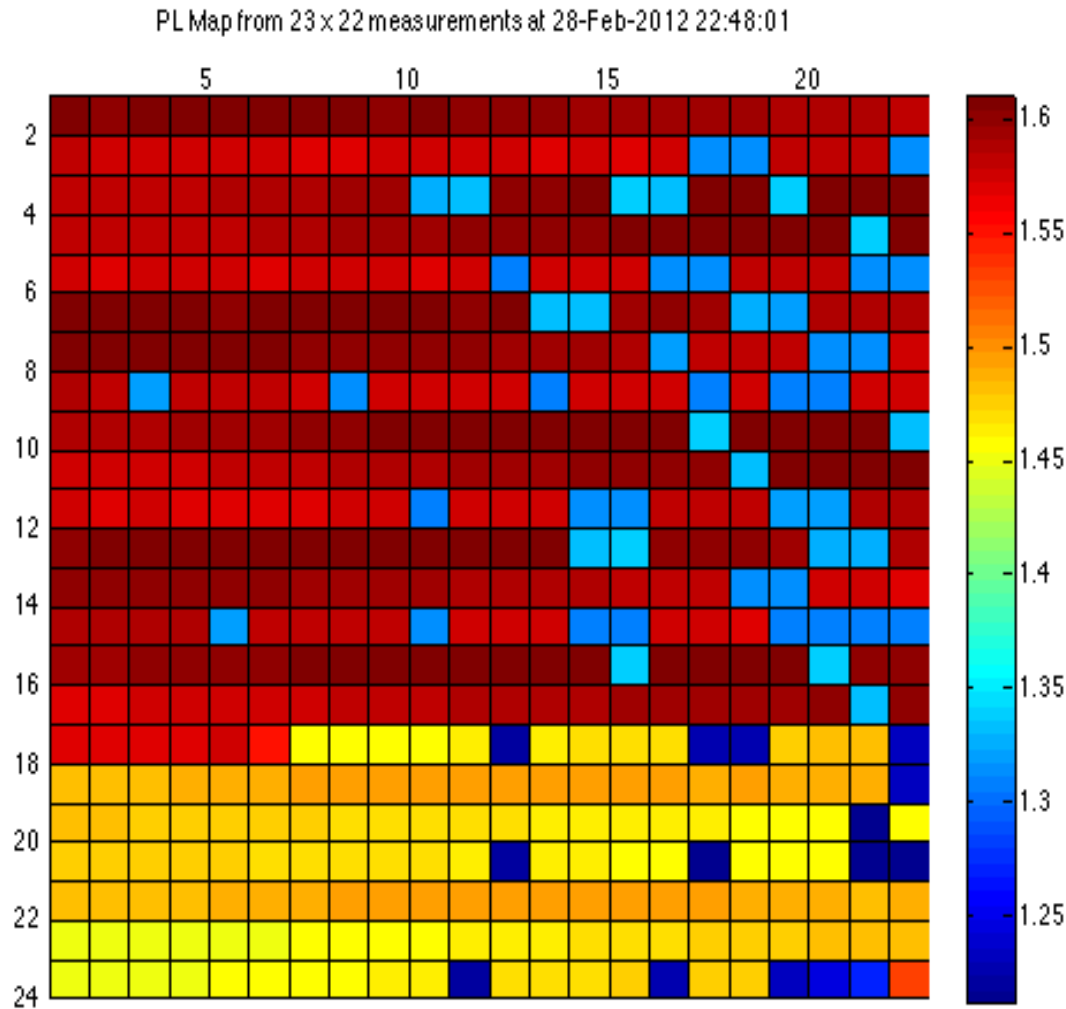
Si sample – non interpolated

PL Map from 21 x 19 measurements at 27-Feb-2012 13:27:44



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GaAs sample – non interpolated



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