

17th Photonics Workshop | Kopaonik, Serbia | 10-14.03.24

Josué R. León-Torres

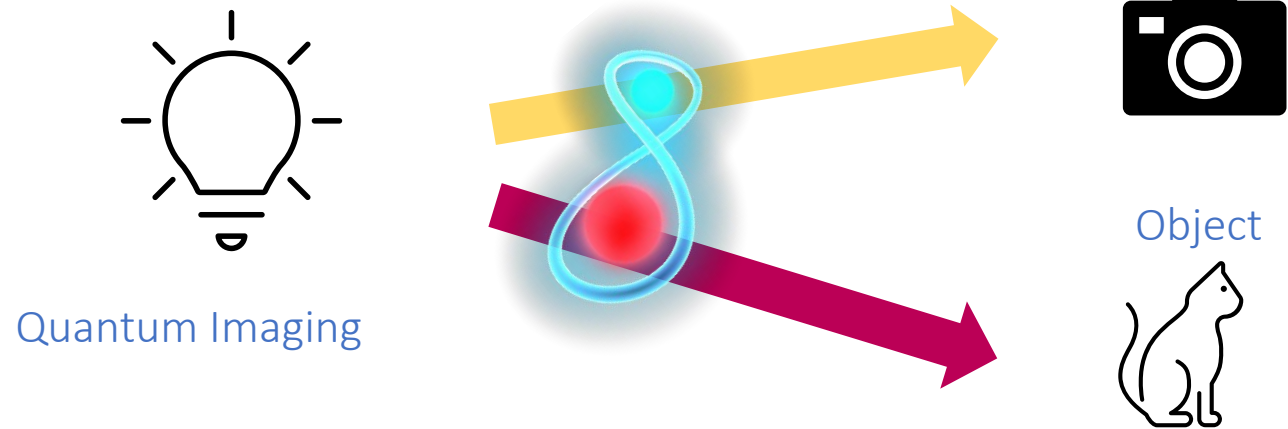
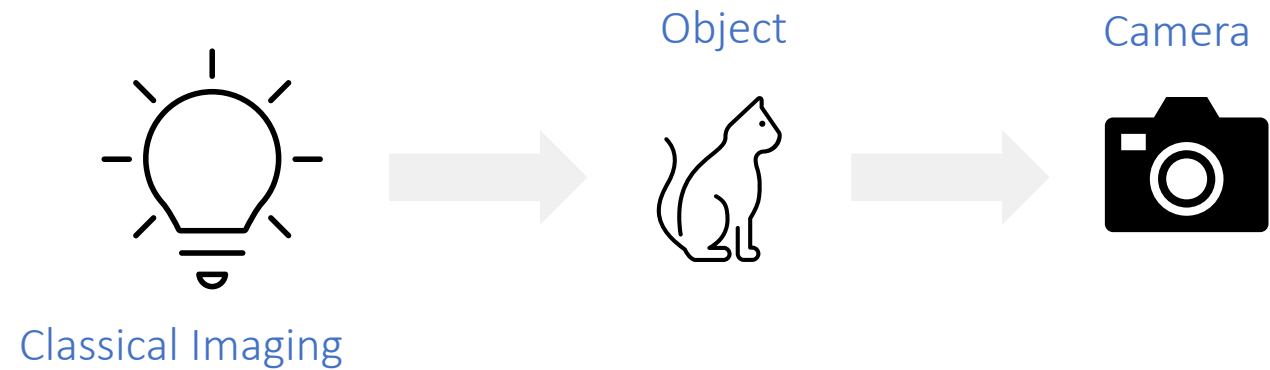
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# Mid-Infrared Quantum Scanning Microscopy with Visible Light



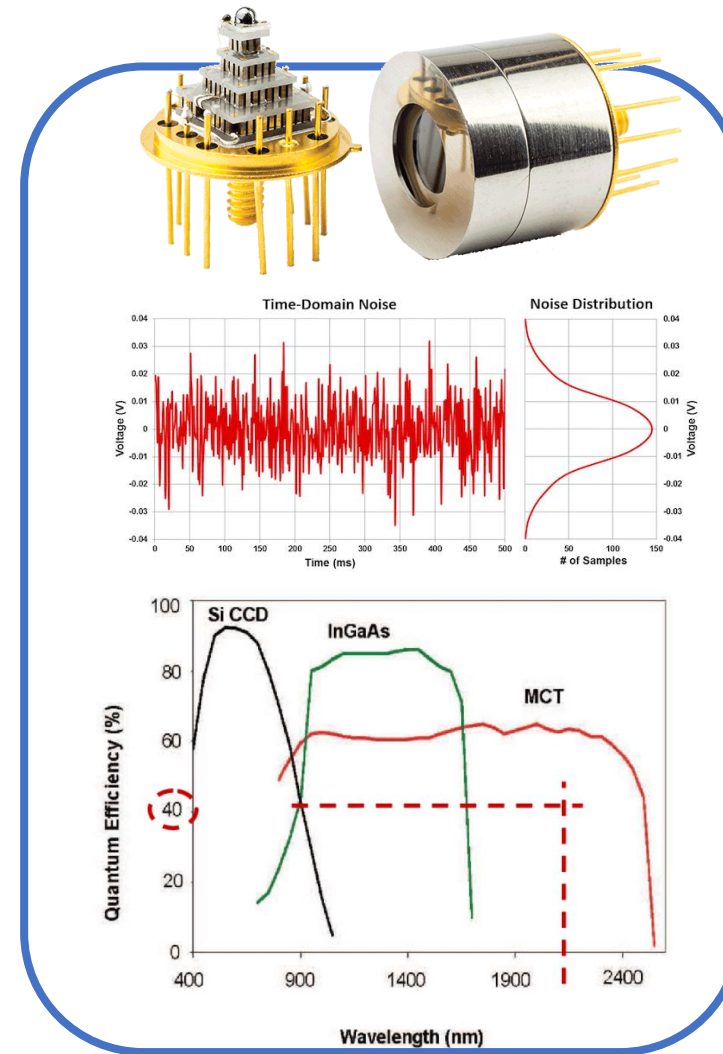
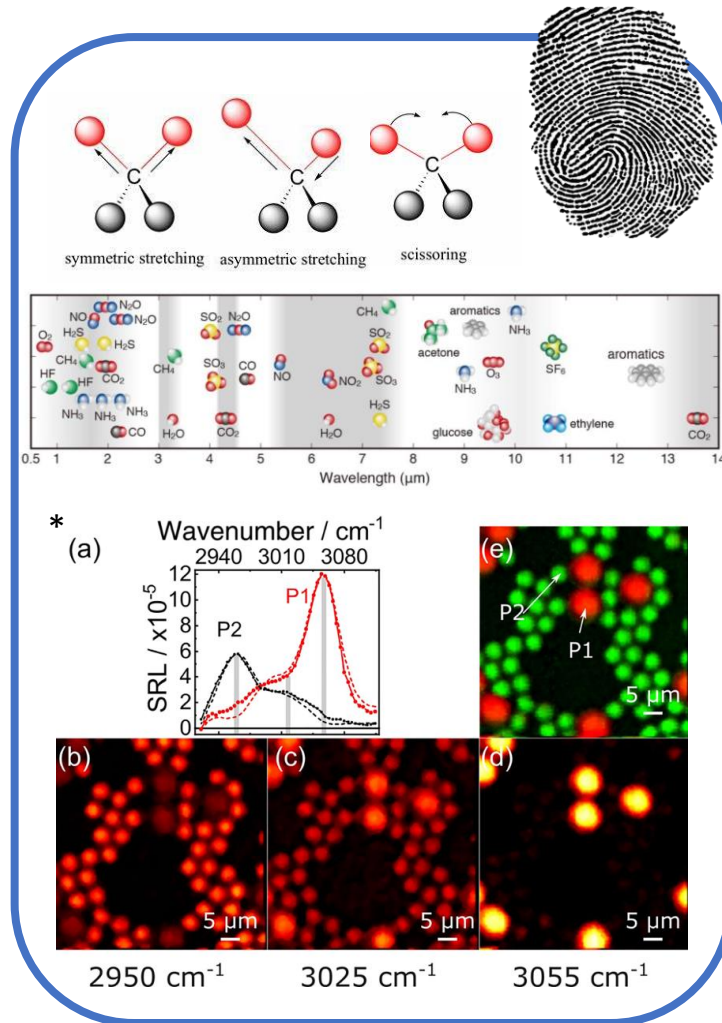
# Undetected photons concepts

- Going around the classical barriers



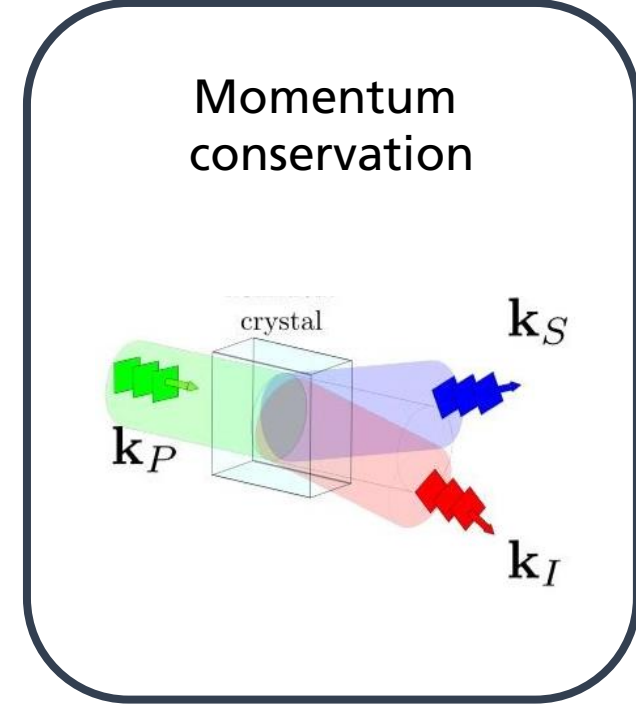
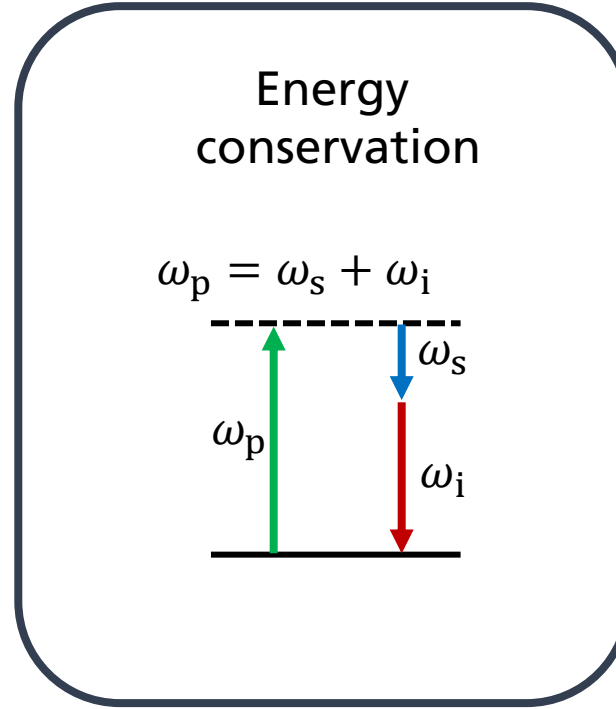
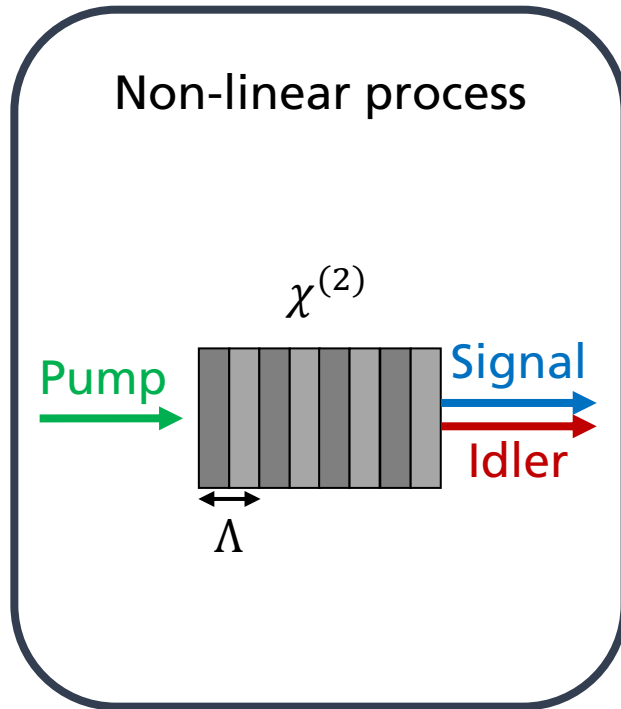
# Why Mid-IR light?

- Why undetected light?



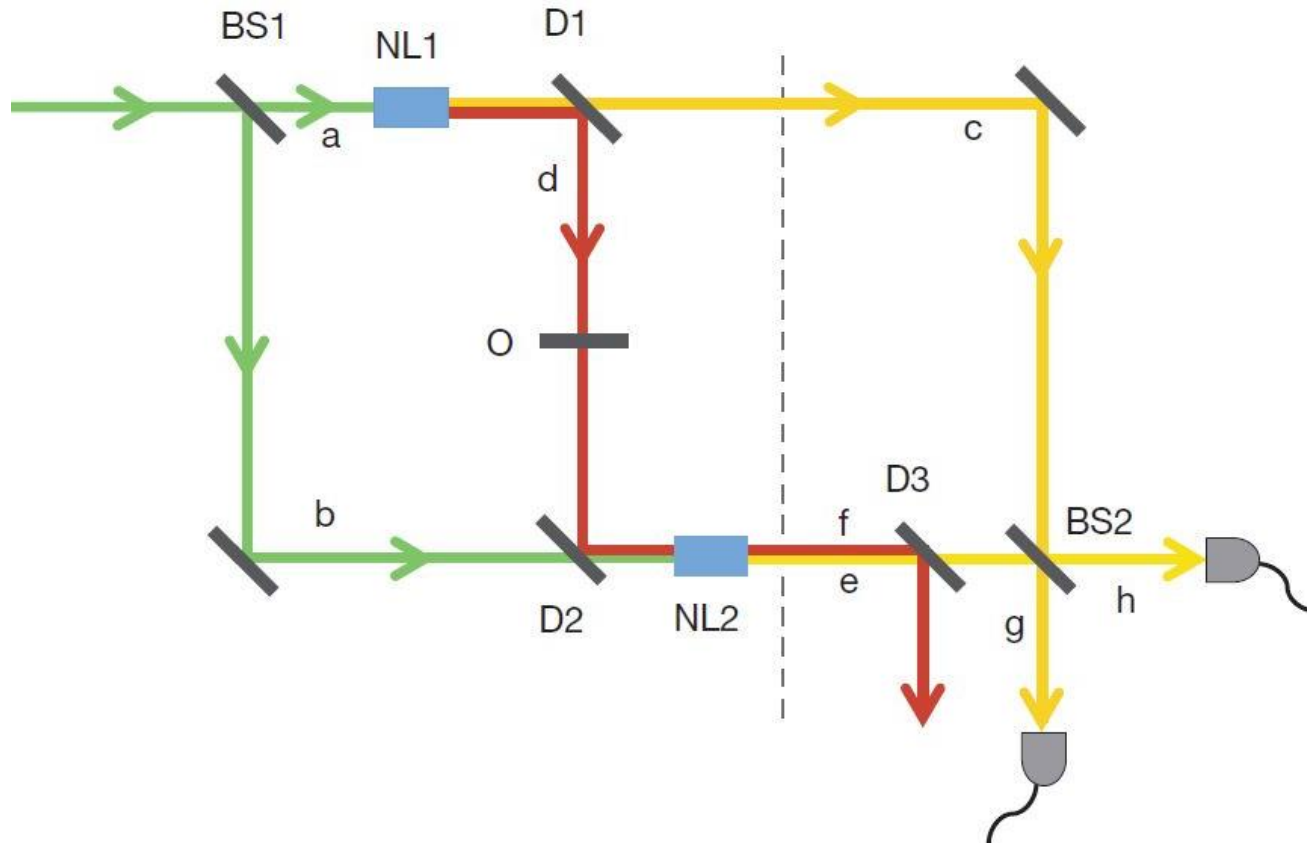
# Spontaneous parametric down-conversion

- Generation of nonclassical light



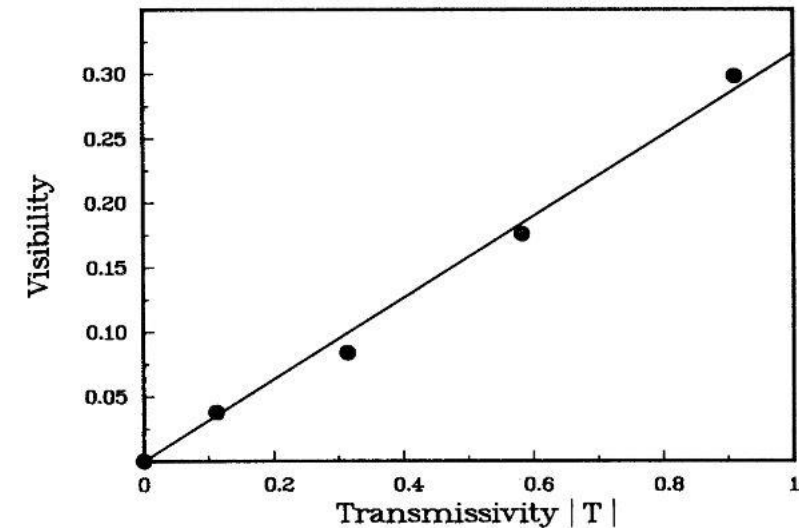
# Induced-coherence without induced emission

- Shifting the detection to the VIS wavelength range



Lemos, et al. *Nature* **512**, pages 409–412 (2014)

- Path indistinguishability
- Single photon interference
- Capability to retrieve an image with undetected light



Wang, et al. *Physical Review A* **44.7** 4614 (1991)

Zou, et al. *Physical review letters* **67.3** 318 (1991)

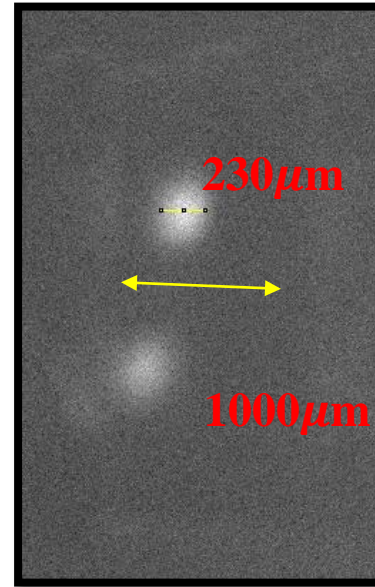
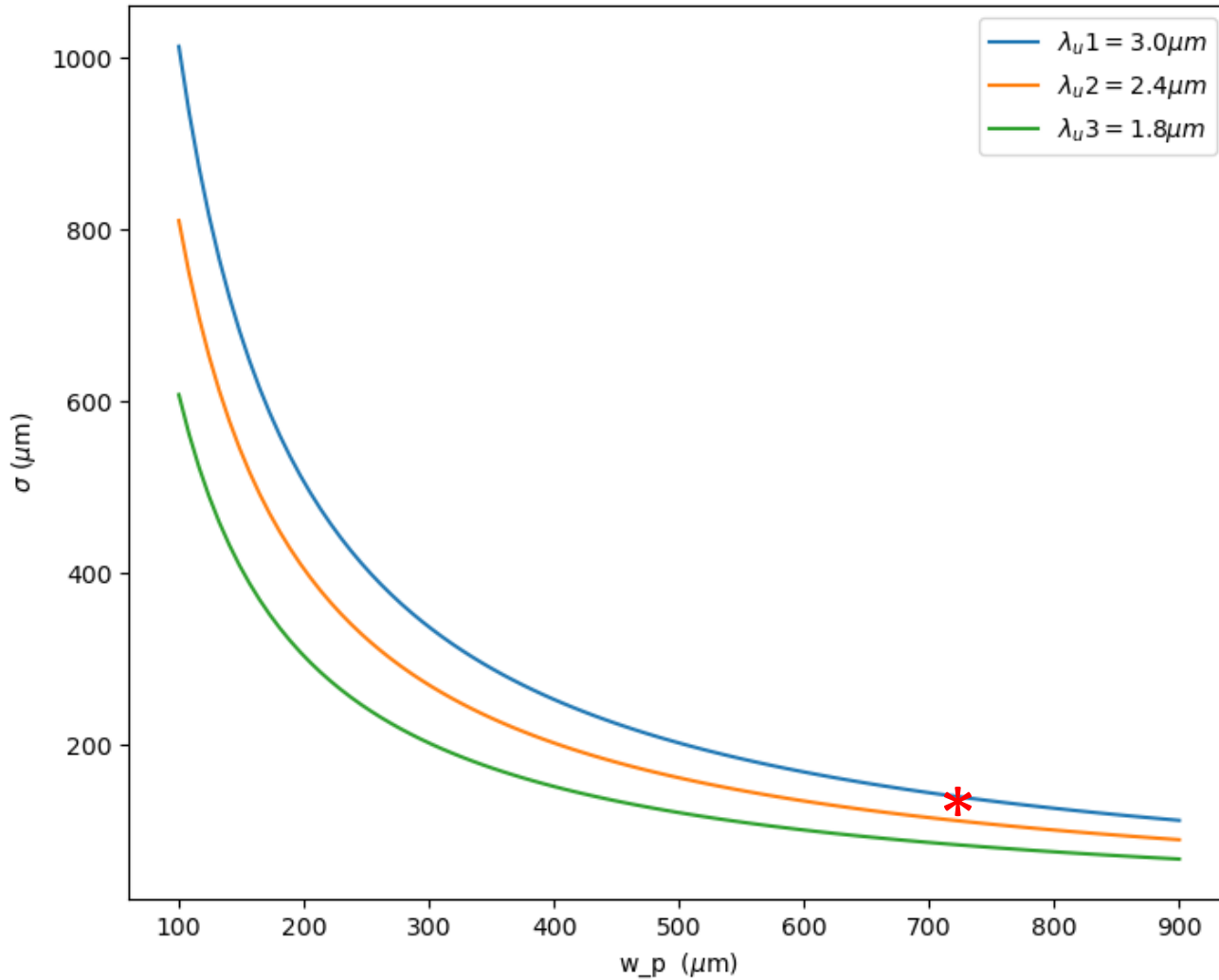
# WHY SCANNING?

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# The dilemma of the resolution

- The role of the spatial correlations

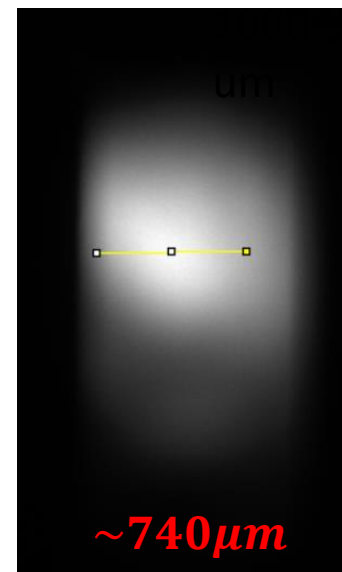
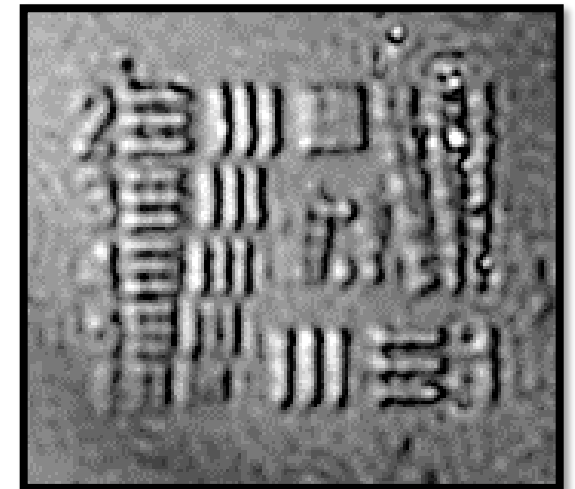
Minimum resolvable distance vs pump waist



$w_p=230\mu\text{m}$   $\lambda_u = 730\text{nm}$



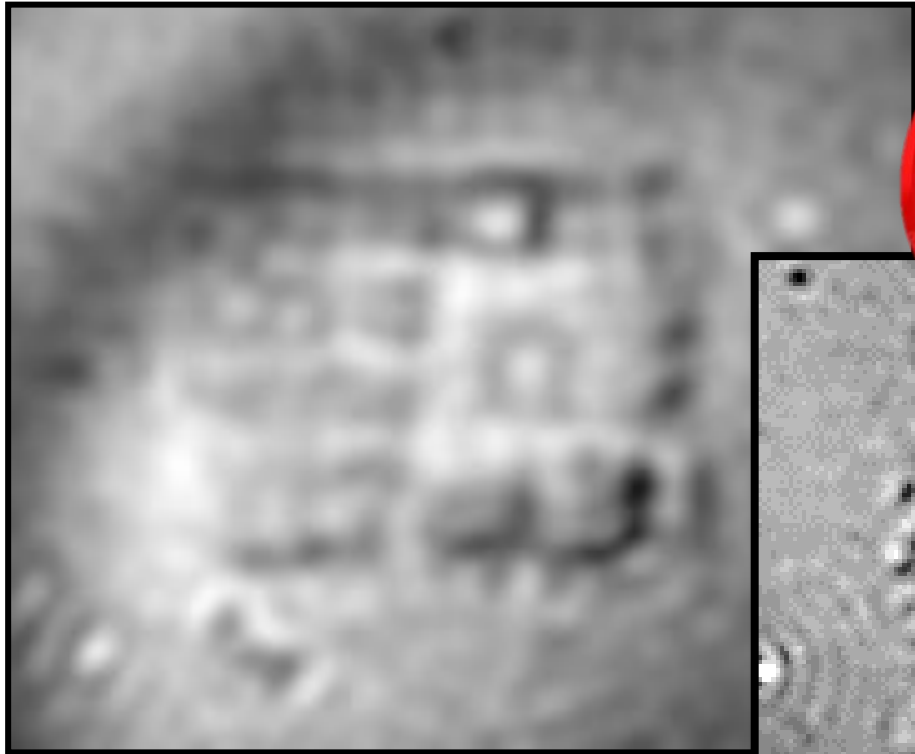
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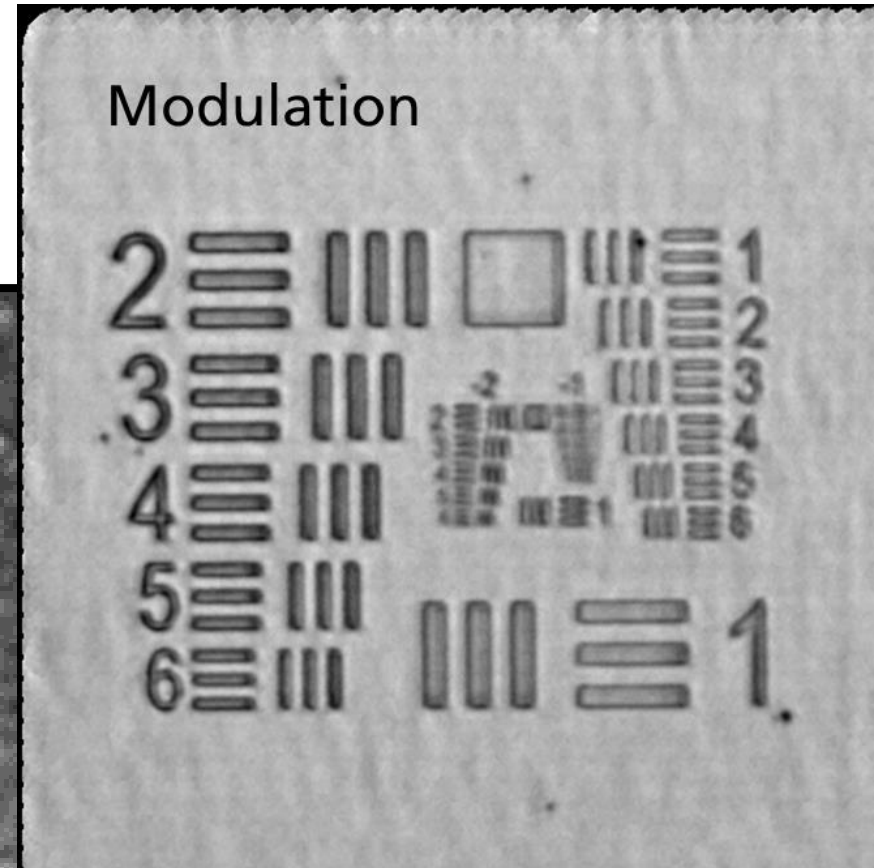
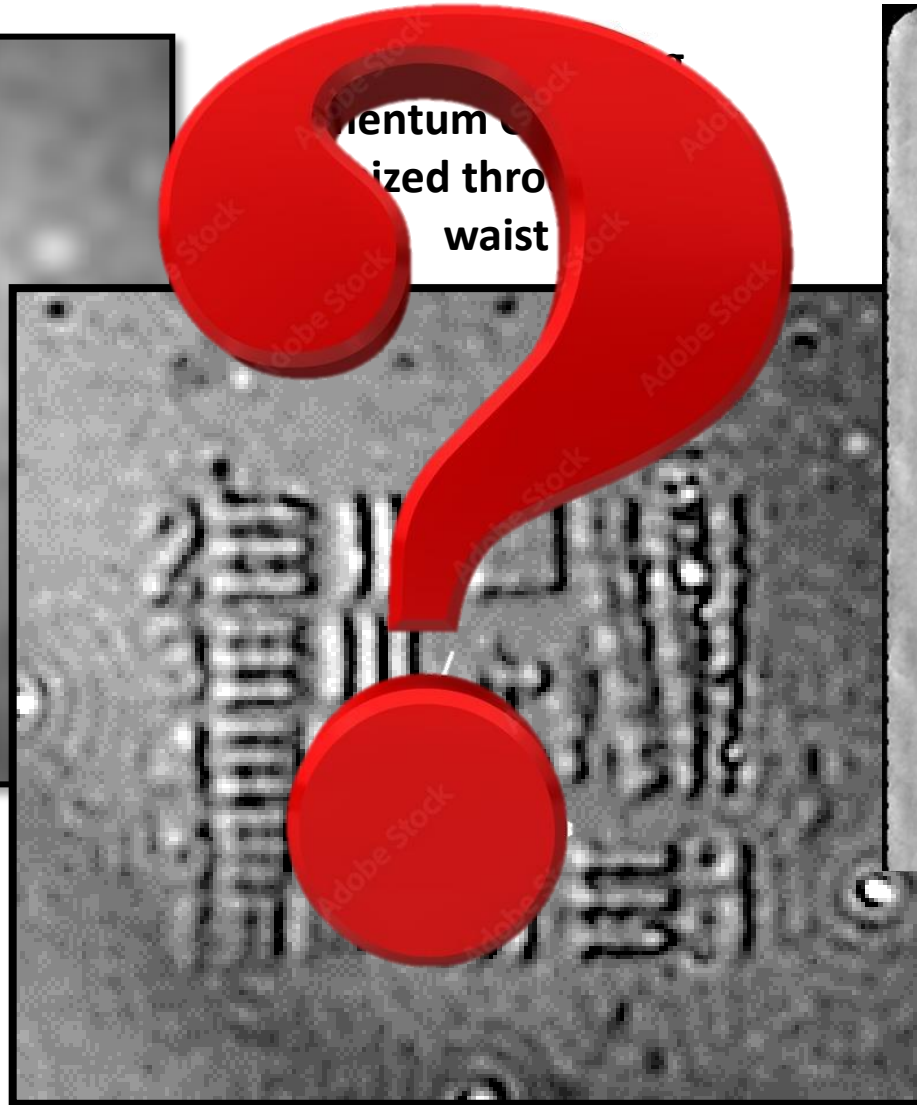


# Scanning microscopy

- The path to a better spatial resolution



Wide-field Imaging  
Momentum Correlations



Scanning Microscopy  
Position Correlations

# The IOF and Uni Jena Quantum Crew

# Thank you for your attention



## Contact Information:

Josué Ricardo León Torres

[josue.ricardo.leon.torres@iof.fraunhofer.de](mailto:josue.ricardo.leon.torres@iof.fraunhofer.de)

Check out my profile at:

[www.linkedin.com/in/JosueLeonT](https://www.linkedin.com/in/JosueLeonT)



