

Digital Holographic Microscopy with Structured Illumination: A study of the thickness limit of the imaged samples

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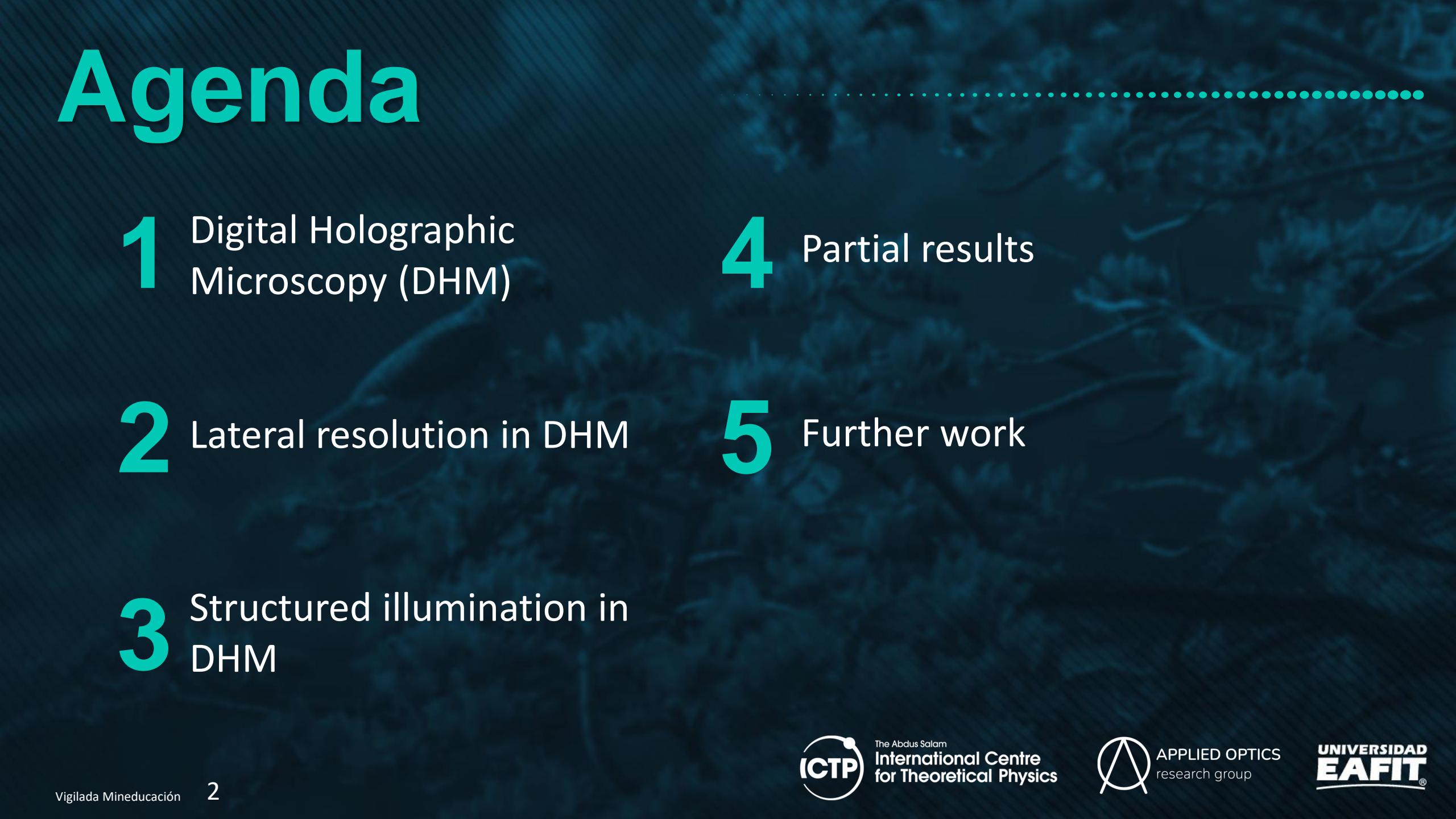
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Agenda



1 Digital Holographic Microscopy (DHM)

2 Lateral resolution in DHM

3 Structured illumination in DHM

4 Partial results

5 Further work



Digital Holographic Microscopy



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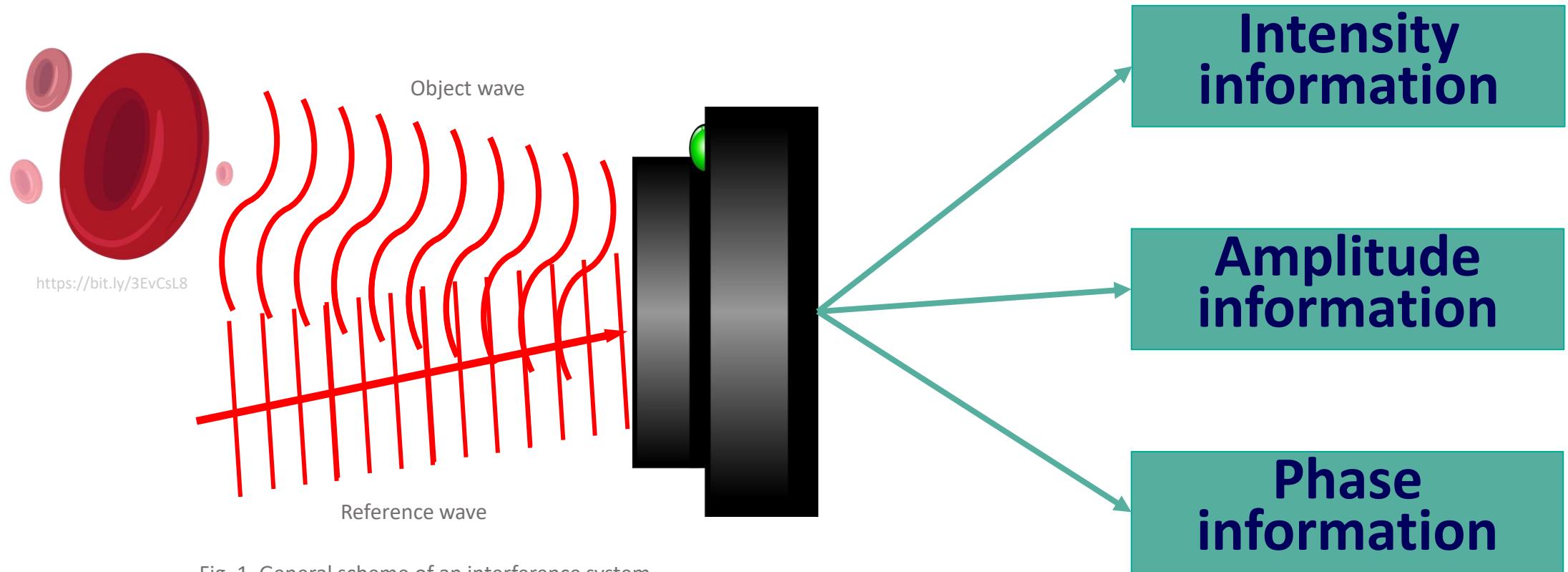


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Digital Holographic Microscopy (DHM)

Interferometric recording technique



Lateral resolution in DHM



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Lateral resolution in DHM

Abbe diffraction limit

$$\text{Lateral Resolution} = \frac{\lambda}{2 NA}$$

Our system

$$\lambda = 633 \text{ nm}$$

$$\text{NA} = 0.10 \quad \text{and} \quad M = 5X$$

3.165 μm theoretical resolution

USAF 1951 resolution test



Group 8-2 : 3,48 μm

Group 8-3 : 3,09 μm

Structured Illumination in DHM



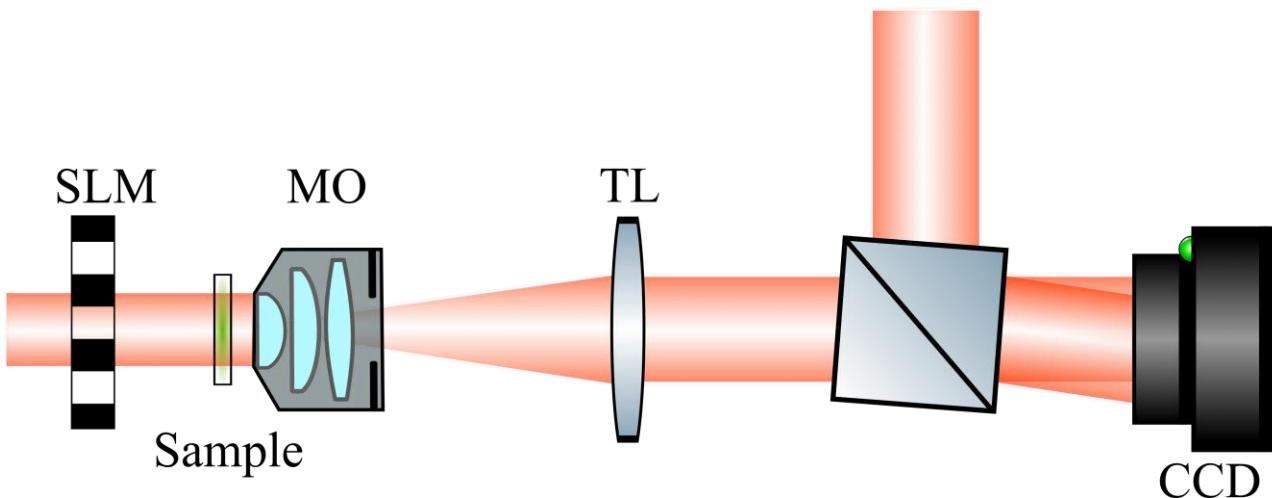
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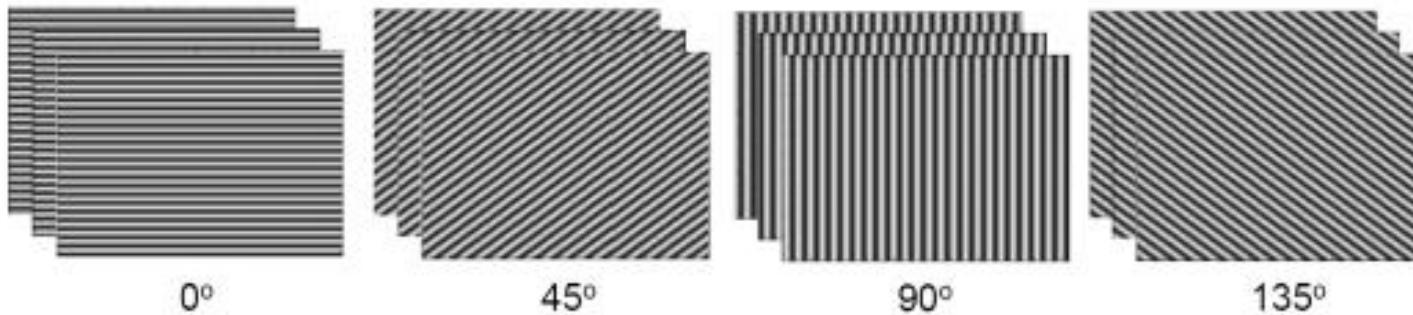
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Structured illumination in DHM



Patterns



Micó, V., Zheng, J., Garcia, J., Zalevsky, Z., & Gao, P. (2019). Resolution enhancement in quantitative phase microscopy. *Advances in Optics and Photonics*, 11(1), 135-214.

Synthetic numerical aperture

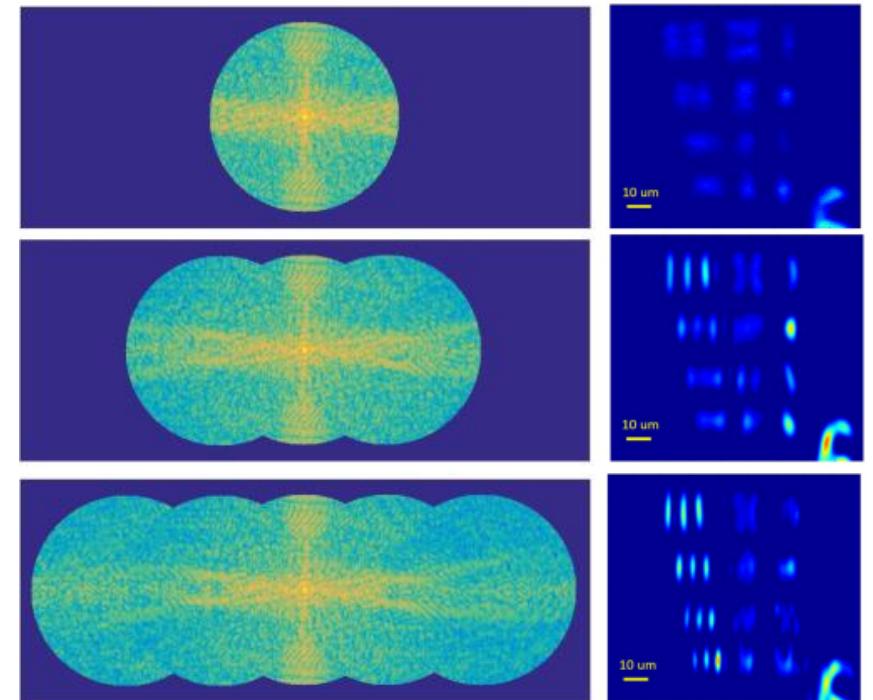
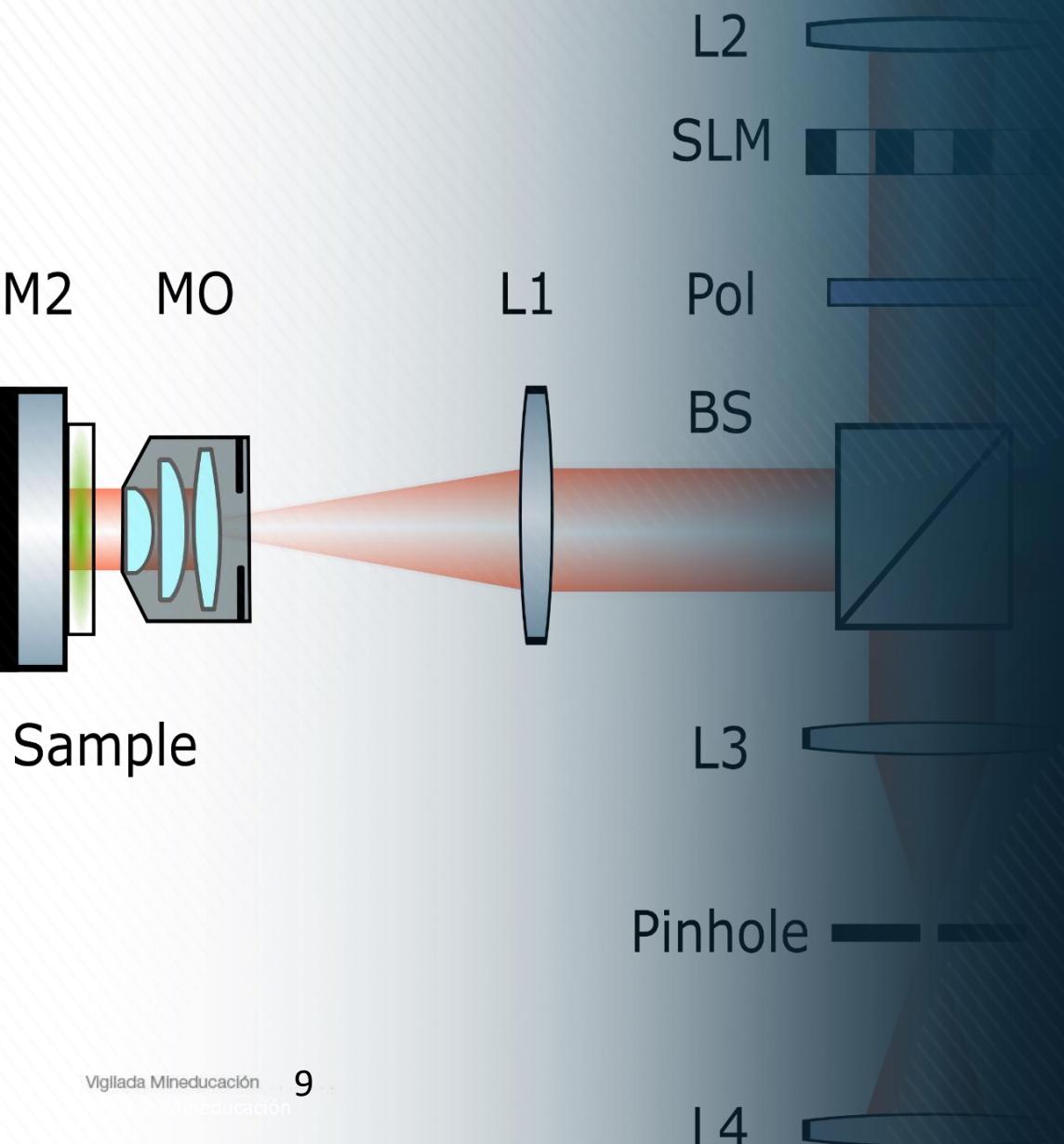


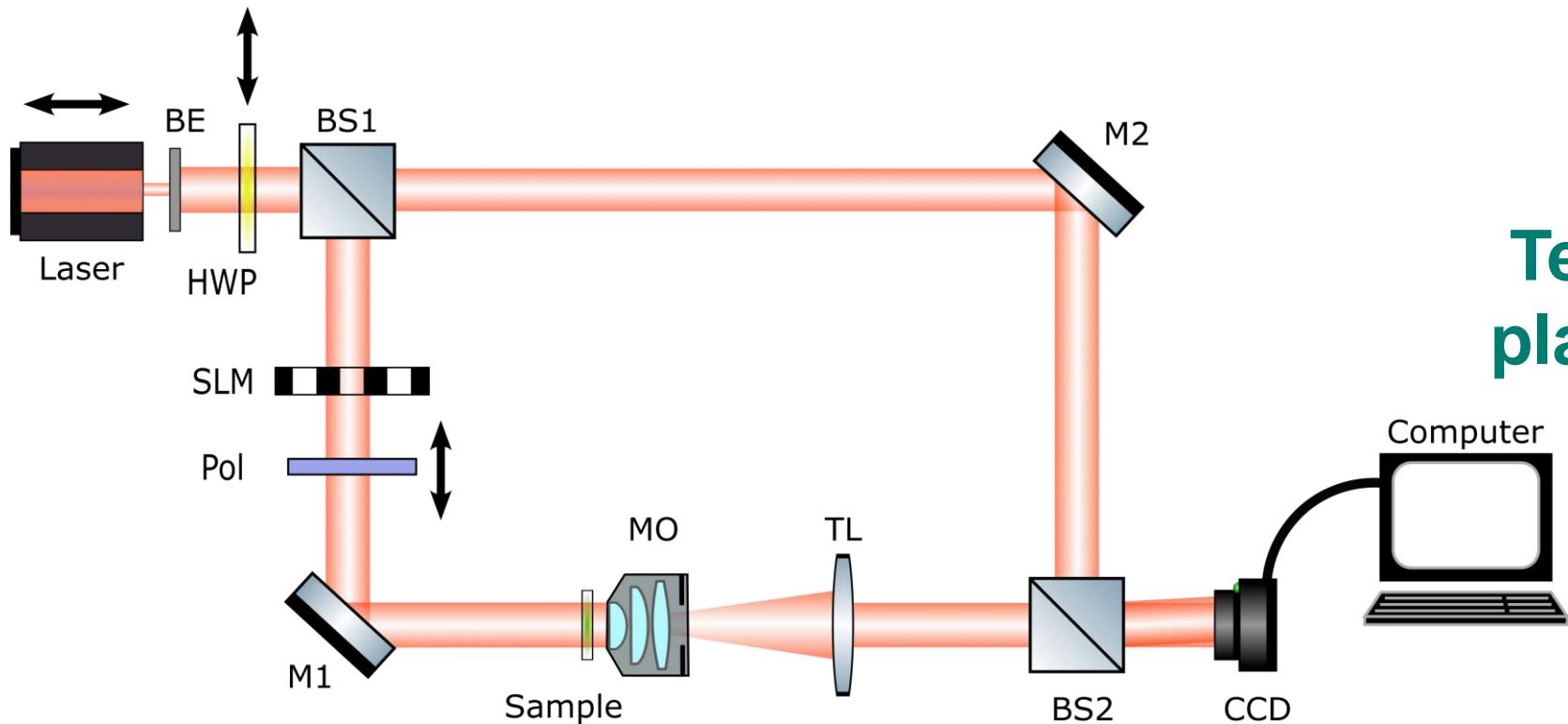
Image taken from Wilde, J. P., Goodman, J. W., Eldar, Y. C., & Takashima, Y. (2017). Coherent superresolution imaging via grating-based illumination. *Applied Optics*, 56(1), A79-A88.



Partial Results

Partial results

1 SI-DHM in transmission mode

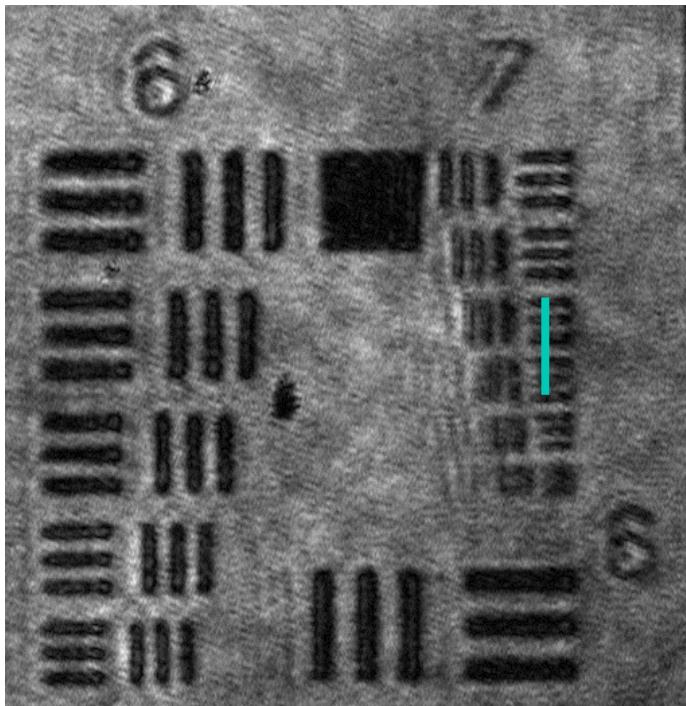


Telecentric Image-plane configuration

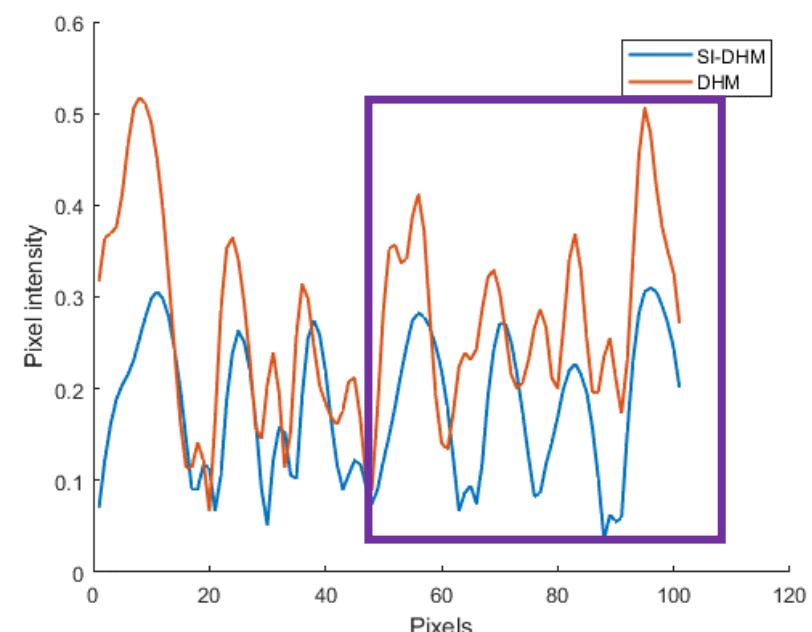
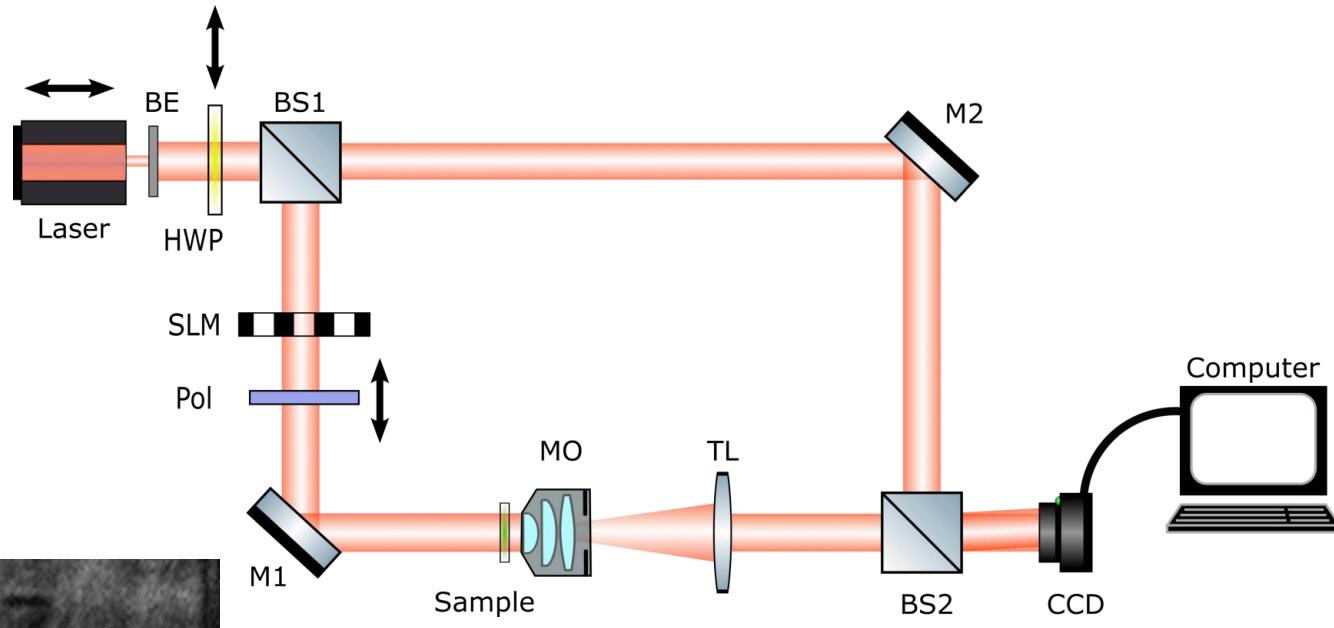
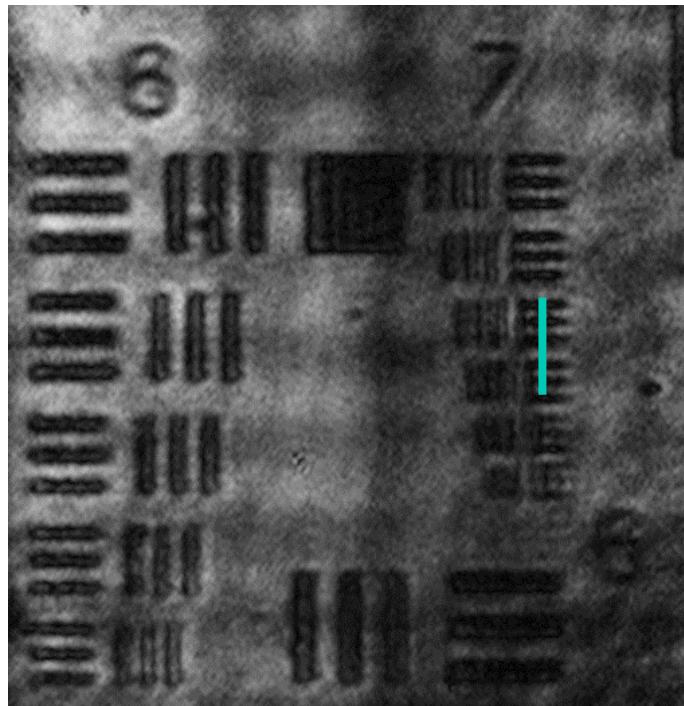
Partial results

1 SI-DHM in transmission mode

Traditional DHM



SI-DHM

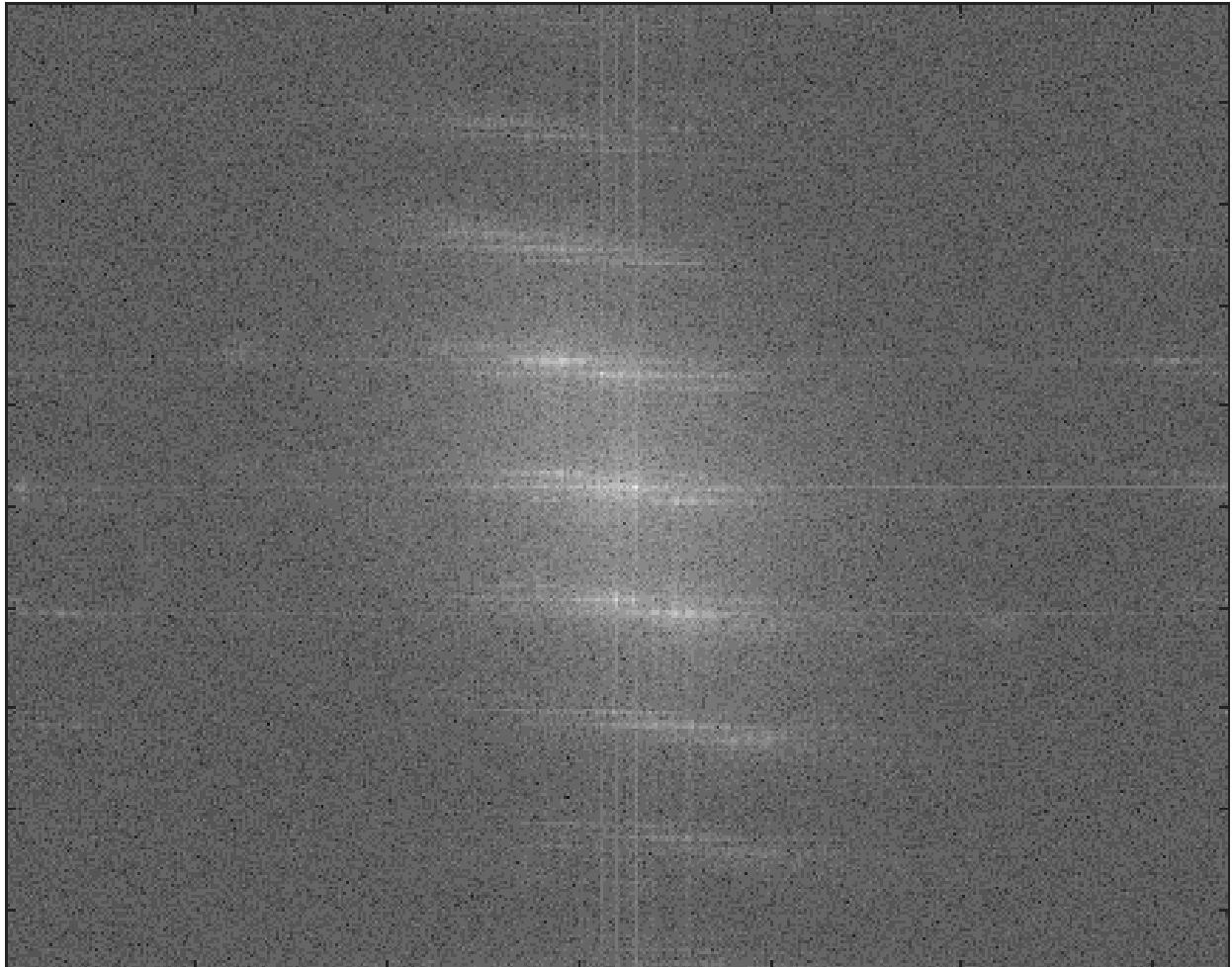


Partial results

2 SI-DHM in reflection mode

Obstacles

1. Spatial filtering the reference beam
2. Off-axis configuration



A close-up photograph of a crumpled piece of white paper resting on a light-colored, lined notebook page. The paper is heavily creased and folded, with some blue ink visible through the folds, suggesting it might be a drawing or a sketch. The background is a dark, solid color.

Further work

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Further work

1 Solve the alignment problems for the reflection mode

2 Measure the topography of several samples

3 Implement an Optical Diffraction Tomography setup based on a modified reflection DHM system

Thanks to



Vicerrectoría de Ciencia,
Tecnología e Innovación

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And Thanks for your attention

