

Reconfigurable holograms with nanometric resolution

Internship mission

New technologies based on photonics or even nanophotonics are major assets for developing new automotive HMIs (HMI: human-machine interface) to increase attractiveness, user experience and safety. Future interfaces such as 3D displays or 3D assistants promise a new on-board experience for the driver and passengers. Holographic optical systems could play a major role in improving the quality of 3D displays while maintaining a compact volume.

One solution is to "dynamically" implement holograms thanks to a spatial light modulator (SLM), usually SLM-LCOS (Liquid Crystal On Silicon) which are based on a matrix of liquid crystal pixels. However, the maximum resolution of these SLMs around 4μm, because of the limit of silicon technology, is the main limit to the expansion of this technology: the resolution of the SLM is directly related to the resolution and field of view of the final image (figure below).

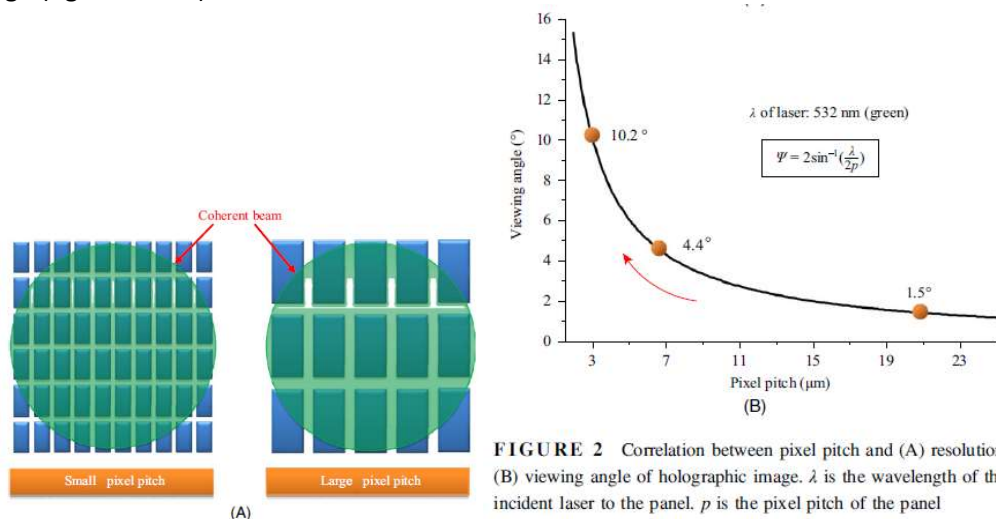


FIGURE 2 Correlation between pixel pitch and (A) resolution, (B) viewing angle of holographic image. λ is the wavelength of the incident laser to the panel. p is the pixel pitch of the panel

(Choi, J. H., Pi, J. E., Hwang, C. Y., Yang, J. H., Kim, Y. H., Kim, G. H., ... & Hwang, C. S. (2019). Evolution of spatial light modulator for high-definition digital holography. *ETRI Journal*, 41(1), 23-31.)

The internship mission is a scientific study about the design of a spatial light modulator with very high resolution (pixel pitch < 1 μm).

Based on C2N research work, the new architecture is based on **plasmonic** particles used as "optical tweezers" that can trap beads that modulate the phase and/or amplitude of the incident light wave. The main objective of the internship will be to study the feasibility of this concept through a literature review, analytical calculations and electromagnetic simulations. The internship will take place at C2N at Palaiseau (91).

Required skills:

- Student in last year of engineering school or Master 2 (internship of 6 months)
- Curiosity for scientific research and ability to work in English - read documentation, write reports...
- Good knowledge of optics and physics
- Experience in numerical modelling of optical/electromagnetic propagation

The internship will take place at C2N, 10 bd Thomas Gobert, 91120 Palaiseau

Contacts

Béatrice Dagens, C2N, beatrice.dagens@c2n.upsaclay.fr

Thomas Lopez, Groupe PSA, thomas.lopez@mpsa.com