# Lab project M1 PPN & QuanTEEM

**12/05/2025 – 20/06/2025**

**Title of the project:**
**Development of microfabrication processes based on maskless optical lithography**

**Supervisor(s): L.Markey ; I. Gallet ; F. Prum**

Laboratory / Department / Team : ICB / platform ARCEN-CARNOT / Nanofab

**Collaborations:**

**Summary:**

The micro and nano fabrication processes we developped in our lab are based on either the UV mask aligner or the e-beam lithography (EBL) or a combination of both. EBL is very accurate down to a few nanometers but suffers from a slow writing speed and is limited in terms of thickness, while UV lithography with a mask aligner is quick but based on diffraction-limited pre-fabricated photomask. The nanofab team of the platform ARCEN-Carnot has recently received a new optical maskless lithography (ML) tool, which offers the advantage to print the design directly from a 2D file like in EBL, while being much faster. Besides this main characteristic, this tool has the capability to print in grey-scale, delivering 2.5D structures, like those shown in the figure below. These 2.5D can find applications in photonics for micro-photonic structures like 3D tapers or in microfluidics for the fabrication of molds with more complex shapes than the usual UV fabricated molds.

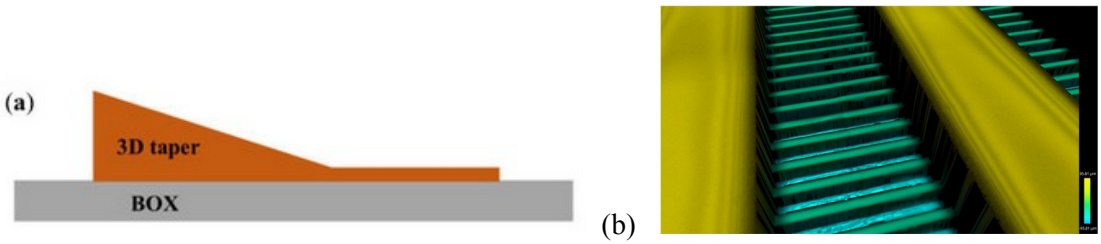


Figure 1 : 2.5D structures which can be produced by grey-scale lithography

The objectives of the proposed project are to develop ML-based processes and to fabricate new types of structures for biosensing and microfluidics. More precisely, an objective is to transpose existing fabrication process flows based on UVL or EBL to ML-based process flows and to optimize these processes to reach the theoretical specifications of the machine. This first objective can be based on existing photonic waveguide fabrication processes. Another objective is to develop a grayscale process for a microfluidic application through the realization of a SU8 master mold with local flow restrictions. This master mold will be used for the replication of microfluidic channels into plastic microfluidic modules by hot-embossing. This development will be useful for application in the medical field of diagnostic for hemostasis, or to enhance the sensitivity of on-chip biosensors we develop for other medical applications (European project MULTILAB).

**Type of project (theory/experiment): Experimental (clean room work, lithography)**

**Required skills:**