

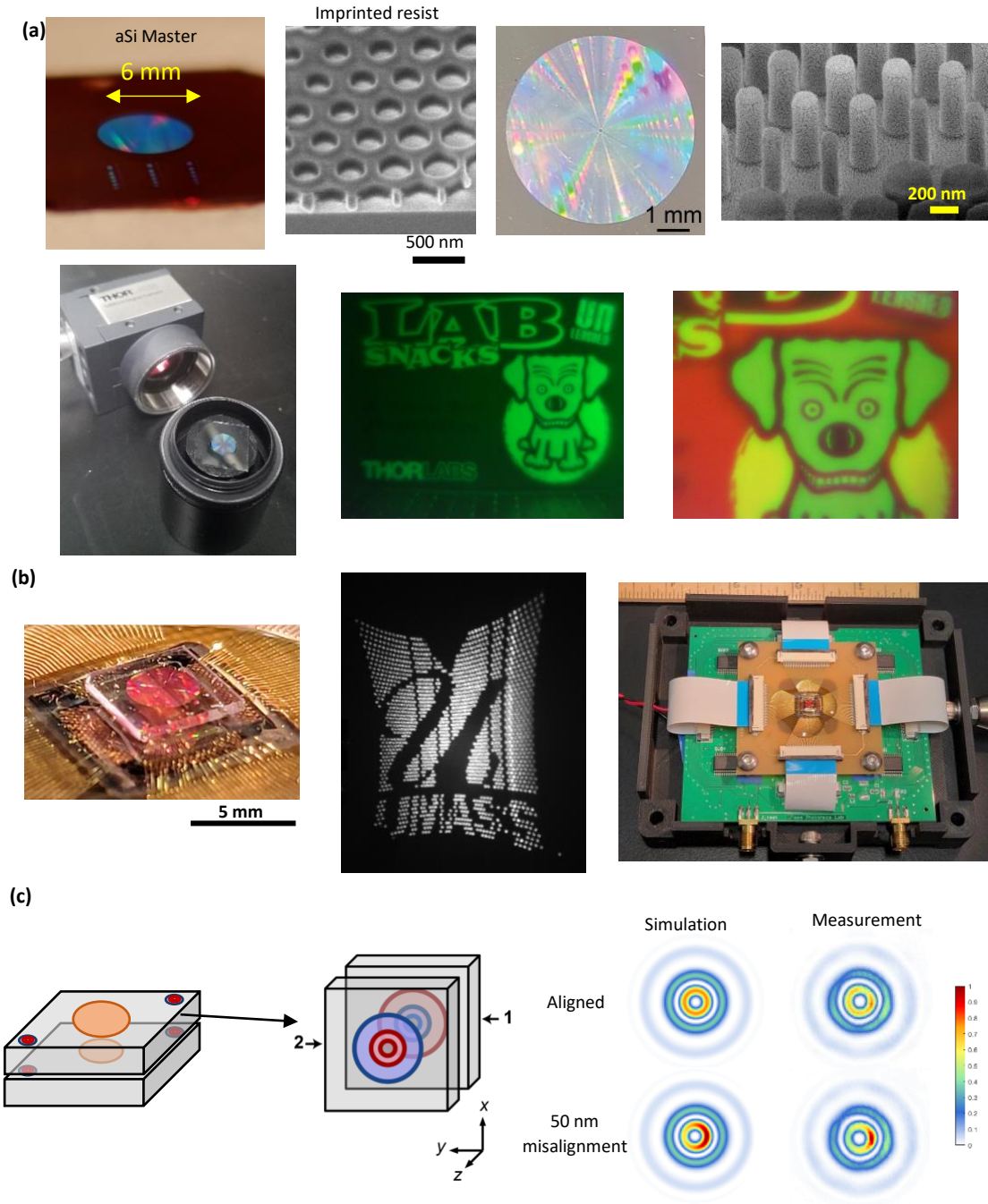
# Fabrication, assembly and applications of metasurfaces and metasystems

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The rapid advancement of optical metasurfaces has enabled a wide range of applications<sup>1</sup>. In this talk, we will provide an overview of our work on developing optical metasurfaces and metasystems. Specifically, we will discuss the scalable fabrication of efficient visible metasurfaces (Fig. 1a), miniature beam scanning, and high-resolution 3D alignment techniques using metasurfaces. As an example of an optical system enabled by metalenses, we will present a compact laser beam scanner capable of scanning a laser beam with nanosecond speed and a power consumption of just 7.5 mW (Fig. 1b). Additionally, we will introduce a novel technique that enables the alignment of distant patterns with sub-nanometer precision using optical metasurfaces (Fig. 1c). This technique has applications in the registration of multilayer lithography patterns.



**Figure 1.** (a) 6-mm-diameter visible metalens fabricated using nanoimprint lithography. Single color and visible photos taken with the metalens. (b) Miniature, fully-integrated, laser beam scanner enabled by a metalens. (c) Highly accurate 3D alignment of two samples using metalens-based alignment marks.

#### References:

[1] Arbabi, A., Faraon, A. Advances in optical metalenses. Nat. Photon. 17, 16–25 (2023).