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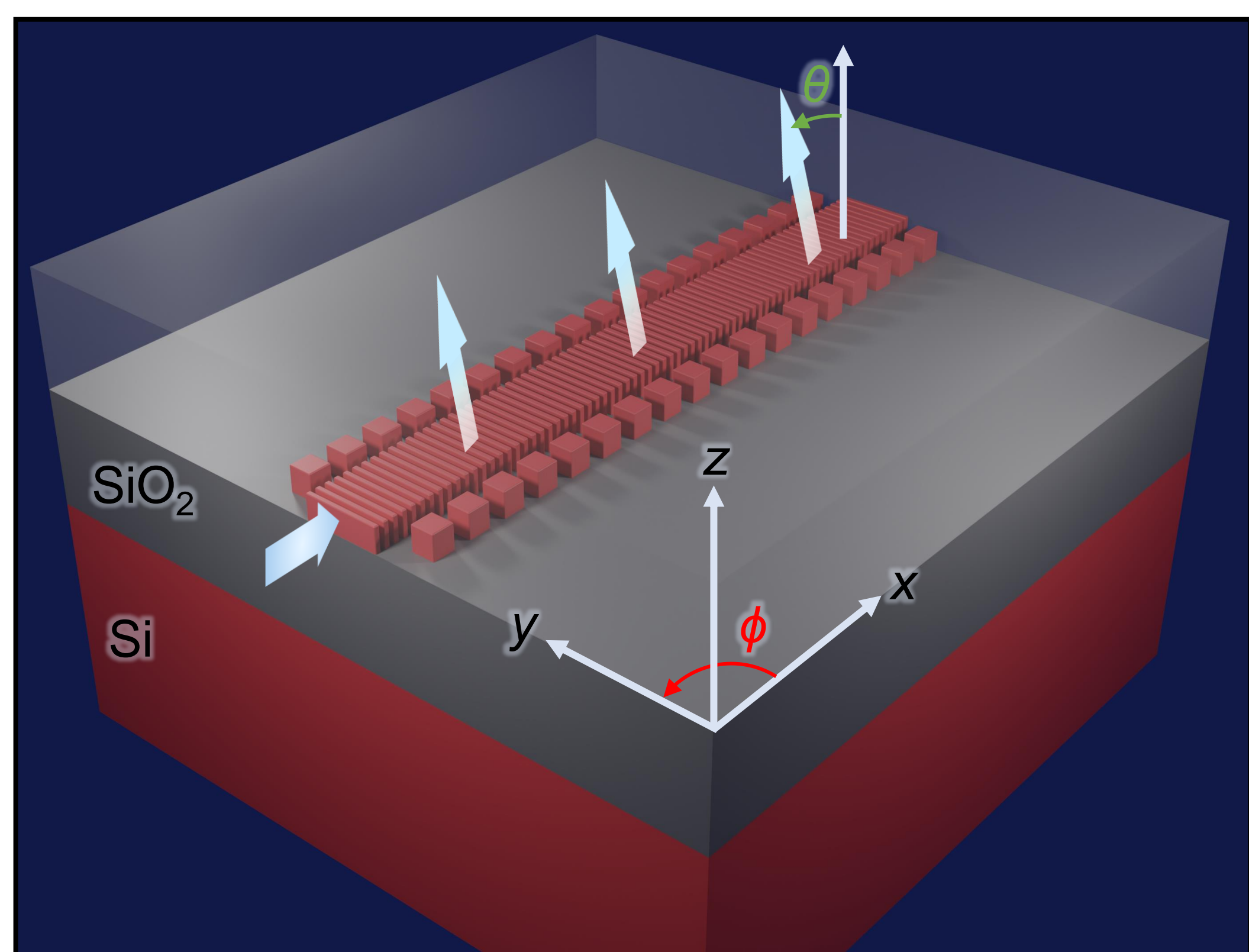
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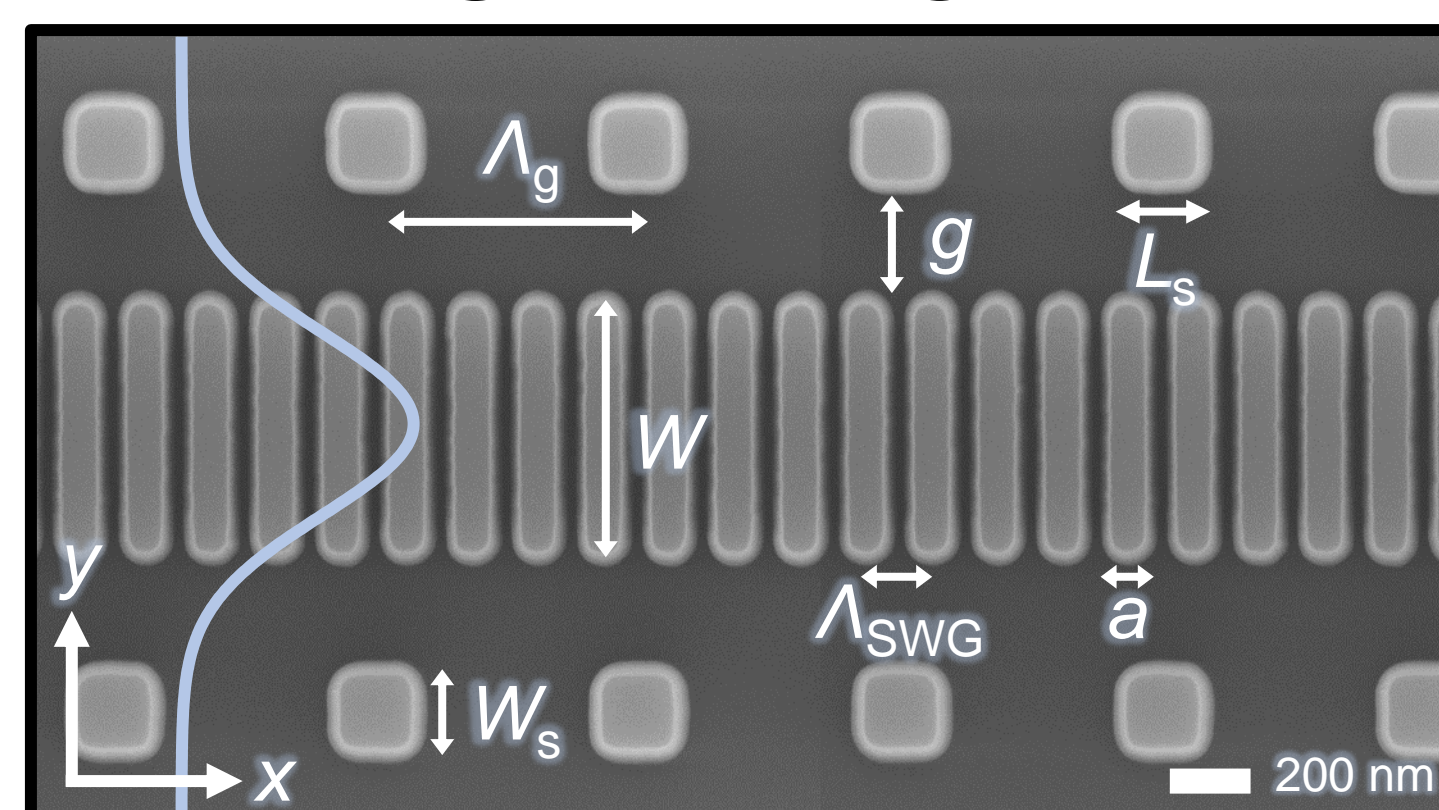
Abstract

We propose a distributed Bragg deflector working as a low-loss (<math><0.3\text{ dB}</math>) ultra-compact beam expander, which generates an on-chip Gaussian beam that illuminates a 1D array of 112 optical antennas with a length of 1.5 mm. The device has been fabricated on a 220-nm silicon-on-insulator platform using a single etch process with a minimum feature size of 80 nm. We present an antenna array with a directivity of 53 dBi, a radiation efficiency of -3.8 dB and a far-field spot with an angular divergence of $1.8^\circ \times 0.2^\circ$.

Weak surface-emitting antenna



SEM IMAGE

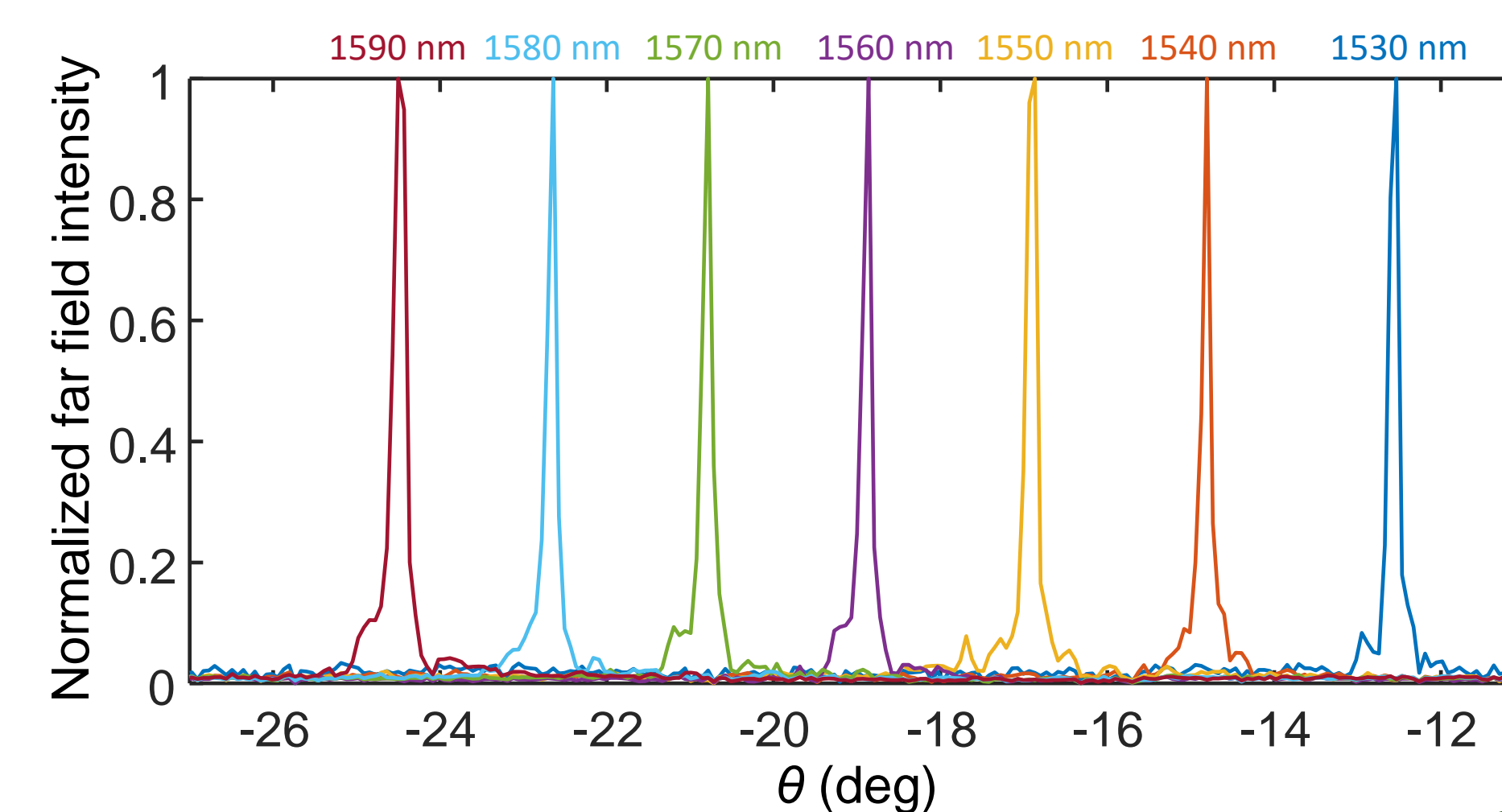


GEOMETRY

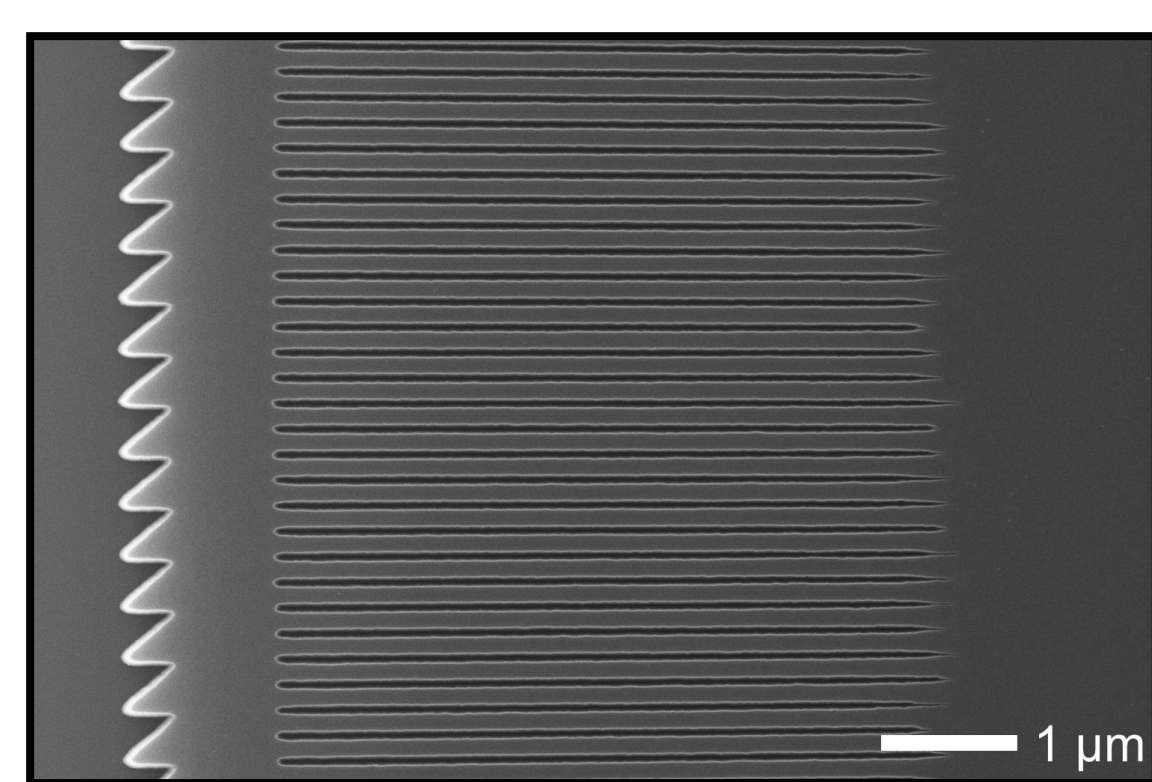
Subwavelength grating (SWG) core

Lateral diffractive elements

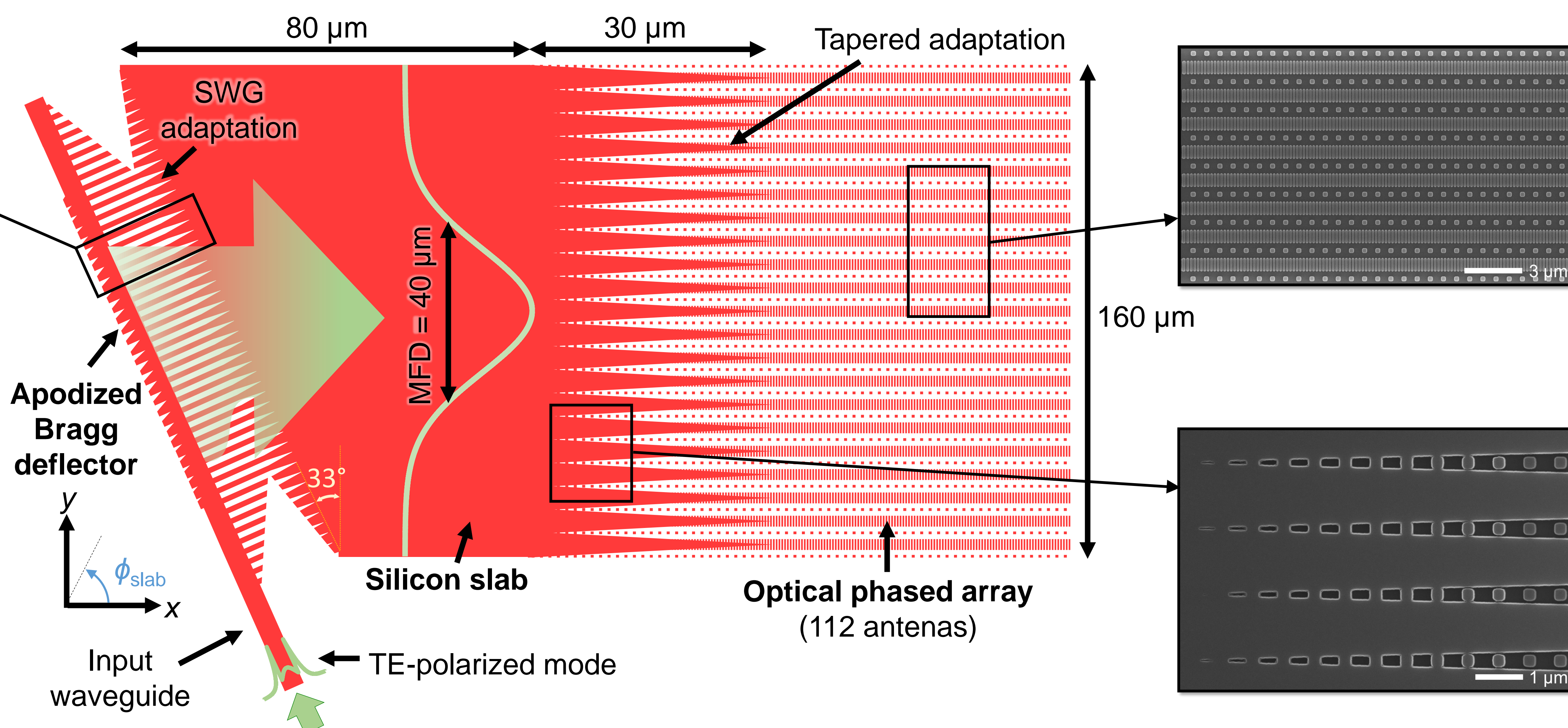
- The **SWG core** controls the **confinement** of the Floquet mode.
- With the **separation and the geometry of the lateral segments** we can precisely control the **radiation strength** of the antenna.
- A **2-millimeter-long** antenna is demonstrated [1].



Antenna array

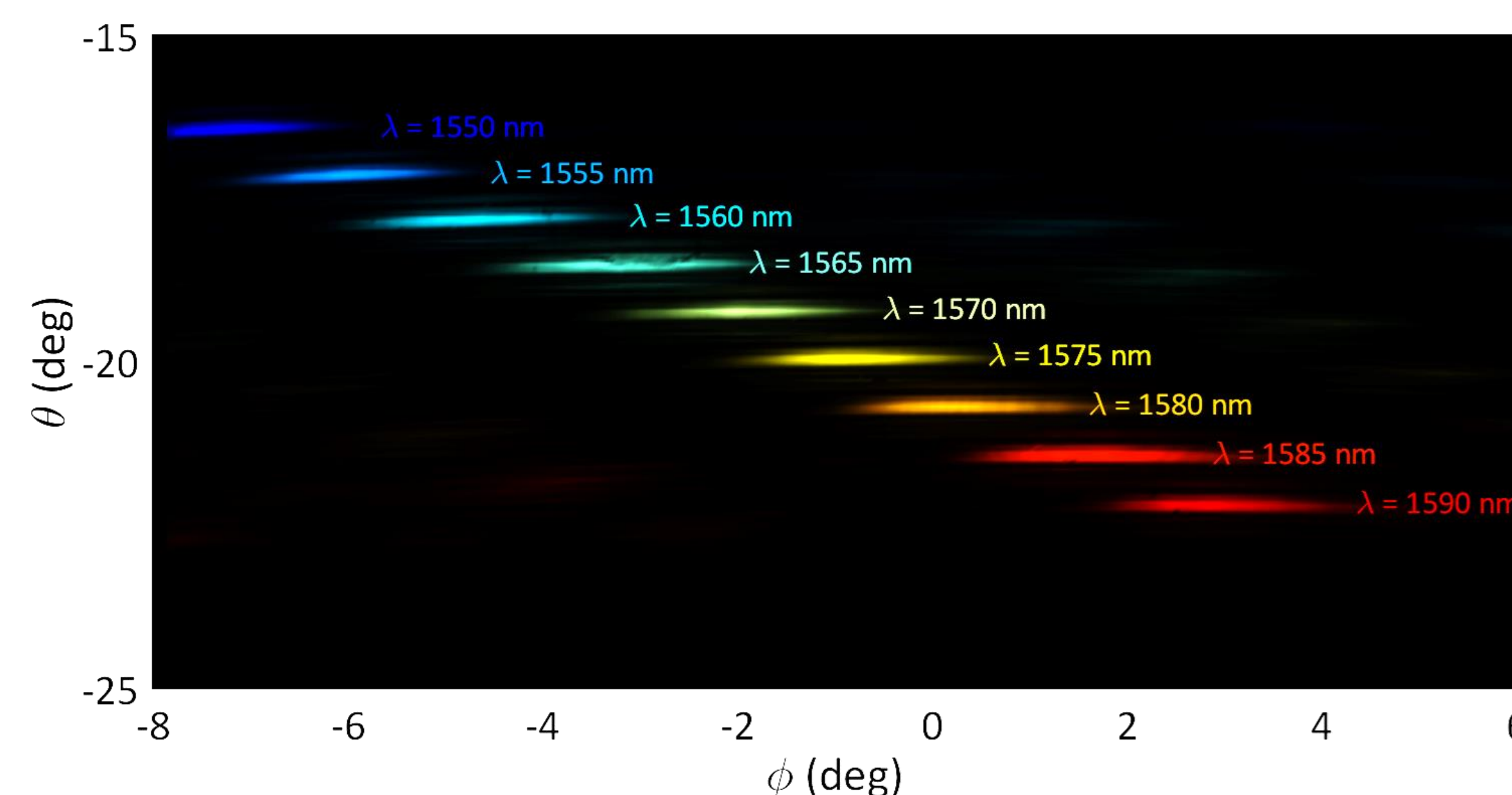
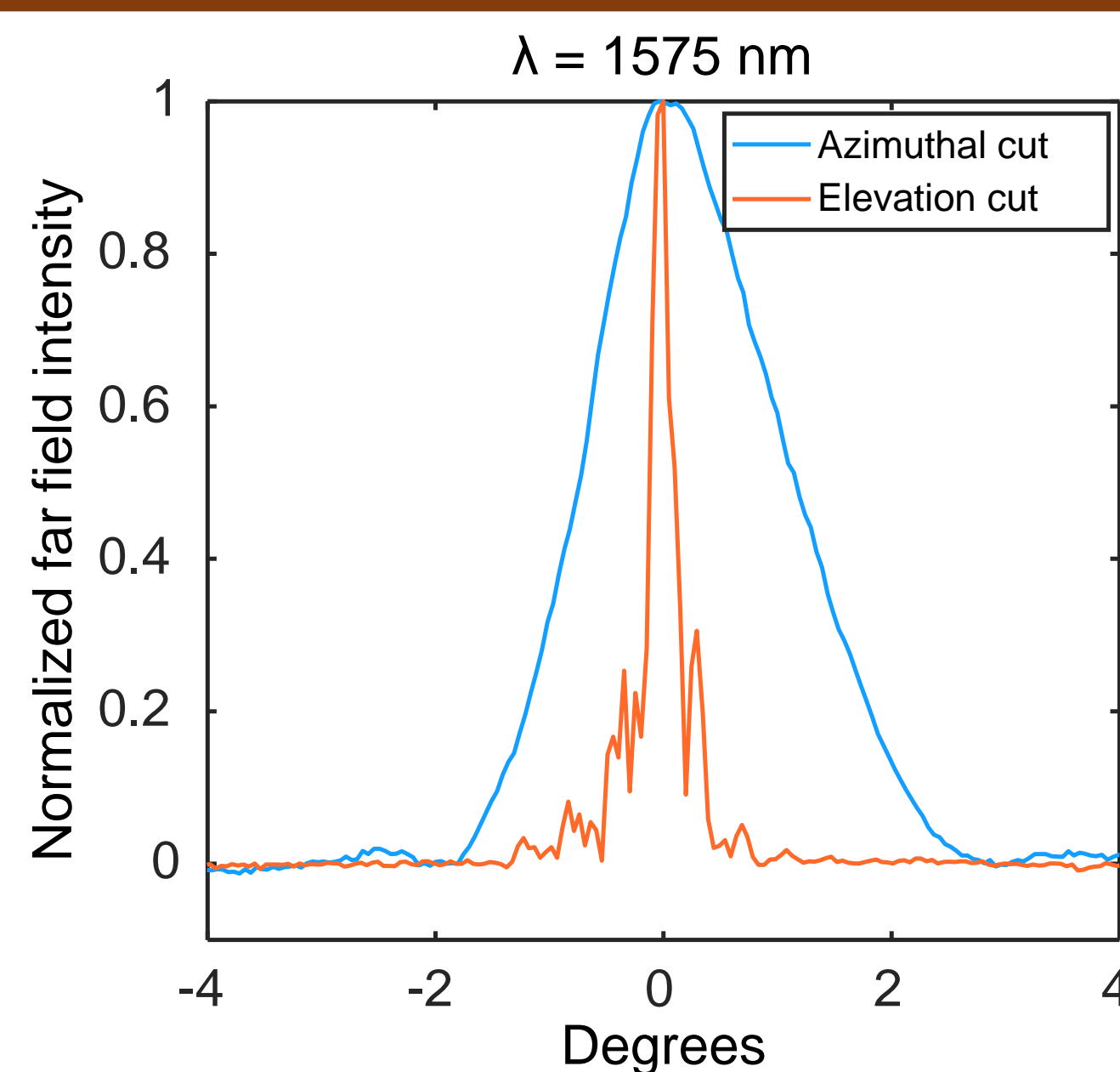


- The **incident angle** of the Gaussian beam (ϕ_{slab}) is controlled with the apodized Bragg deflector.
- With only **one device** we are able to illuminate a complete antenna array.



Experimental results

- The far-field spot in the azimuthal direction (ϕ) has a **Gaussian** form with **no sidelobes**.
- The far-field spot in the elevation direction (θ) corresponds to a **Lorentzian** form.
- A far-field spot with an angular divergence of $1.8^\circ \times 0.2^\circ$ is demonstrated [2].



References

- [1] Pablo Ginel-Moreno, Alejandro Sánchez-Postigo, José de-Oliva-Rubio, Abdelfettah Hadij-Elhouati, Winnie N. Ye, J. Gonzalo Wangüemert-Pérez, Íñigo Molina-Fernández, Jens H. Schmid, Pavel Cheben, and Alejandro Ortega-Moñux, "Millimeter-long metamaterial surface-emitting antenna in the silicon photonics platform," *Optics Letters*, 2021, vol. 46, no 15, p. 3733-3736.
[2] Pablo Ginel-Moreno, Abdelfettah Hadij-Elhouati, Alejandro Sánchez-Postigo, J. Gonzalo Wangüemert Pérez, Íñigo Molina-Fernández, Jens H. Schmid, Pavel Cheben, and Alejandro Ortega-Moñux, "On-chip metamaterial antenna array with distributed Bragg deflector for generation of collimated steerable beams," *Laser & Photonics Reviews*. In production.



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