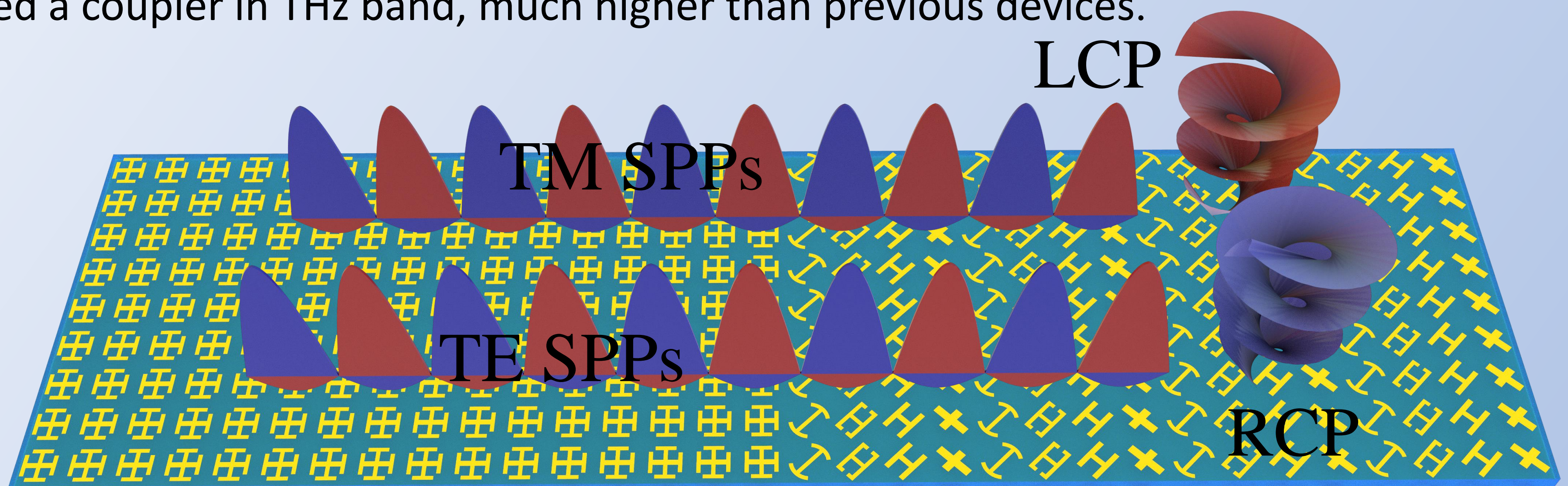


High-efficiency polarization convert Spps coupler

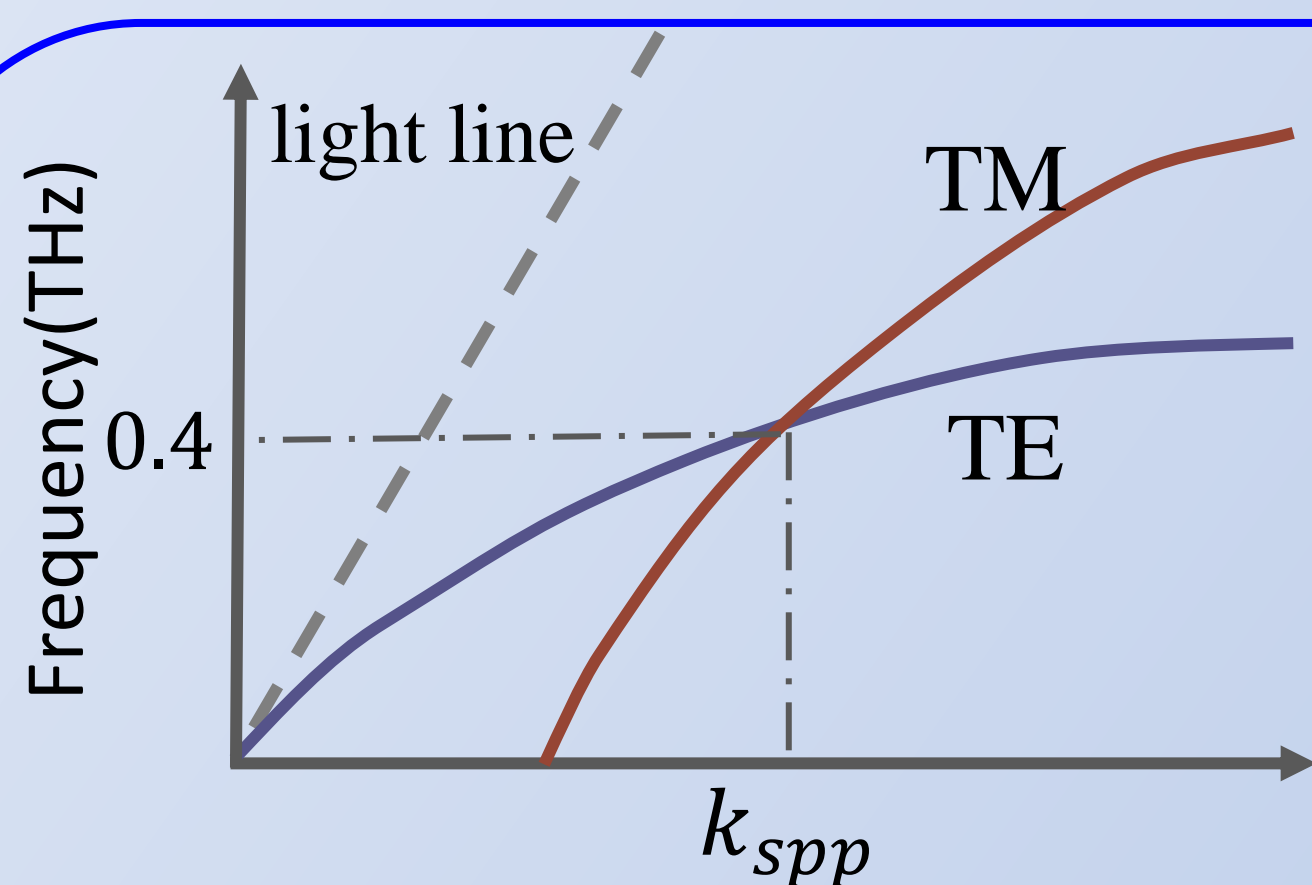
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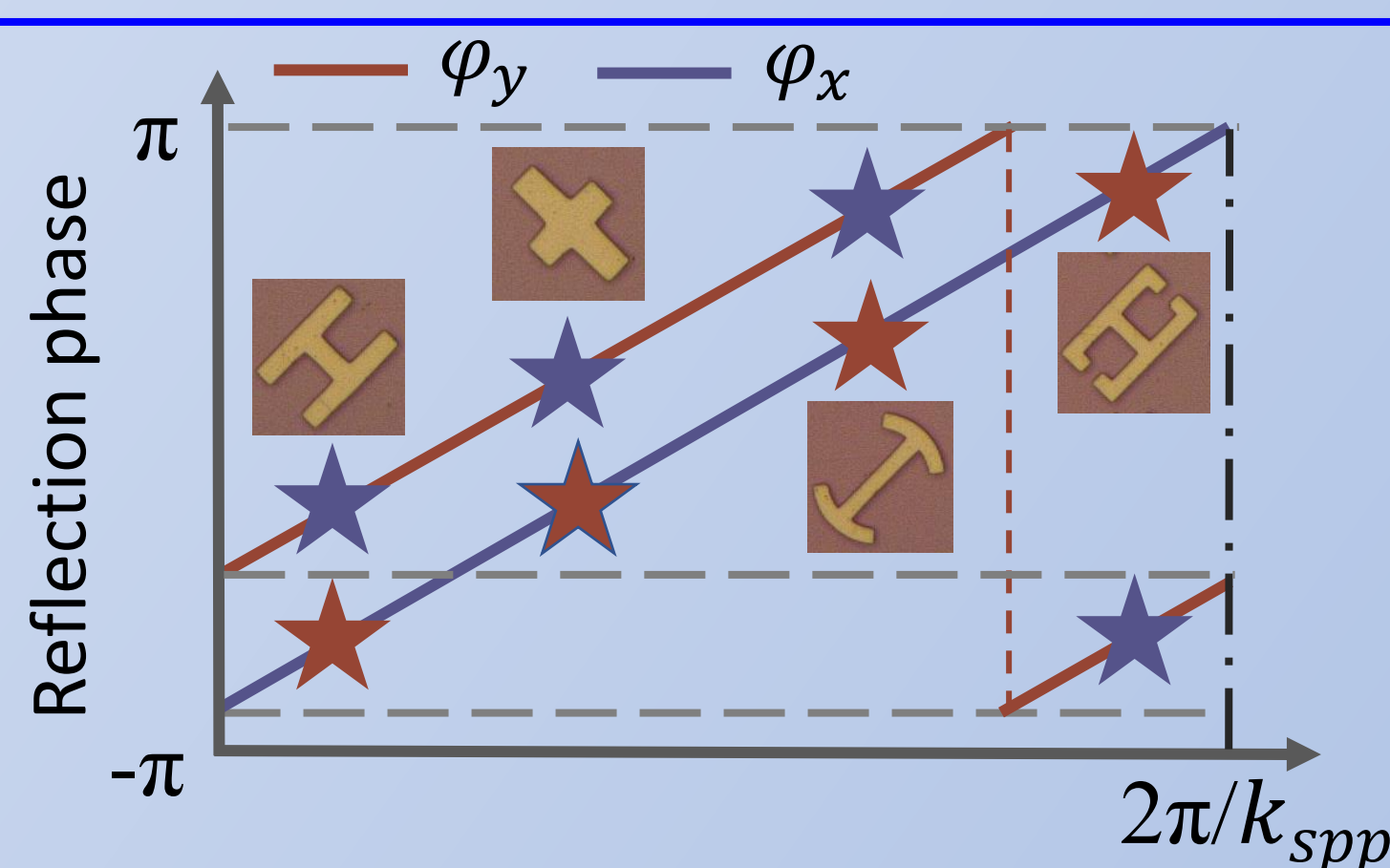
Abstract: Surface plasmon polaritons (SPPs) are eigenstate of electromagnetic traveling along the interface between metal and dielectric. Due to its sub-wavelength and field-enhanced properties, SPPs have attracted intensive attention in the past decades. But its excitations has always been a problem especially for circular polarization (CP) waves. Here we designed and fabricated a coupler in THz band, much higher than previous devices.



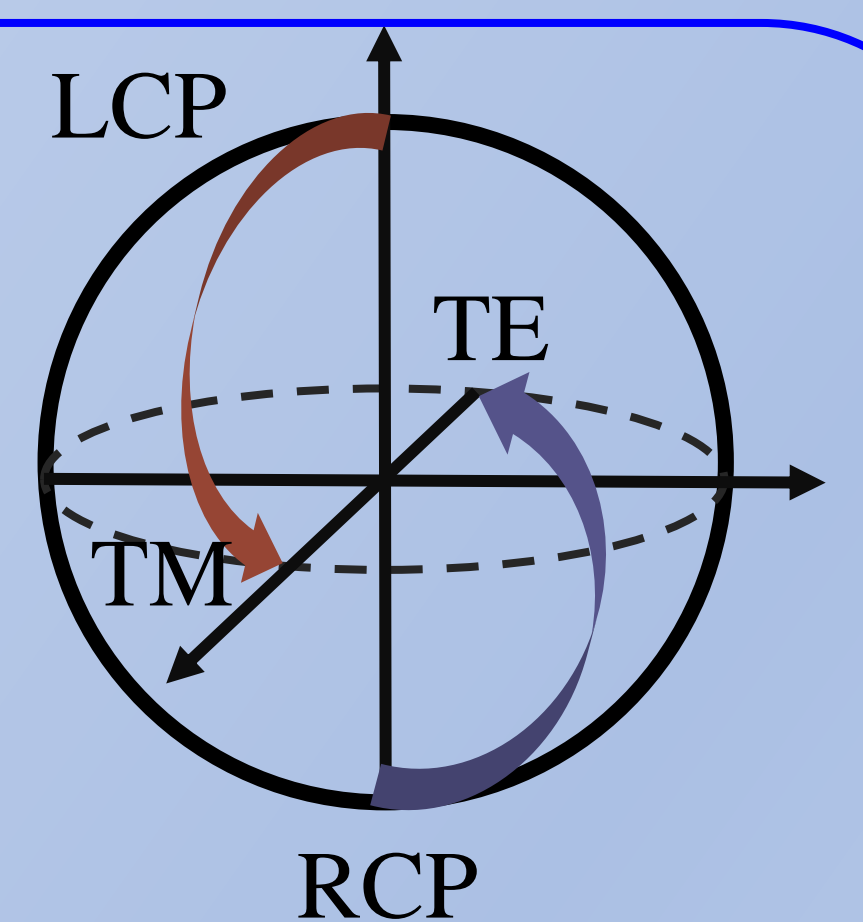
Schematics of the realistically designed SPPs coupler illuminated by the LCP or RCP waves. Incident propagating CP wave is firstly converted into linear polarization (LP) wave, then the gradient phase distribution meta-surface transfer the lp wave into spoof Spps, and finally guided by the artificial plasmonic metal which supports both TE and TM mode SPPs.



The dispersion curve of the artificial plasmonic metal. The metal-insulator-metal (MIM) structure is equivalent to a magnetic material, thus supports two modes of SPPs.

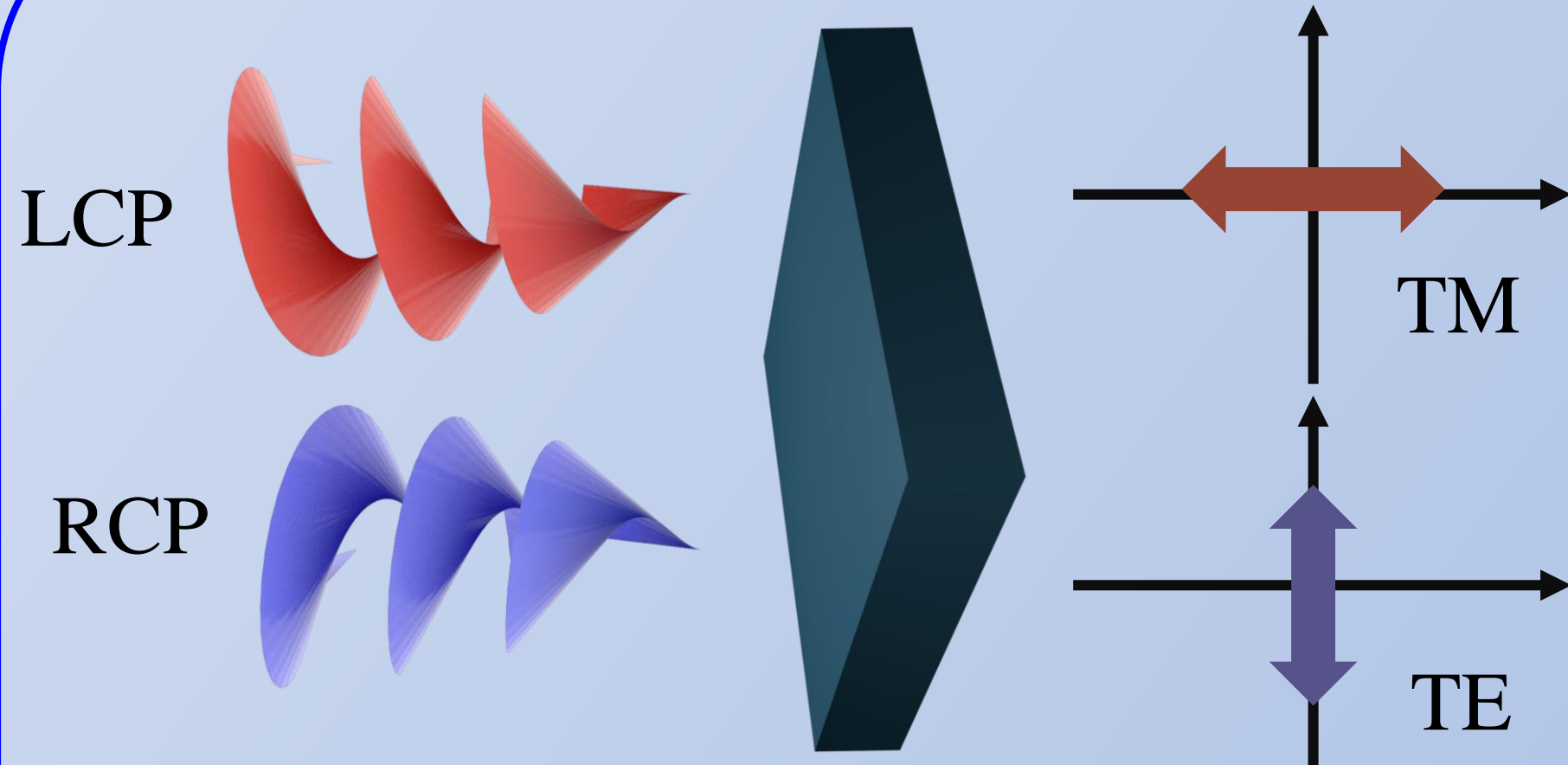


Reflection phase distributions of two polarizations. Each atom is a quart waveplate, which convert cp to lp wave. The phase gradient compensates a parallel wave vector equals k_{spp} .



Polarization convert process expressed in Bloch's sphere, the cp wave is converted to lp wave. Also, the incident lp wave can be converted to cp SPPs.

A quart waveplate rotated by $\pi/4$



A $\pi/4$ or $3\pi/4$ polarized lp can be convert into cp by a quart waveplate, and vice versa, so we need a $\pi/4$ berry phase to design eigen slab.

Conclusions:

We designed and fabricated a SPPs coupler independent polarization in THz band, in FEM stimulation its efficiency reaches 80%. It may play a role in integrated optics.

References:

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2. sDuan, J. *et al. Scientific Reports* **7**, 1354.
3. Wang, D. *et al. Light: Science & Applications* **10**, 67.

