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# Supporting Information

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# Spin-Selective Full and Subtle Light Intensity Manipulation with Diatomic Metasurfaces

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This file includes:

**S1**. *Visualized analysis on the optical resonances of the two umbrella-shaped structures at different wavelengths and with different* $\beta_2$

**S2**. *Analysis on the reason for the difference between the simulated and measured reflection spectra of the designed diatomic metasurface with* $\beta_2 = 130$ *degrees*

**S3**. *Custom-built experimental setup for spectral measurement and optical imaging*

## S1. Visualized analysis on the optical resonances of the two umbrella-shaped structures at different wavelengths and with different $\beta_2$

The current density distribution is related to the resonance strength, and all the excited dipoles in the proposed diatomic metasurface can be calculated based on it. To visualize and analyze the optical resonances of the two umbrella-shaped structures (S1 and S2, as shown in Figure 1) at different wavelengths, we simulated the current density distributions in the cross section of the proposed diatomic metasurface at different wavelengths, as shown in **Figure S1.** For LCP illuminations, the current flows in S1 and S2 are in-phase at the three different wavelengths. It can be seen that the resonance strengths of S1 and S2 are almost the same and remain unchanged with the change of wavelength. Meanwhile, for RCP illuminations, the current flows in S1 and S2 are out-of-phase at the three different wavelengths. The resonance strength of S1 is weaker than that of S2 at 1350 nm, while the resonance strength of S1 is stronger than that of S2 at 1590 nm. At 1470 nm, the resonance strengths of S1 and S2 are almost the same. These results are in good agreement with the calculated results in Figures 3(a) and 3(b).

We further analyzed the current density distributions in the cross section of the proposed diatomic metasurface at 1470 nm for different $\beta_2$, as shown in **Figure S2**. The results indicate that the resonance strength and resonance mode of the proposed diatomic metasurface remain unchanged with increasing $\beta_2$ when illuminated by LCP waves. In contrast, both the resonance strength and resonance mode are significantly changed with the increase of $\beta_2$ when illuminated by RCP waves. The current flows in S1 and S2 change from in-phase to out-of-phase with increasing $\beta_2$. At the meantime, the resonance strength of S2 continuously increases with increasing $\beta_2$, while that of S1 first decreases and then increases. These results are in keeping with the calculated results in Figures 3(c) and 3(d).

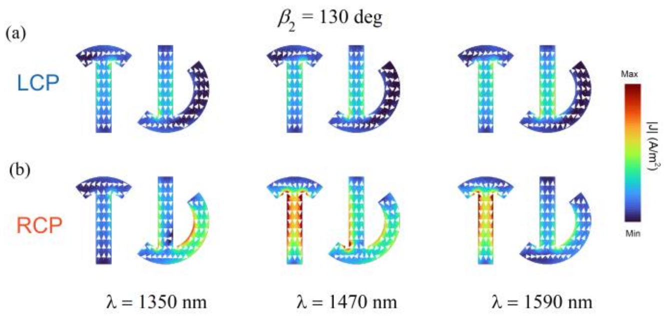

**Figure S1.** Simulated results of the direction of the current flow (white arrow) and the distribution of the current density in the cross section of the proposed diatomic metasurface with $\beta_2$ = 130 degrees under (a) LCP and (b) RCP illuminations at three different wavelengths.

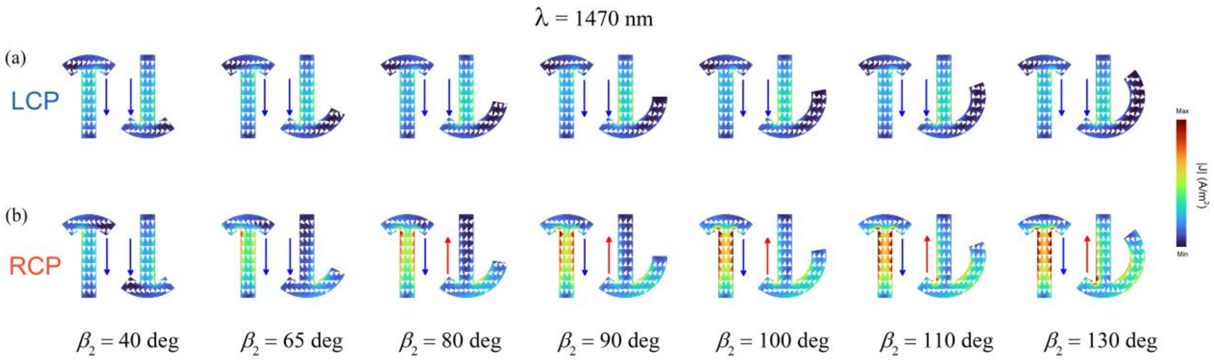

**Figure S2**. Simulated results of the direction of the current flow (white arrow) and the distribution of the current density in the cross section of the proposed diatomic metasurfaces at 1470 nm under (a) LCP and (b) RCP illuminations as $\beta_2$ varies from 40 to 130 degrees. The red and blue arrows represent the direction of current flow on the handles of the two umbrella-shaped structures.

## S2. Analysis on the reason for the difference between the simulated and measured reflection spectra of the designed diatomic metasurface with $\beta_2 = 130$ degrees

The simulated and measured reflection spectra in Figure 4 show some difference for designed diatomic metasurfaces with $\beta_2$ = 130 degrees, which can be attributed to the fabrication error. For further validation, we analyzed the structure and morphology of the fabricated sample based on the captured top-view scanning electron microscope (SEM) image, as shown in **Figure S3**(a). The angle $\beta_2$ of the fabricated sample is near 140 to 145 degrees. When $\beta_2$ changes from 130 to 140 or 145 degrees, the wavelength corresponding to the lowest reflection intensity of RCP waves has a red shift, and the value of the lowest reflection intensity increases, which are in good agreement with the measured results and supports the above-mentioned claim. (Figure S3(b) and S3(c)).

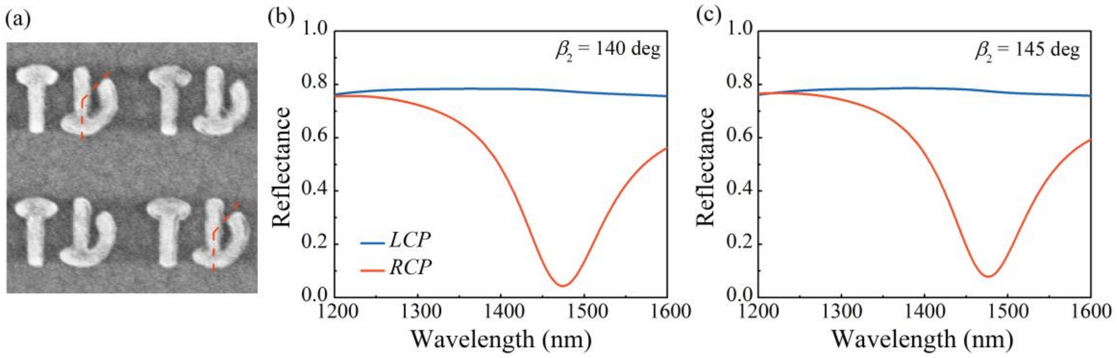

**Figure S3**. (a) SEM images of the designed diatomic metasurface with $\beta_2$ = 130 degrees. Simulated reflection spectra of diatomic metasurfaces illuminated by circularly polarized waves when (b) $\beta_2$ = 140 degrees, and (c) $\beta_2$ = 145 degrees.

## S3. Custom-built experimental setup for spectral measurement and optical imaging

The experimental measurement of the designed diatomic metasurfaces was based on two custom-built optical settings, as shown in **Figure S4**.

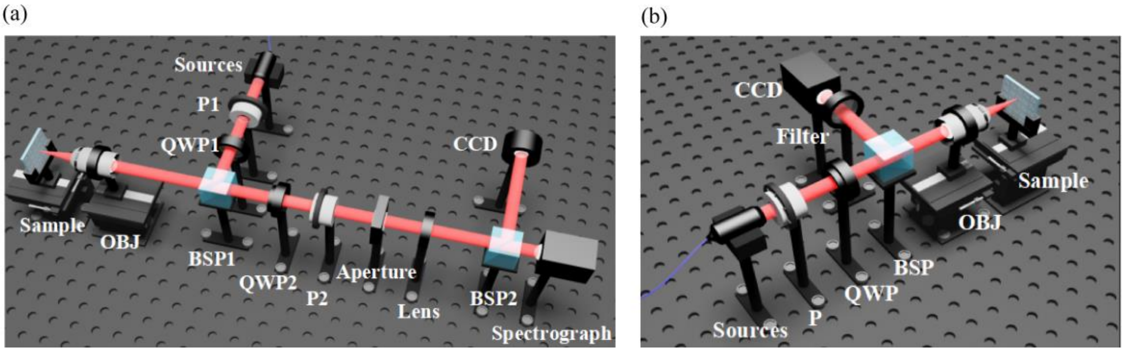

**Figure S4.** Schematic illustrating the home-built setup to (a) measure spectra and (b) capture gray images. P: polarizer, QWP: quarter-wave plate, OBJ: objective, BSP: beam splitter prism, CCD: charge-coupled device camera.