

Supplementary Materials for Tailored Triggering of High-quality Multi-dimensional Coupled Topological States in Valley Photonic Crystals

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Fig. S1. Valley-momentum locking phenomenon of two edge states at the K' valley.

Fig. S2. Field distribution of different hybrid modes in transmission spectrum.

Fig. S3. Excitation of high-quality tunable multi-dimensional coupled topological states with LCP source.

Fig. S4. Robustness of multi-dimensional coupled topological states.

Fig. S5. Regulation of multi-dimensional coupled topological states with different coupling strength when the RCP source is at position 3.

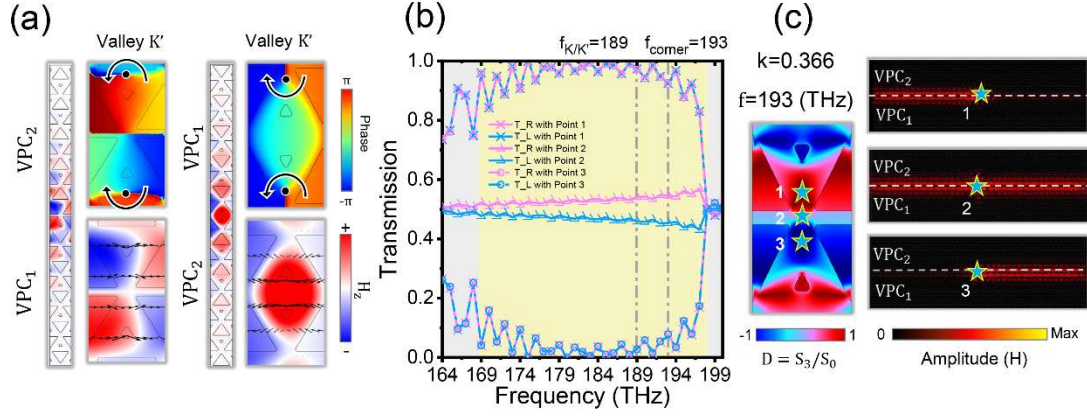


Fig. S1. Valley-momentum locking phenomenon of two edge states at the K' valley. (a) Valley-momentum locking properties of type I and type II VESs at K'-valley. (b) Normalized energy flow at the left or right ports when a LCP source is at positions 1, 2, and 3, respectively. (c) Positional dependence of the normalized Stokes S_3/S_0 parameter at the interface, and the field distributions with the LCP source at positions 1, 2, and 3.

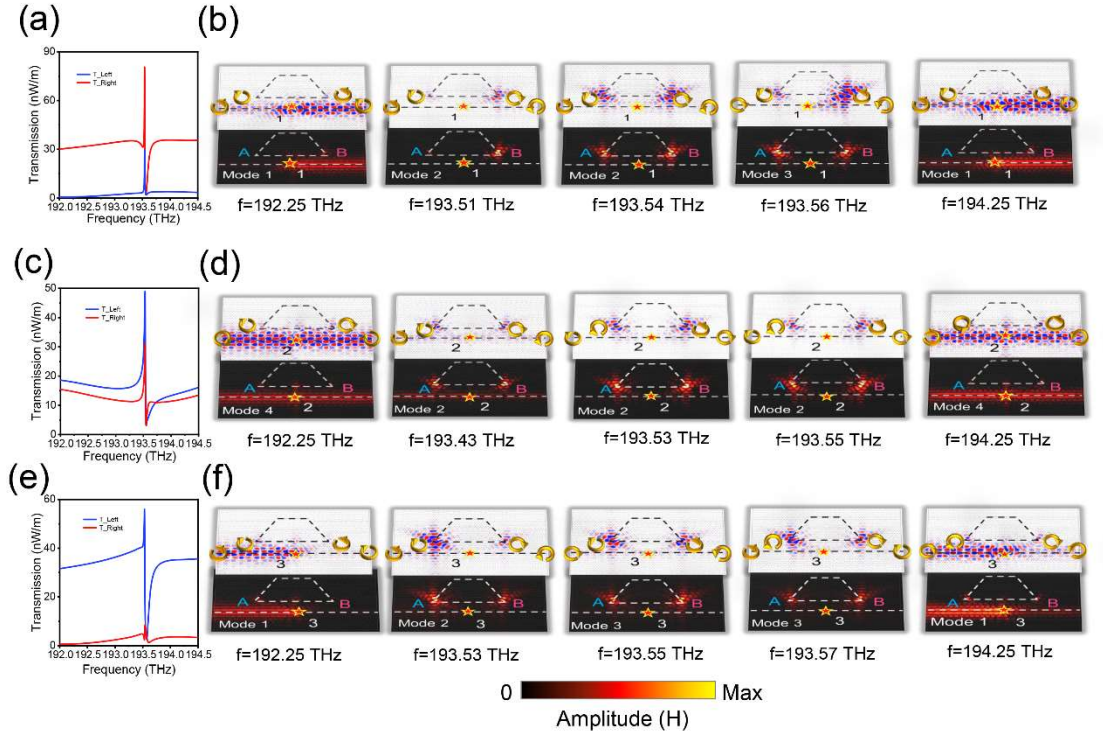


Fig. S2. Field distribution of different hybrid modes in transmission spectrum. (a-f) H and H_z distributions of modes at different frequencies in the transmission spectral line when the RCP source is at positions 1, 2, and 3, respectively, where the dark modes are $Mode_2$ or $Mode_3$ and the bright modes are $Mode_1$ or $Mode_4$.

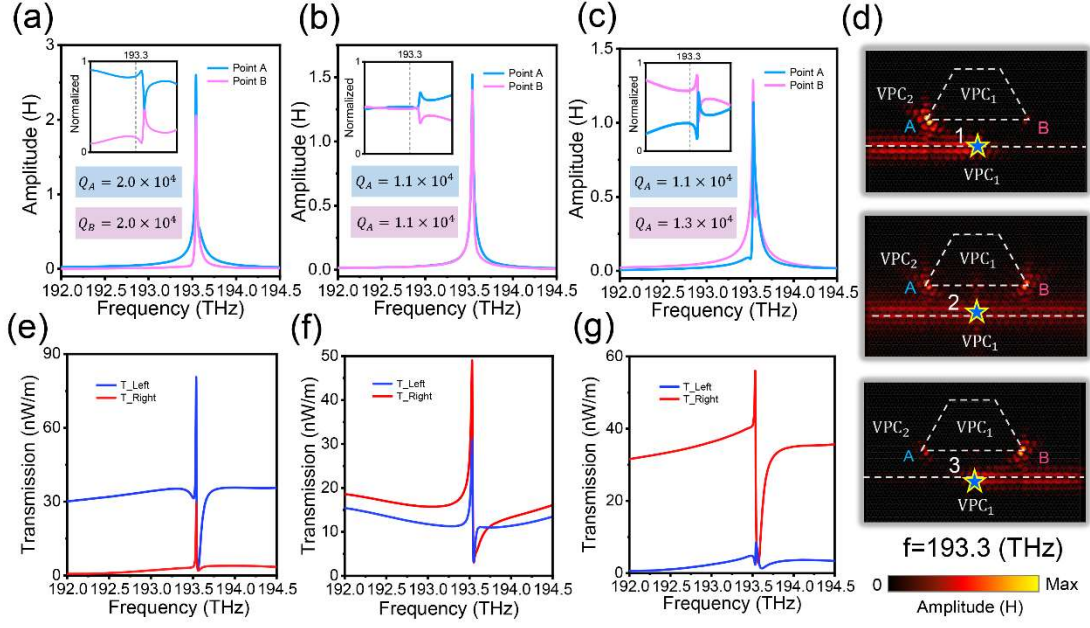


Fig. S3. Excitation of high-quality tunable multi-dimensional coupled topological states with LCP source. (a)-(c) Field intensity of the VCS nanocavities when the LCP source is at positions 1, 2, and 3, respectively, and the inset shows the normalized intensity at points A and B. (d) Field distributions of the LCP source at the 1, 2 and 3 positions, respectively. (e)-(f) Transmission spectra of the two ports of the waveguide when the LCP source is at positions 1, 2 and 3, respectively.

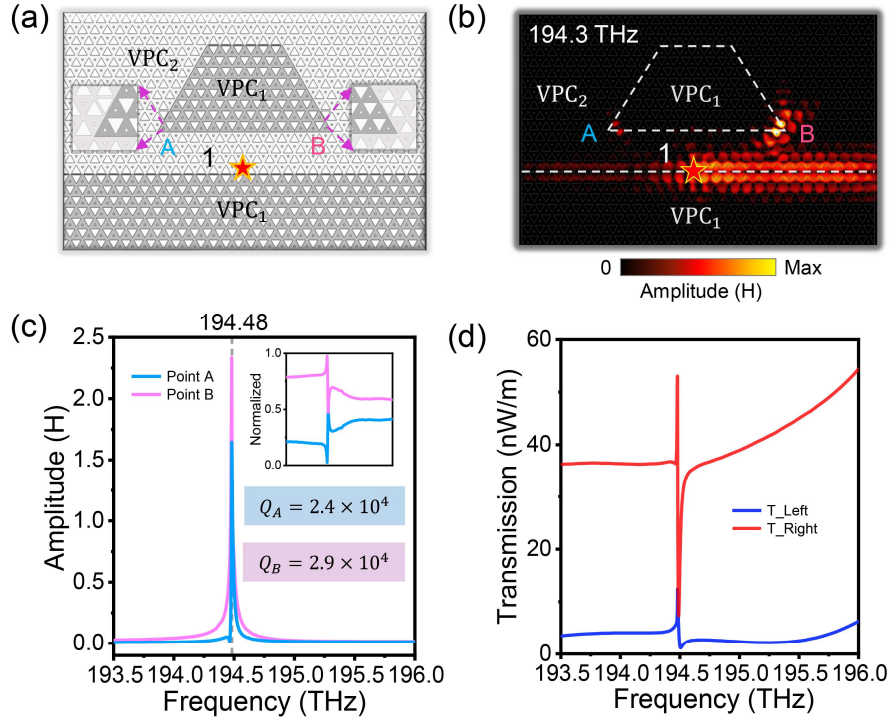


Fig. S4. Robustness of multi-dimensional coupled topological states. (a) Schematic of the structure, where a small triangular hole near the splicing corner is replaced by a large triangular hole as shown in the enlarged figure. (b) Field distribution of the multi-dimensional coupled topological states with defect. (c) Field intensity at points A or B, and the inset shows the normalized intensity. (d) Transmission spectrum at the left or right ports.

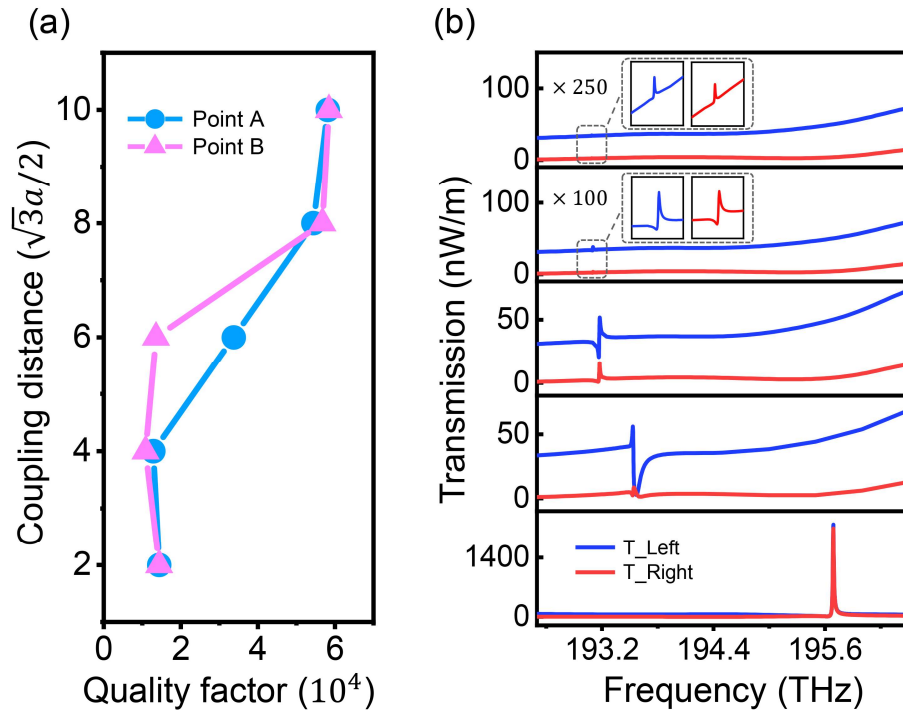


Fig. S5. Regulation of multi-dimensional coupled topological states with different coupling strength when the RCP source is at position 3. (a) and (b) Dependence of the quality factor and transmission spectrum of the structure with different coupling strength when the RCP source is at positions 3.