## **Supporting Information**

## Quantum anomalous Hall effect in stable 1T-YN<sub>2</sub> monolayer with a large nontrivial band gap and high Chern number

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**Figure S1.** The comparison of SOC band structures between DFT-PBE calculation and MLWF calculation.

Figure S2. The out of plane spin textures of the 1T-YN<sub>2</sub> monolayer.

**Figure S3-S8.** The side views of the  $YN_2/GaSe$  heterostructures and  $GaSe/YN_2/GaSe$  quantum wells, the vertical views of the  $YN_2/GaSe$  heterostructures and the band structures of the  $YN_2/GaSe$  heterostructures and  $GaSe/YN_2/GaSe$  quantum wells.

**Figure S9.** Momentum and energy dependence of local density of states for the states at the edge of the heterostructures.

Figure S10. Side view and vertical views of hBN/YN<sub>2</sub>/hBN quantum well.

Figure S11. The broadened Raman spectrums of YN<sub>2</sub>/GaSe heterostructures.

Table I. Two frequencies of the largest intensity peaks in the Raman activities of  $YN_2/GaSe$  heterostructures.



Figure S1. The comparison of SOC band structures between DFT-PBE calculation and MLWF calculation.



Figure S2. The out of plane spin textures. The upwards red peak indicates the location of  $\Gamma$  point in the Brillouin zone; the downwards blue peaks indicate the locations of Dirac cones near the M point.



Figure S3. Stacking model A. Left: The side view along  $(1\overline{1}0)$  direction, and the red dashed rectangle represents the heterostructure model. Middle: Vertical view along (001) direction of the heterostructure. Right: The band structures of heterostructure (up) and quantum well (down).



Figure S4. Stacking model B. Left: The side view along  $(1\overline{1}0)$  direction, and the red dashed rectangle represents the heterostructure model. Middle: Vertical view along (001) direction of the heterostructure. Right: The band structures of heterostructure (up) and quantum well (down).



Figure S5. Stacking model C. Left: The side view along  $(1\overline{1}0)$  direction, and the red dashed rectangle represents the heterostructure model. Middle: Vertical view along (001) direction of the heterostructure. Right: The band structures of heterostructure (up) and quantum well (down).



Figure S6. Stacking model D. Left: The side view along  $(1\overline{1}0)$  direction, and the red dashed rectangle represents the heterostructure model. Middle: Vertical view along (001) direction of the heterostructure. Right: The band structures of heterostructure (up) and quantum well (down).



Figure S7. Stacking model E. Left: The side view along  $(1\overline{1}0)$  direction, and the red dashed rectangle represents the heterostructure model. Middle: Vertical view along (001) direction of the heterostructure. Right: The band structures of heterostructure (up) and quantum well (down).



Figure S8. Stacking model F. Left: The side view along  $(1\overline{1}0)$  direction, and the red dashed rectangle represents the heterostructure model. Middle: Vertical view along (001) direction of the heterostructure. Right: The band structures of heterostructure (up) and quantum well (down).



Figure S9. Momentum and energy dependence of local density of states for the states at the edge of the heterostructures.



Figure S10. hBN/YN<sub>2</sub>/hBN quantum well. Side view along  $(1\overline{1}0)$  direction, vertical view along (001) and  $(00\overline{1})$  direction, respectively.



Figure S11. The broadened Raman spectrums of  $YN_2/GaSe$  heterostructures.

Model	А	В	С	D	Е	F
frequencies	359.6	358.0	362.0	358.5	361.7	364.1
	359.8	361.7	368.1	362.9	362.9	366.0

Table I. Two frequencies of the largest intensity peaks in the Raman activities of  $YN_2/GaSe$  heterostructures.