All optical logic devices based on black arsenic–phosphorus with strong nonlinear optical response and high stability

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Section 1: The nonlinear optical response of B-AsP at different concentrations

Figure S1 shows the nonlinear optical response of B-AsP at different concentrations, which demonstrates that after the concentration of the B-AsP material is doubled, the corresponding nonlinear response is also nearly doubled accordingly.

Section 2: Nonlinear optical response of BP and B-As$_{0.4}$P$_{0.6}$

The nonlinear optical response of BP and B-As$_{0.4}$P$_{0.6}$ are shown in Fig. S1. For a comparison, the B-As$_{0.4}$P$_{0.6}$ is measured to have a stronger nonlinear optical response than BP under $\lambda = 532$ nm and 671 nm, indicating that the B-As$_{0.4}$P$_{0.6}$ is more suitable for the design of nonlinear photonic devices.

Fig. S2 | The nonlinear optical response of BP and B-As$_{0.4}$P$_{0.6}$ under $\lambda = 532$ nm and 671 nm.

Section 3: Unidirectional nonlinear excitation at $\lambda = 532$ nm

The phenomenon of unidirectional nonlinear excitation can be achieved not only at $\lambda = 671$ nm, but also at $\lambda = 532$ nm (Fig. S2), indicating that the hybrid structure has a broadband optical response to realize the spatial asymmetric light propagation.

Fig. S3 | The unidirectional nonlinear excitation in 2D B-AsP/ SnS$_2$ hybrid structure at $\lambda = 532$ nm.