

*Supporting Information for*

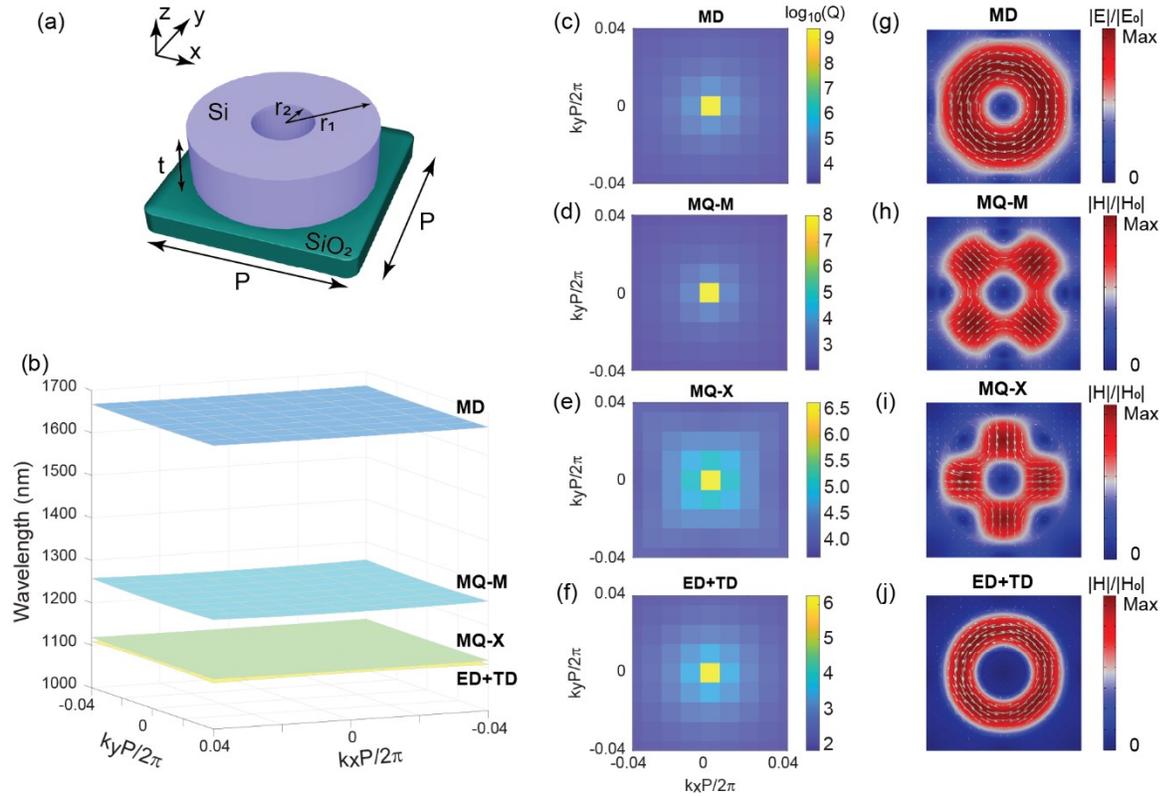
**Nonlinear generation control with torus metasurfaces**

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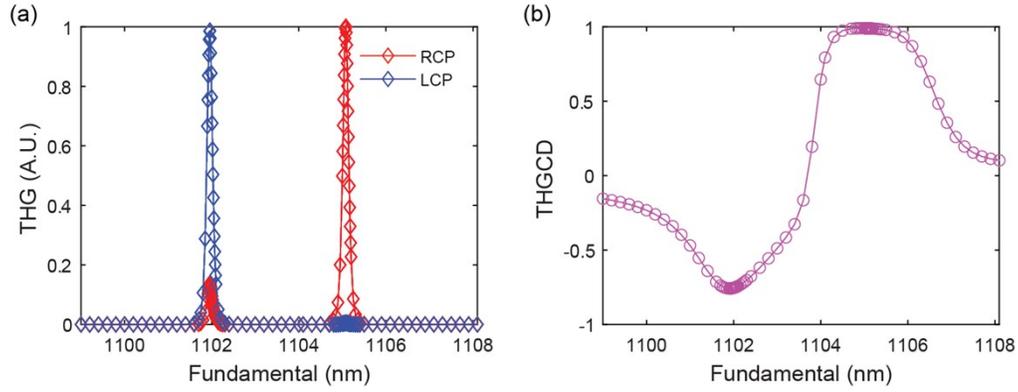
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## Supplemental Data



**Figure S1.** A BIC analysis of the torus structure. (a) Schematic showing a unit cell of the Si torus metasurface without nanogrooves. (b) Simulated band structure of the four modes of interest in the first Brillouin zone. (c)-(f) The corresponding map of the Q-factors. (g) The electric field distribution along with the electric field vectors on a cut-plane located at the middle of the torus resonator corresponding to a MD mode. The magnetic field distributions along with the magnetic field vectors at a (h) MQ-M mode, (i) MQ-X mode, and (j) ED+TD mode.



**Figure S2.** (a) The normalized THG spectra of the chiral torus metasurface under LCP and RCP excitations. (b) The corresponding THG-CD spectrum. The THG-CD is defined as  $THGCD = (I_{THG}^{RCP} - I_{THG}^{LCP}) / (I_{THG}^{RCP} + I_{THG}^{LCP})$ , where  $I_{THG}^{RCP}$  and  $I_{THG}^{LCP}$  are the intensity of THG signals emitted from the metasurface under RCP and LCP excitations, respectively.