

# DETERMINISTIC TWO-PHOTON CONTROLLED-PHASE LOGIC GATE

[Chen, Zihao, Shen, Jung-Tsung, Zhou, Yao](#)

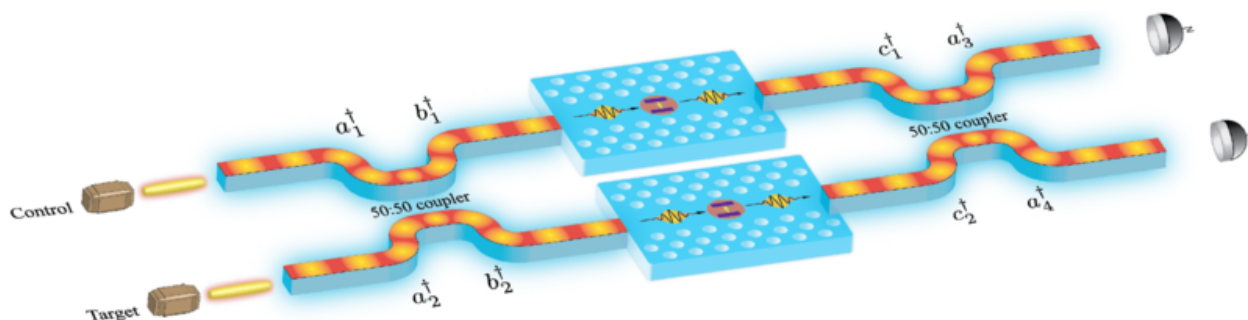
[Maland, Brett](#)

T-018542

## Technology Description

Researchers in the lab of Professor JT Shen at Washington University have developed a two-photon controlled-phase quantum logic gate capable of up to 97% fidelity at room temperature. The design uses chiral optical waveguides with photonic molecules to create a deterministic controlled-phase gate.

While electromagnetically induced transparency can be used to create deterministic gates in ultracold systems, only probabilistic gates have been demonstrated at room temperature. A high-fidelity controlled-phase gate in moderate conditions will enable fully scalable quantum architecture.



*Schematic diagram of the two-photon controlled-phase gate.*

## Stage of Research

The inventors have designed and validated the gate computationally. Ongoing work involves constructing and testing the gate experimentally.

## Publications

- Chen Z, Zhou Y, Shen J-T, Ku P-C, & Steel D. (2021). [Two-photon controlled-phase gates enabled by photonic dimers](#). *Physical Review A*, 103:052610.
- Jefferson B. (2021). [A new piece of the quantum computing puzzle](#). *The Source*, Washington University in St. Louis.

## Applications

- Optical quantum computing

## Key Advantages

- Capable of functioning at room temperature
- Highly efficient: deterministic gate has fidelity up to 97%

**Patents:** Pending

**Related Web Links:** Shen [Profile](#) & [Lab](#)