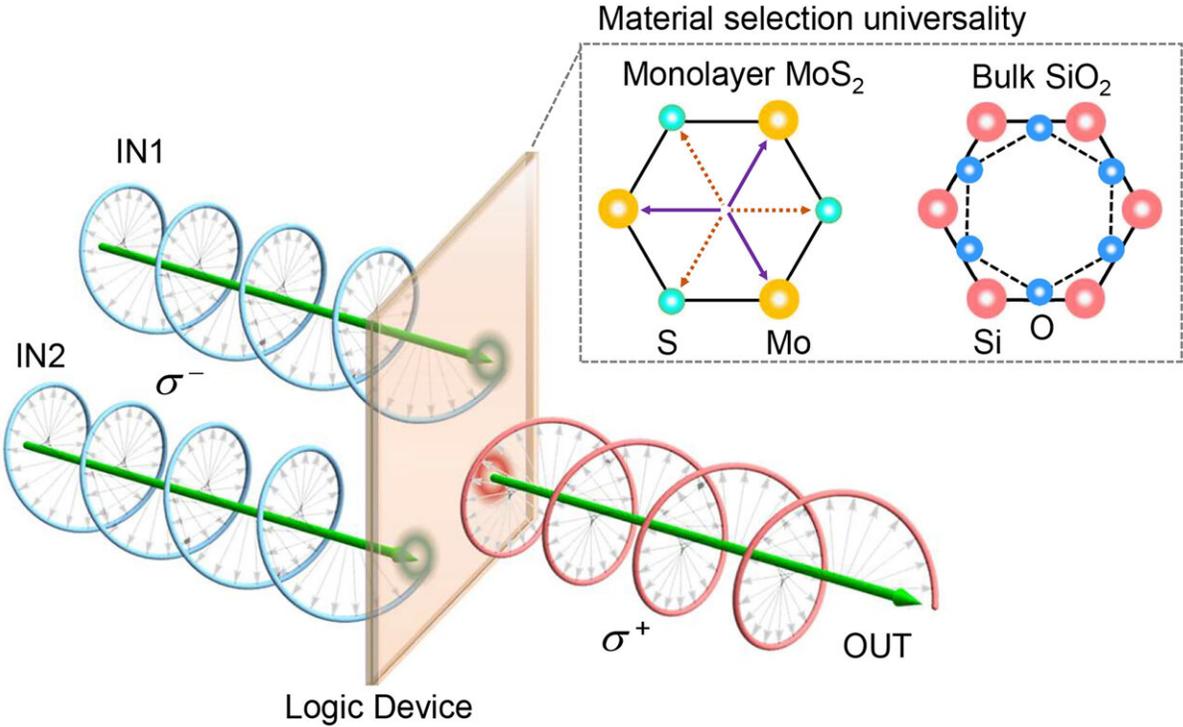


# New optical computing approach offers ultrafast processing

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The optical chirality logic gate is made of a material which emit lights with different circular polarization depending on the chirality of the input beams.  
 Credit: Yi Zhang / Aalto University

Logic gates are the fundamental components of computer processors. Conventional logic gates are electronic—they work by shuffling around

electrons—but scientists have been developing light-based optical logic gates to meet the data processing and transfer demands of next-generation computing.

New optical chirality [logic gates](#) developed by researchers at Aalto University operate about a million times faster than existing technologies, offering ultrafast processing speeds.

The new approach uses circularly polarized light as the [input signal](#). The logic gates are made from crystalline materials that are sensitive to the handedness of a circularly polarized light beam—that is, the light emitted by the crystal depends on the handedness of the input beams. This serves as the basic building block for one type of logic gate (XNOR), and the remaining types of logic gates are built by adding filters or other optical components.

The team also showed that a single device could contain all of their chirality logic gates operating simultaneously in parallel. This is a significant advance over existing logic gates, which can only carry out a single logic operation at a time. Simultaneous parallel logic gates could be used to build complex, multifunctional logic circuits.

Finally, the team demonstrated that the chirality logic gate could be controlled and configured electronically, a necessary step for hybrid electrical/optical computing.

The work is published in the journal *Science Advances*.

**More information:** Yi Zhang et al, Chirality Logic Gates, *Science Advances* (2022). [DOI: 10.1126/sciadv.abq8246](https://doi.org/10.1126/sciadv.abq8246).  
[www.science.org/doi/10.1126/sciadv.abq8246](https://www.science.org/doi/10.1126/sciadv.abq8246)

Provided by Aalto University

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