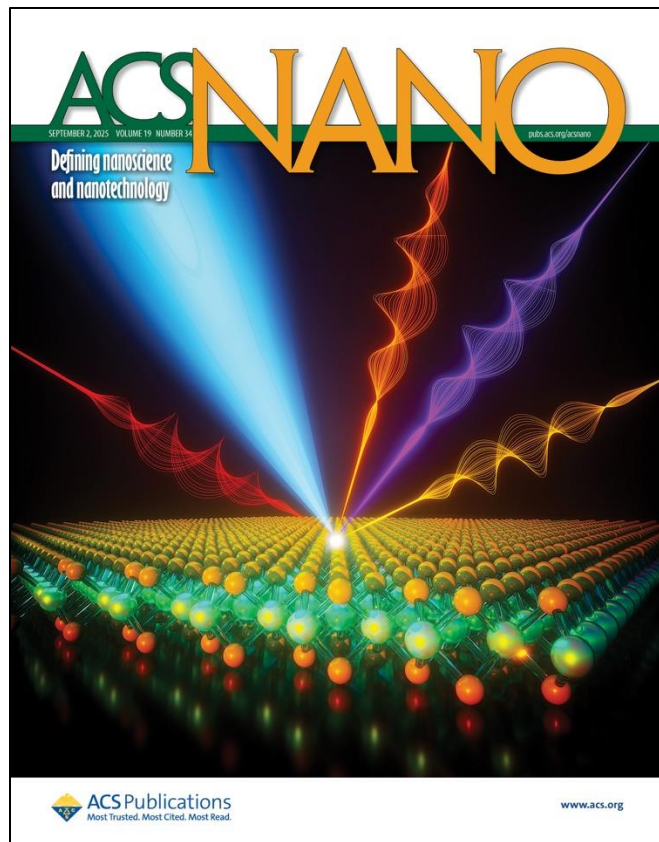


Twisted Nonlinear Optics in Monolayer van der Waals Crystals



Scientific Achievement

A CINT User Team discovered how to precisely control the elementary properties of “twisted” vortex light at the ultimate limit of material dimensionality using monolayer van der Waals crystals.

Significance and Impact

The nanoscale manipulation of twisted light could be used to realize more compact/resilient optical communication systems and quantum information science platforms.

Research Details

- Multiple laser pulses were mixed in a two-dimensional (2D) quantum material, producing new twisted vortex light.
- The team realized nonlinear effects such as difference-frequency generation, sum-frequency generation, and four-wave mixing across a wide spectrum in an ultracompact platform.

Norden, T.; Martinez, L. M.; Tarefder, N.; Kwock, K. W.; McClintock, L. M.; Olsen, N.; Holtzman, L. N.; Yeo, J. H.; Zhao, L.; Zhu, X.; Hone, J. C.; Yoo, J.; Zhu, J.-X.; Schuck, P. J.; Taylor, A. J.; Prasankumar, R. P.; Kort-Kamp, W. J.; Padmanabhan, P. Twisted Nonlinear Optics in Monolayer van Der Waals Crystals. *ACS Nano*. 2025.

Figure: Monolayer van der Waals crystals enable broad-spectrum control of “twisted” light through multi-beam vortex nonlinear optics, unlocking exciting possibilities for structured light manipulation at the nanoscale.

Work was performed, in part, at the Center for Integrated Nanotechnologies.