

Hyperbolicity on-demand in van der Waals Semiconductors

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Strong anisotropy is inherent to naturally layered van der Waals (vdW) materials. Consequentially, dipole active resonances can render the principle values of the dielectric tensor of opposite sign along orthogonal crystallographic directions within naturally occurring vdW materials. Chief among the resultant non-intuitive optical properties is the formation of sub-diffractive wavepackets that travel as conical rays with hyperbolic dispersion throughout their bulk. Here, I discuss our work on producing an on-demand hyperbolic response within the vdW semiconductor WSe_2 . By utilizing femtosecond photoexcitation to inject electron-hole pairs in WSe_2 we dramatically altered its electronic response. Our time-resolved nano-imaging data reveals key signatures of hyperbolicity produced on-demand, which appear on the sub-picosecond timescale.

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