

## **Probing and manipulating valley coherence of dark excitons in WSe<sub>2</sub> monolayer**

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Monolayers of semiconducting transition metal dichalcogenides are two-dimensional direct-gap systems that host tightly-bound excitons with an internal degree of freedom corresponding to the valley of the constituting carriers. Strong spin-orbit interaction and the resulting ordering of the spin-split subbands in the valence and conduction bands makes the lowest-lying excitons in WX<sub>2</sub> (X being S or Se) spin-forbidden and optically dark. This results in their long lifetime, making them potentially interesting for valleytronics. With polarization-resolved photoluminescence experiments performed on a WSe<sub>2</sub> monolayer encapsulated in a hexagonal boron nitride, we demonstrate how the intrinsic exchange interaction in combination with the applied in-plane and perpendicular magnetic fields enables one to probe and manipulate the valley degree of freedom of the dark excitons.

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