

Valley-Mechanical Coupling in a Monolayer Semiconductor

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The interaction of macroscopic mechanical object with electron charge and spin plays a vital role in today's information technology and fundamental studies of the quantum-classical boundary. Recently emerged valleytronics encodes information to the valley degree-of-freedom and promises exciting applications in communication and computation. We realize valley-mechanical coupling in a monolayer MoS₂ resonator and demonstrate transduction of valley information to the mechanical states. The valley and mechanical degrees-of-freedom are coupled through the magnetic moment of the valley carriers under a magnetic field gradient. We identify the valley-actuated mechanical motion by optical interferometry and attain a transduction confidence level near unity. Our experiment lays the foundation for a new class of valley-controlled mechanical devices and facilitates realization of hybrid quantum valley-mechanical systems.

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