

Simple materials offer a peek into the quantum realm

October 10 2019, by Aliyah Kovner

As reported in *Nature Physics*, a Berkeley Lab-led team of physicists and materials scientists was the first to unambiguously observe and document the unique optical phenomena that occur in certain types of synthetic materials called moire; superlattices. The new findings will help researchers understand how to better manipulate materials into light emitters with controllable quantum properties.

Moire; superlattices are made by layering sheets of single-atom-thick materials on top of one another in precise configurations to create a larger and more complex overall pattern. In these arrangements, the otherwise simple composite materials display intriguing behavior.

For example, recent studies from the same team showed that moire; superlattices made with three layers of graphene sandwiched in between layers of boron nitride can act as an exotic insulator and a [high-temperature superconductor](#).

In the current study, Berkeley Lab graduate student researcher Emma Regan and her colleagues used two highly sensitive spectroscopy approaches to examine the excitons (bound pairs of electrons and electron-holes, which occur in semiconductive materials) across the layers of a moire; [superlattice](#) formed by [tungsten disulfide](#) and tungsten diselenide.

"Our work provides needed clarity on how the excitons in moire; superlattices can exist in different states," said Regan. "And now we

know a straightforward way to create perfect arrays of interlayer excitons with distinct optical properties, which can serve as light emitters in next-generation electronic devices."

More information: Chenhao Jin et al. Identification of spin, valley and moiré quasi-angular momentum of interlayer excitons, *Nature Physics* (2019). [DOI: 10.1038/s41567-019-0631-4](https://doi.org/10.1038/s41567-019-0631-4)

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