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External User Project - 2019

Deterministic Quantum Emission in an Epitaxial Two-Dimensional Material

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LANL CINT scientists and their collaborators at UConn, AFRL, Penn State, and U. Oregon have discovered a method to create spatially localized quantum emission sites in a wafer-scale transition metal dichalcogenide film, WSe_2, synthesized at the 2D Crystal Consortium (2DCC) facility. The team's objective was to determine the role of strain in creating localized quantum emission sites in order to learn how to control their properties through strain.

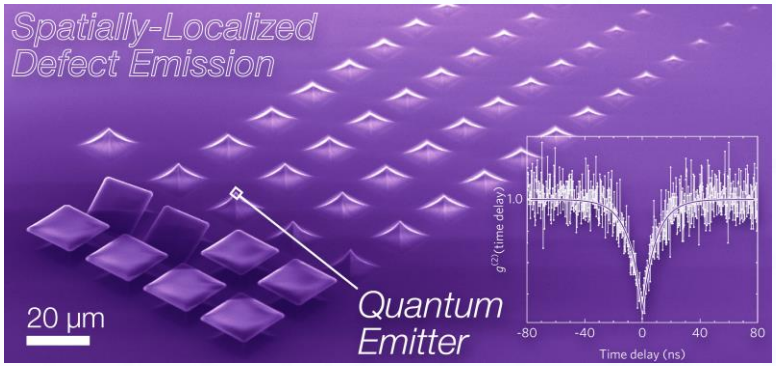
Because the WSe_2 was very thin, it conformed to the radius of ultra-sharp tips with sub-10 nanometer diameters, and bent towards the substrate. The resulting strain was enough to change the electronic structure, but only at the tips. The affected area emitted light that was fundamentally different in nature than that from the rest of the WSe_2 film, where photons were ejected one-by-one, achieving what is referred to as deterministic quantum emission.

An undergraduate REU student at UConn participated in the research as is a co-author on the paper.

The team published the results as a Featured Article in the May 27th issue of *Applied Physics Letters*.

Link to LANL press release:

https://www.lanl.gov/discover/news-release-archive/2019/May/0529-quantum-information.php



Scanning electron micrograph of the array used to create deterministic single photon sources in epitaxial tungsten diselenide. Inset shows the Hanbury-Brown Twiss interferometry measurement proving quantum emission.

W. Wu, C. K. Dass, J. R. Hendrickson, R. D. Montaño, R. E. Fischer, X. Zhang, T. H. Choudhury, J. M. Redwing, Y. Wang, and M. T. Pettes*, "Locally defined quantum emission from epitaxial few-layer tungsten diselenide," *Appl. Phys. Lett.* **2019**, *114*(21), 213102. https://doi.org/10.1063/1.5091779

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