Two-dimensional nanophotonics on rise

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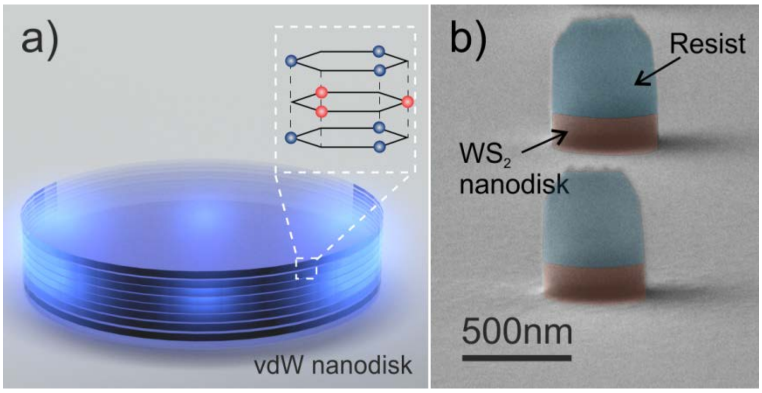

Fig. 1: (a) a sketch of a nanodisk made of TMDC material or van der Waals heterostructure, (b)scanning electron microscopy figure of the fabricated WS_2 nanodisks.

What is it? Using transition metal dichalcogenide (TMDC) materials, semiconductor analogs of famous graphene, scientists at Sweden's Chalmers University of Technology have found a way to control light-matter interactions in highly unusual ways, thus paving the way towards TMDC nanophotonics.

Why does it matter? "TMDC nanophotonics" hold the promise for highly compact optical solutions for photodetection, light harvesting, light emission, as well as light guiding, confining and manipulating. One could imagine constructing metasurfaces and optical circuits to manipulate light in many different ways at the same time providing very compact and bendable solutions. For example the nanodisk array can be as thin as about 50 nanometers and still perform well.

How does it work? Despite quite intense research on TMDC materials and its interesting exciton physics, the fact that TMDCs also have a very high index of refraction has received relatively little attention. At the same time it is well known that nanostructures that have high refractive index can support geometrical optical modes, also known as Mie resonances. Moreover, when Mie modes and excitons sit together in the same body, they may start interacting with each other. This is precisely what was demonstrated in a recent publication from scientists at Chalmers University of Technology.

Publication

R. Verre, D.G. Baranov, B. Munkhbat, J. Cuadra, M. Käll, and T. Shegai, *Transition metal dichalcogenide nanodisks as high-index dielectric Mie nanoresonators*,
arXiv preprint arXiv:1812.04076. Accepted in **Nature Nanotechnology**.