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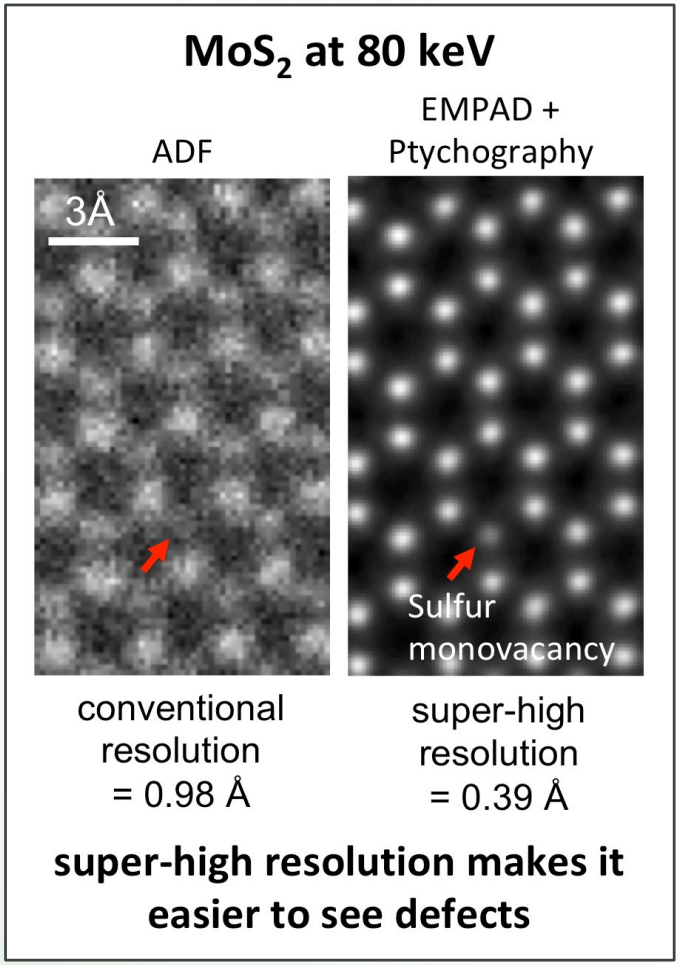
# A Guinness World Record: The Highest Resolution Microscope, enabled by a new detector technology

David Muller, Cornell University
Jiwoong Park, University of Chicago

Electron microscopy is a widespread and often essential tool for structural and chemical analysis at the atomic level. Image resolution is dominated by the energy (or wavelength) of the electron beam and the quality of the lens. Two-dimensional valleytronic materials are imaged with low beam energies to avoid damaging the samples, limiting spatial resolution to ~1 Å. By combining our new design of electron microscope pixel array detector (EMPAD) which has the dynamic range to record the complete distribution of transmitted electrons at every beam position, and a phase retrieval algorithm to process the data, PARADIM's in-house research team has increased the spatial resolution well beyond the traditional lens limitations, reaching a new world record for spatial resolution. As is apparent in the image on the right taken at a beam energy of 80 keV, the ptychographic reconstructions significantly improve the image contrast of single-atom defects in $MoS_2$, corresponding to a 0.39 Å Abbe resolution, at the same dose and imaging conditions where conventional imaging modes reach only 0.98 Å.

This new super-resolution imaging is available to PARADIM users utilizing the new EMPAD detector in combination with ptychography available in (and only in) PARADIM's electron microscopy user facility.

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