# Adiós flatland – Quantum transport in $MoS_2$ nanotube and nanoribbon quantum dots


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Extensive research on planar, 2D TMDCs focuses on their exceptional electronic and optical properties arising from their inherent layer structure. Despite numerous studies on optical behavior, achieving single-level transport in lithographic quantum dots at low temperatures, crucial for quantum electronic devices, faces challenges due to the need for small confinement potentials and disorder at nanoflake edges.
A highly promising solution [1,2] involves using crystalline $MoS_2$ nanotubes grown via a chemical transport process, for natural electron confinement in two directions. With bismuth as contact material, Schottky barriers can be avoided. Low-temperature measurements confirm nondestructive, transparent contacts and single-level quantum transport at $T < 100$mK [1].
To further reduce disorder, an innovative dry transfer technique with anthracene crystals as a pick-up material [3] is employed; several fabrication variants are discussed.

## References


[1] R. T. K. Schock, A. K. Hüttel, *et al.*, Adv. Mat. 35 (2023), 2209333
[2] S. Reinhardt, A. K. Hüttel, *et al.*, pssRRL 13 (2019), 1900251
[3] K. Otsuka *et al.*, Nat. Comm. 12 (2021), 3138


## Figures

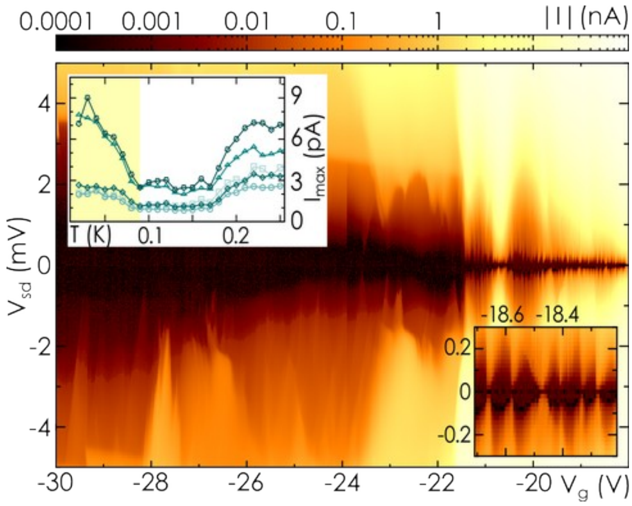


**Figure 1:** Coulomb "diamonds" of a $MoS_2$ nanoribbon (nanotube collapsed during growth), with charging energies consistent with the active device region.

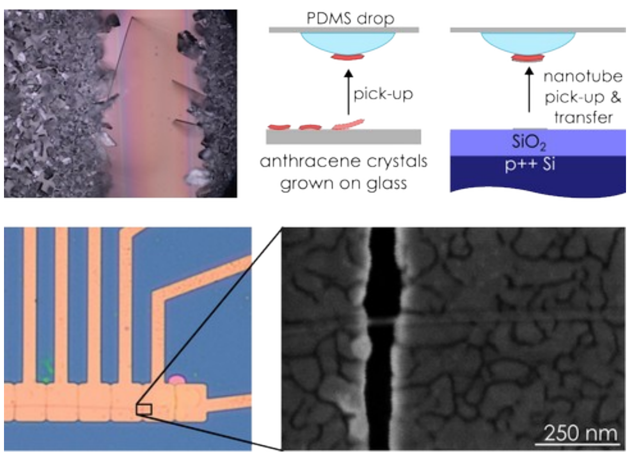


**Figure 2:** Top: Anthracene crystal based residue-free transfer of $MoS_2$ nanotubes. Bottom: $MoS_2$ nanotube device (optical and SEM image).