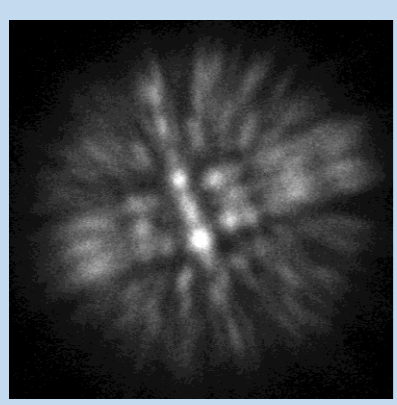


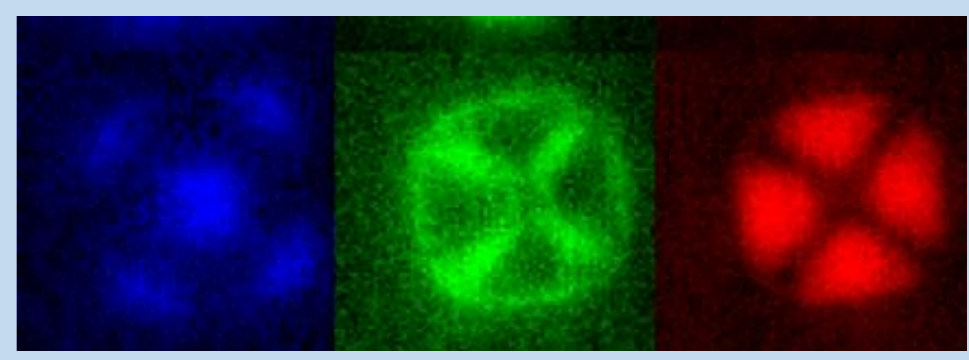
We develop methods to 'see' and measure atoms using some of the world's most powerful electron microscopes.

$$\psi_n(h,k) = (i\sigma)^n \sum_l \sum_{h_1 k_1 l_1} \dots \sum_{h_{n-1} k_{n-1} l_{n-1}} V(h_1 k_1 l_1) V(h_2 k_2 l_2) \dots V\left(h - \sum_{r=1}^{n-1} h_r, k - \sum_{r=1}^{n-1} k_r, l - \sum_{r=1}^{n-1} l_r\right)$$

$$\frac{\exp - 2\pi i \zeta H}{(2\pi i)^n} \left[\frac{\exp 2\pi i \zeta_1 H - 1}{\zeta_1 (\zeta_1 - \zeta_2) \dots (\zeta_1 - \zeta_{n-1}) (\zeta_1 - \zeta)} + \sum_{m=2}^{n-1} \frac{\exp 2\pi i \zeta_m H - 1}{\zeta_m (\zeta_m - \zeta_1) \dots (\zeta_m - \zeta_{m-1}) \dots (\zeta_m - \zeta)} + \frac{\exp 2\pi i \zeta H - 1}{\zeta (\zeta - \zeta_1) \dots (\zeta - \zeta_{n-1})} \right]$$



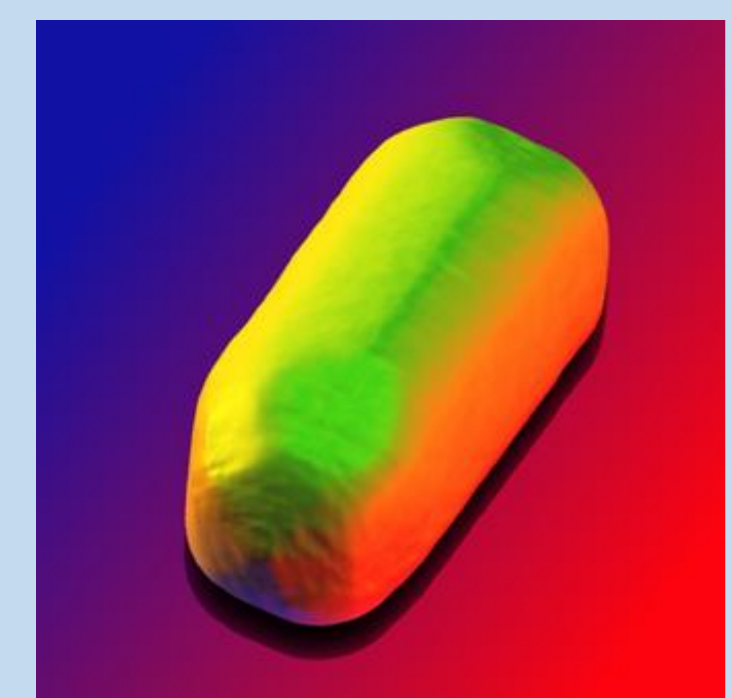
At the atomic level, amazing and beautiful quantum phenomena can occur that is very different to the macroscopic world.



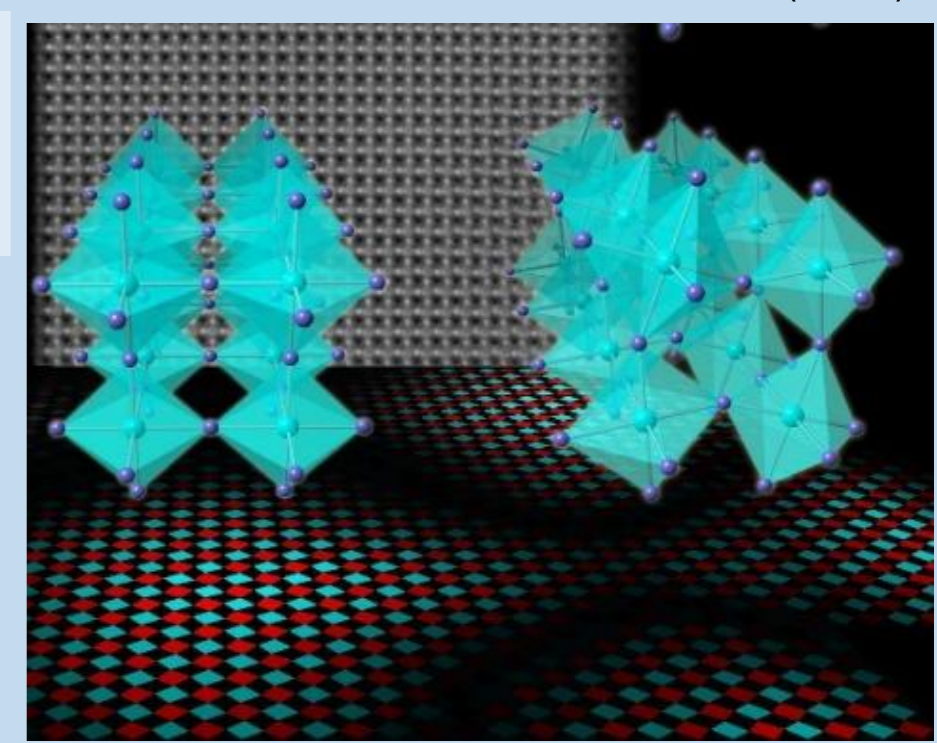
Electrons after scattering from atoms: *PRL* 106 (2011)

Surface plasmon polaritons in an 'anti-nanoparticle' *ACSnano* 11 11383 (2017)

We apply these methods to understand how atomic and electronic structure controls the physical properties of a material.



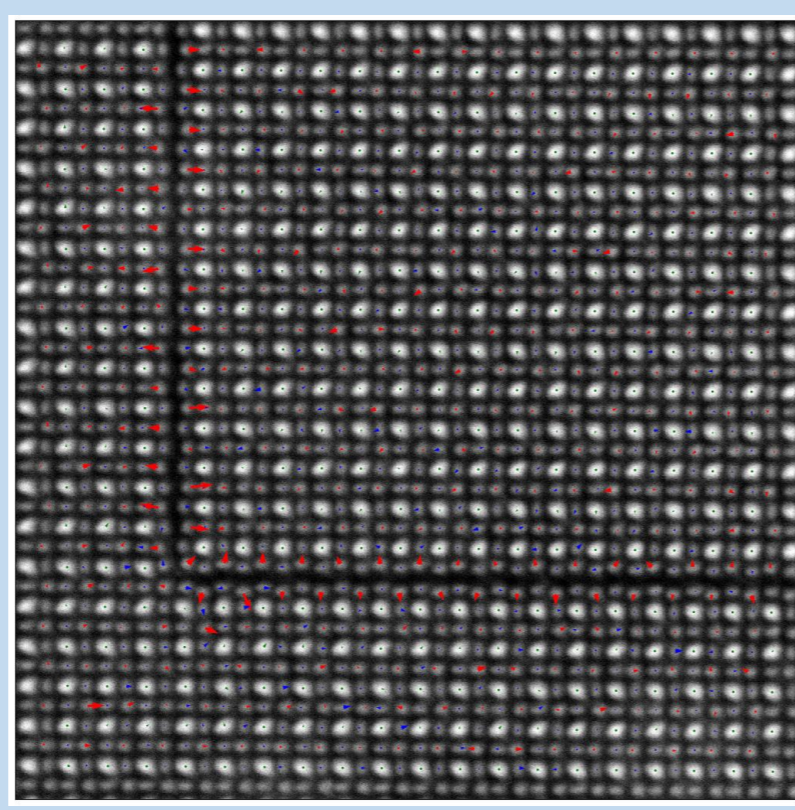
Our group studies a range of materials with applications in solar cells, light manipulation, energy storage and nanoelectronics.



How do nanocrystals grow? How do they interact with light?

- Accts Chem Res.* 50 2925 (2017)
- Nano Letts* 15 1635 (2015)
- ACS Nano* 9 715 (2015)
- Nano Letts* 11, 273 (2011)

Li atoms drive conduction in a battery material *Nature Materials* 14 1142 (2015)



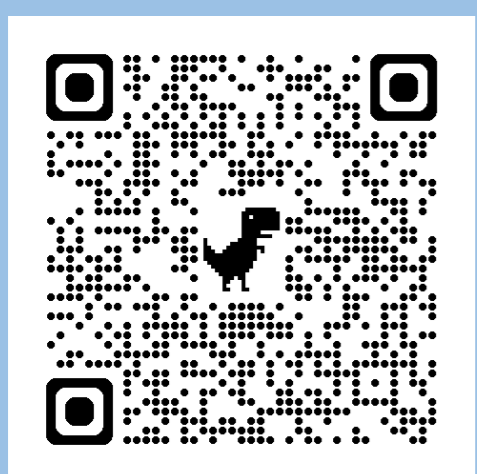
Atomic architecture controls the efficiency of solar cell materials

- Advanced Materials*, 2501788 (2025)
- Nature Comms* 14 8523 (2023)
- Nature Energy* 6 624 (2021)
- Nature Comms* 8 14547 (2017)



We collaborate with many international groups, including Oxford University, Aarhus University, Berkeley Lab, Fudan University, University of Cambridge, and also with the microscopy and solar cell industries.

Hons & PhD Projects: - range from fundamental physics to collaborations with industry.
 - can involve theory or experiment or a mix of both
 - make use of world-first transmission electron microscopes
 - can include travel to a collaborator lab



Use QR to Sign up for PhIG Lab Tours and Pizza Lunch - Thurs 16 Oct

PhD Scholarships: 2 Laureate PhD scholarships available to H1 students.

Contact: Prof Joanne Etheridge joanne.etheridge@monash.edu

