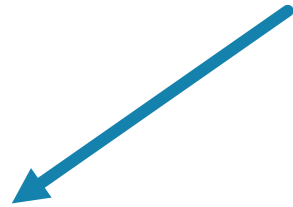

OUTLINE

- Evolution of the thickness of 2D superconductors
- Overview of NbSe₂
- NIR detectors of NbSe₂
- THz detectors of NbSe₂

MOTIVATION

Superconducting quantum sensors



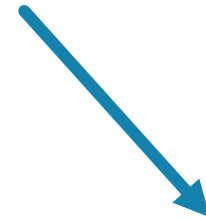
Quantum computers



Quantum
cryptography



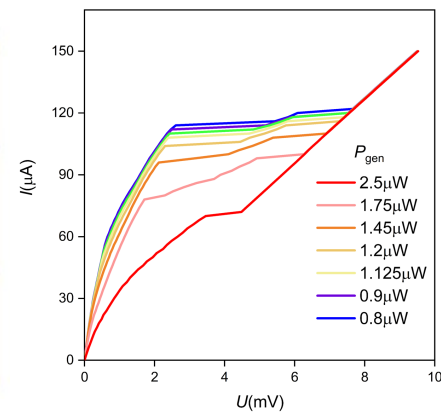
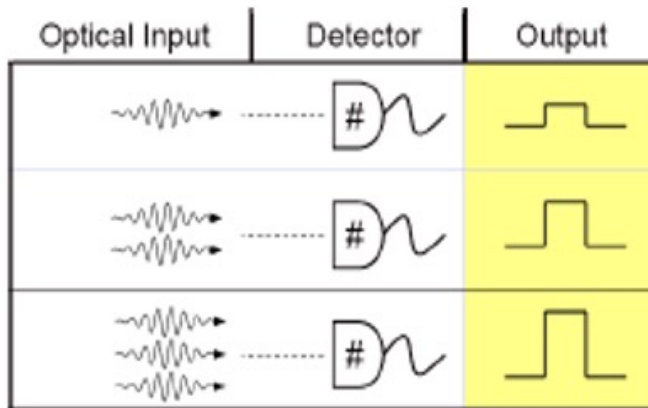
Astronomy



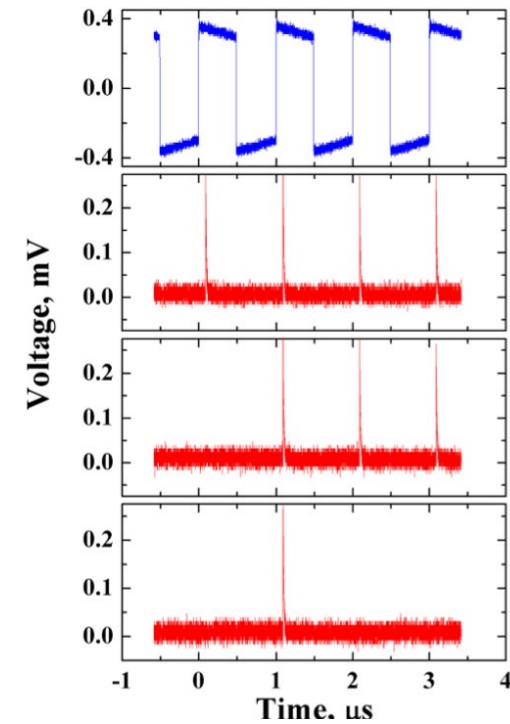
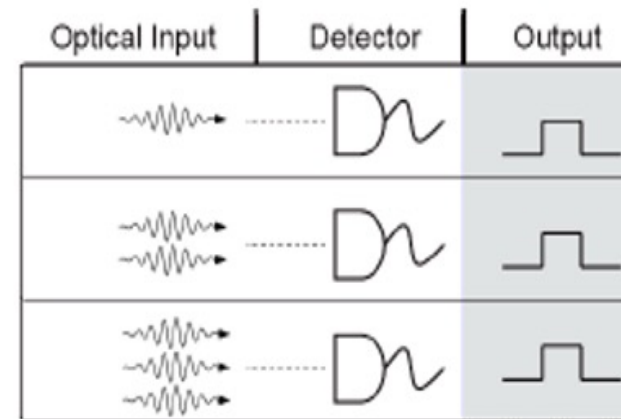
Specific quantum
sensors

SUPERCONDUCTING ELECTROMAGNETIC WAVES DETECTORS

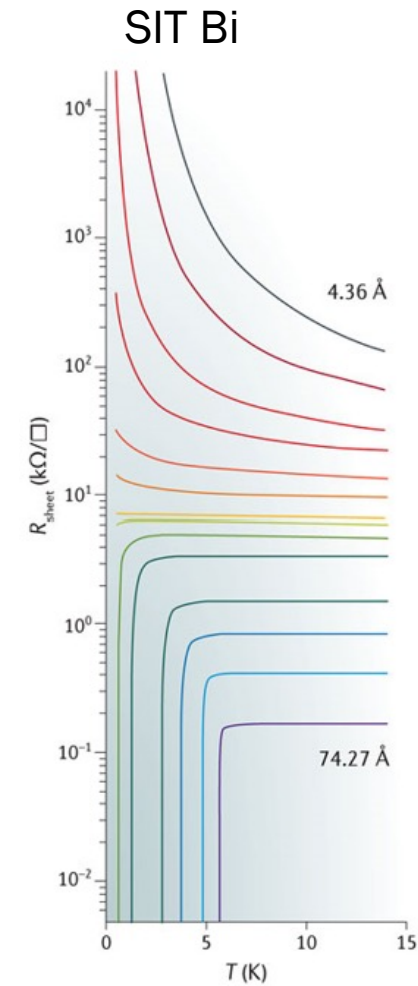
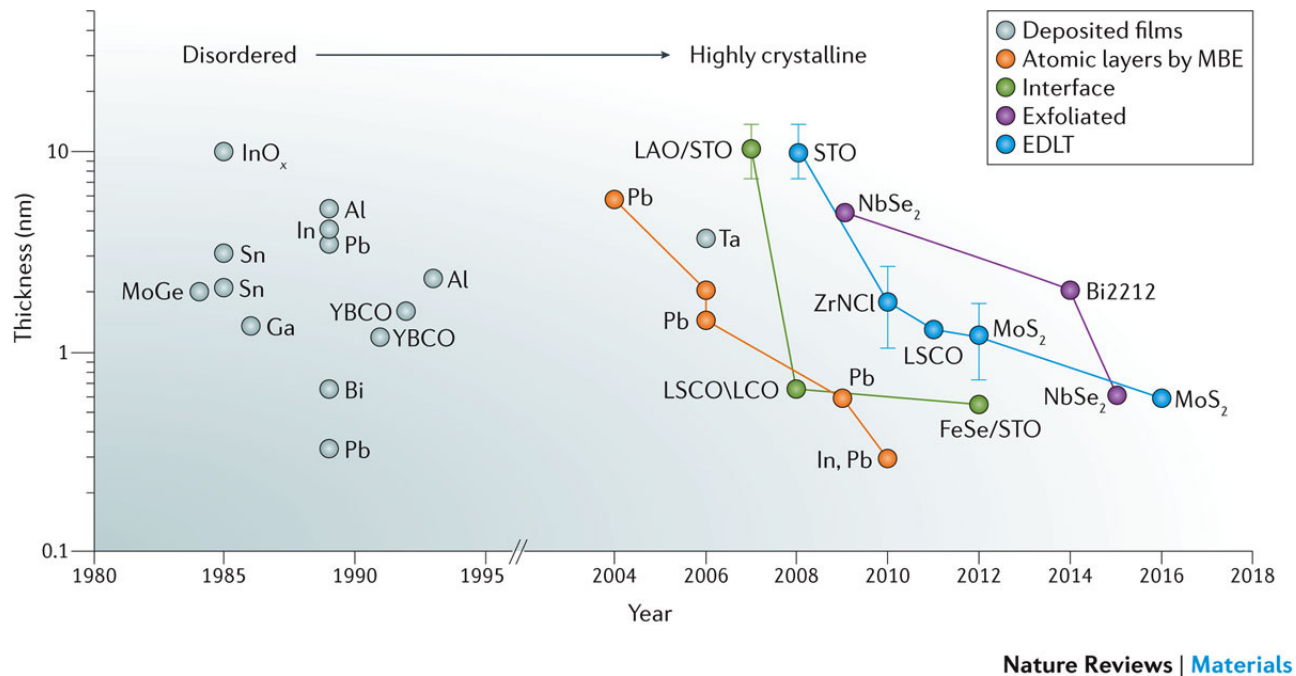
HEB



SNSPD



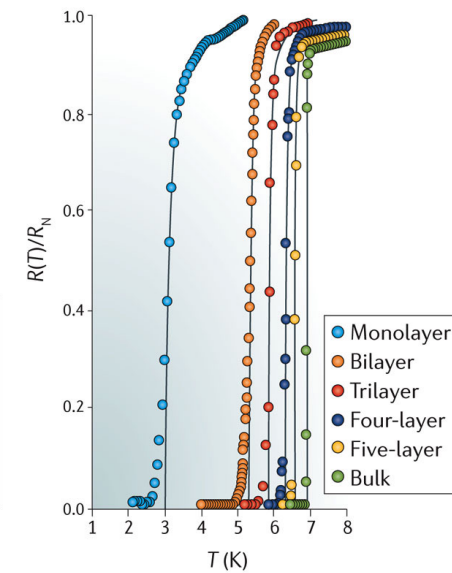
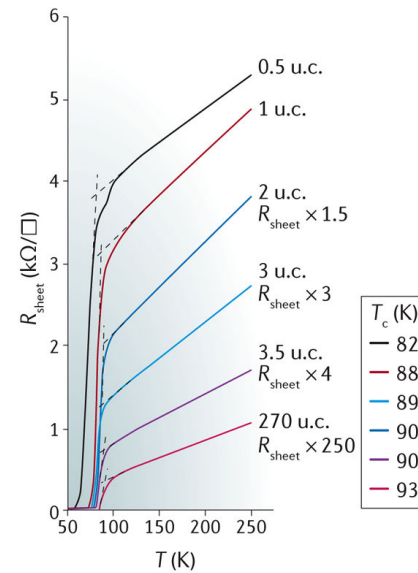
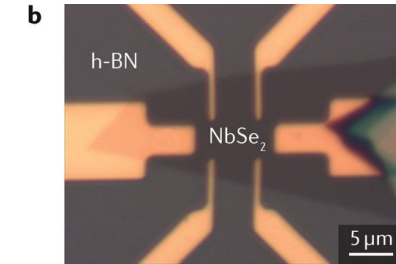
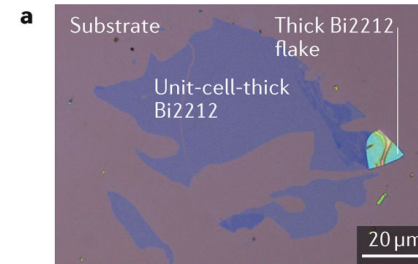
EVOLUTION OF THE THICKNESS OF 2D SUPERCONDUCTORS SINCE 1980



Saito, Y. *et al.* (2016) Highly crystalline 2D superconductors
Nat. Rev. Mater. doi:10.1038/natrevmats.2016.94

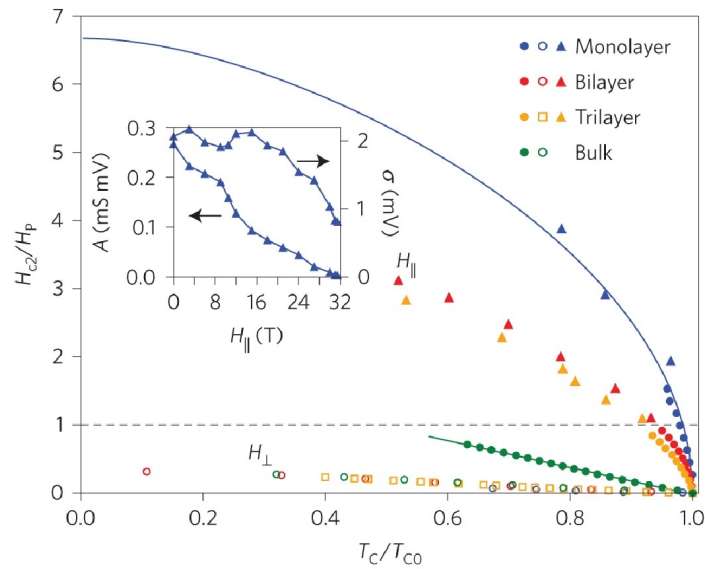
2D SUPERCONDUCTING NIOBIUM DISELENIDE

- 1) Maintains superconductivity down to one atomic layer
- 2) Low heat capacity
- 3) Possibility of creating heterostructures with programmable properties
- 4) Study of fundamental detection limits

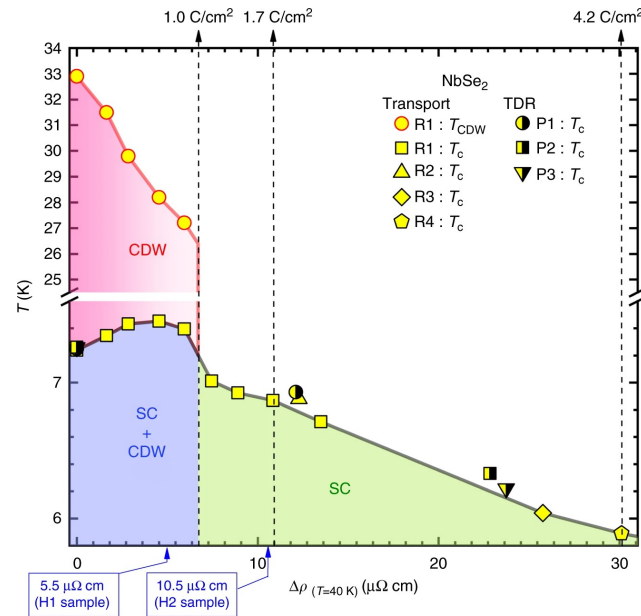


Nature Reviews | Materials

TRANSPORT MEASUREMENT NBSE2

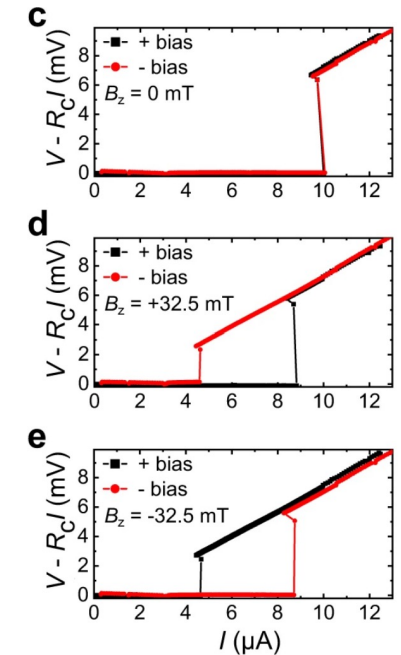


Xi, X., Wang, Z., Zhao, W. *et al.* **Nature Phys** **12**, 139–143 (2016).



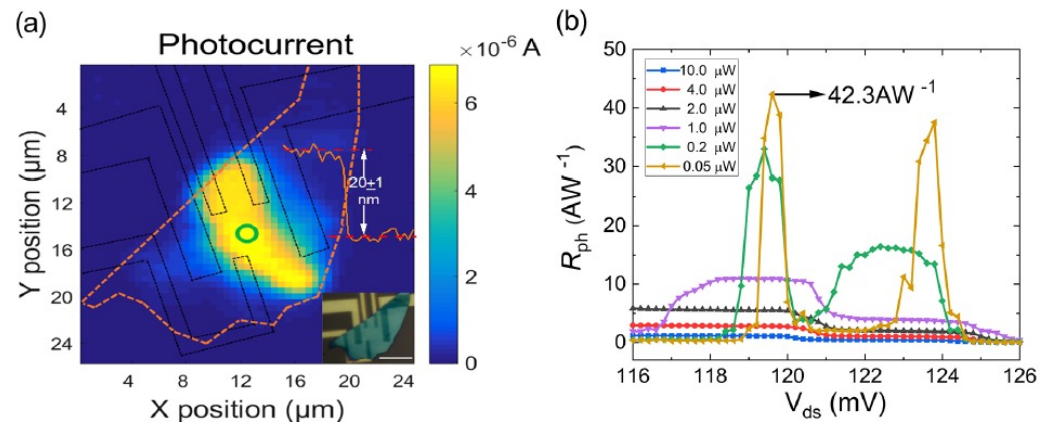
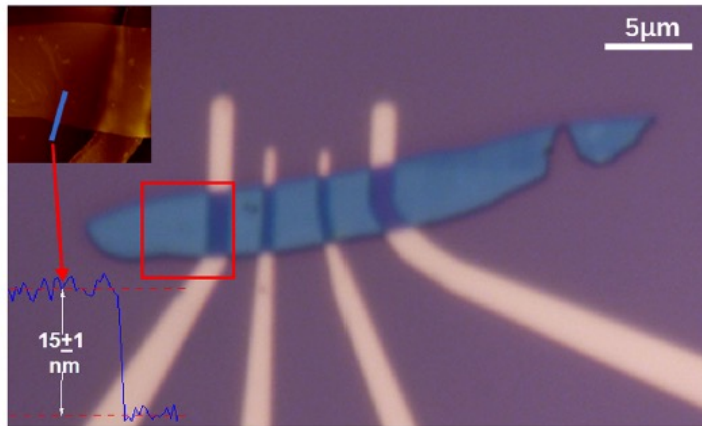
Cho, K., Kończykowski, M., Teknowijoyo, S. *et al.* **Nat Commun** **9**, 2796 (2018).

Supercurrent diode effect and magnetochiral anisotropy

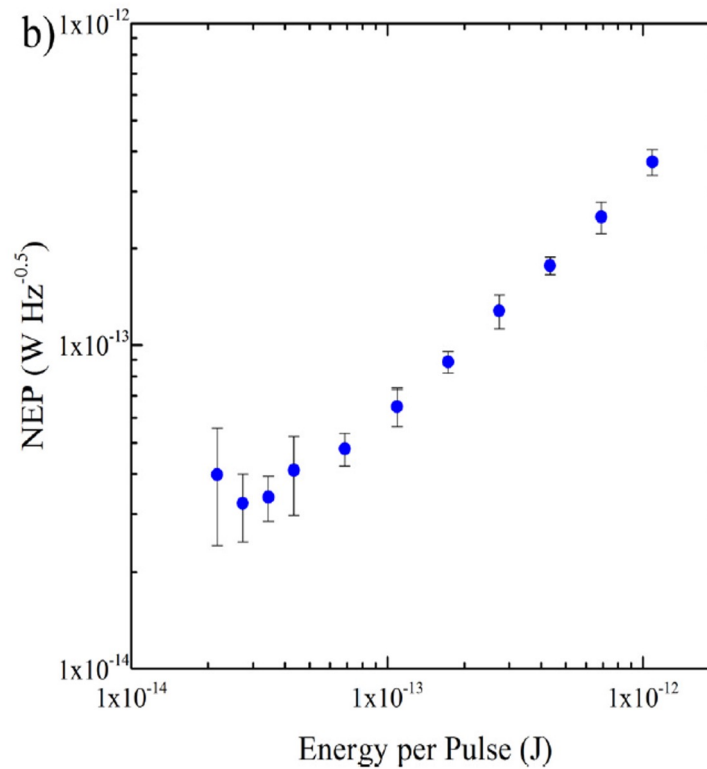
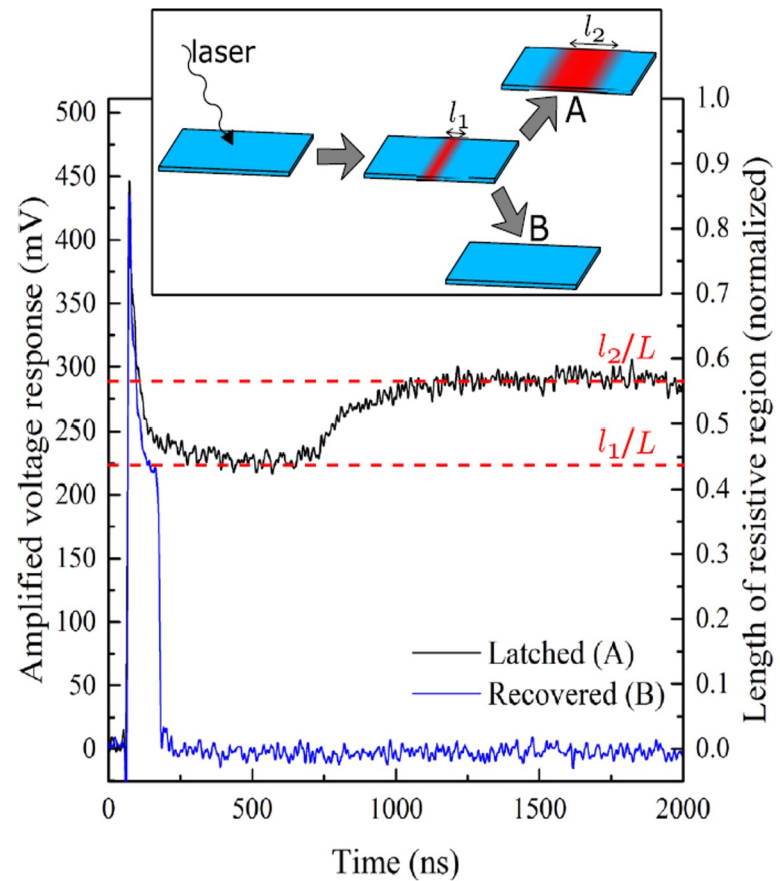
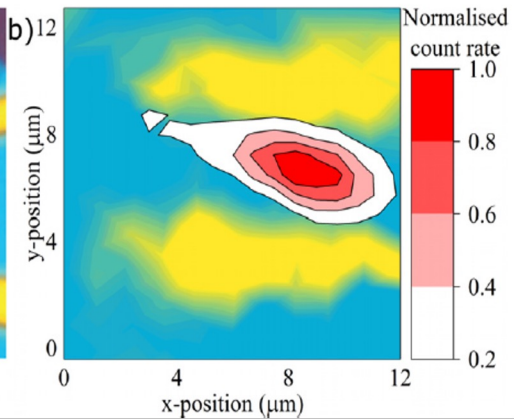
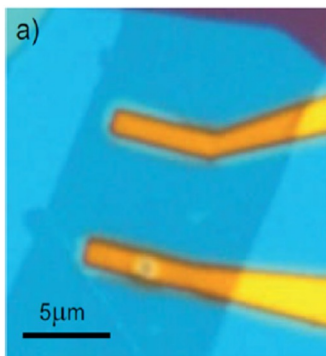


Bauriedl, L., Bäuml, C., Fuchs, L. *et al.* **Nat Commun** **13**, 4266 (2022).

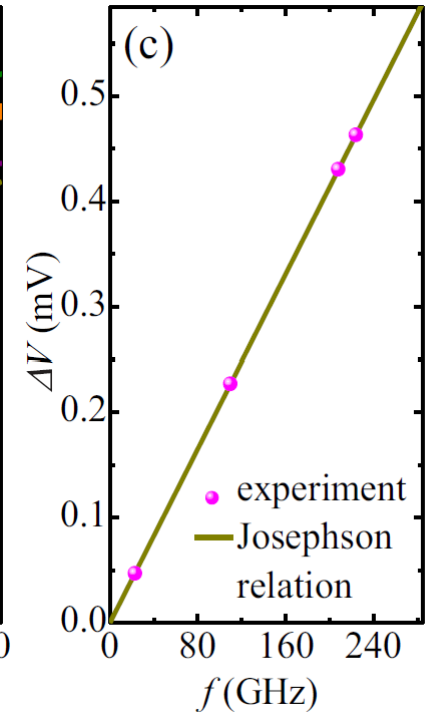
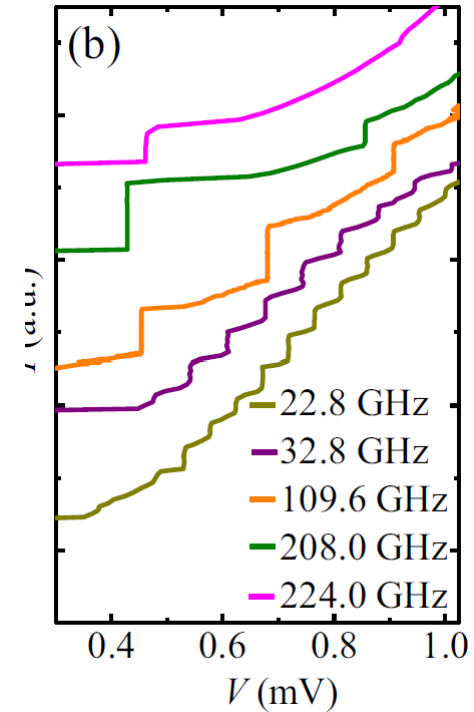
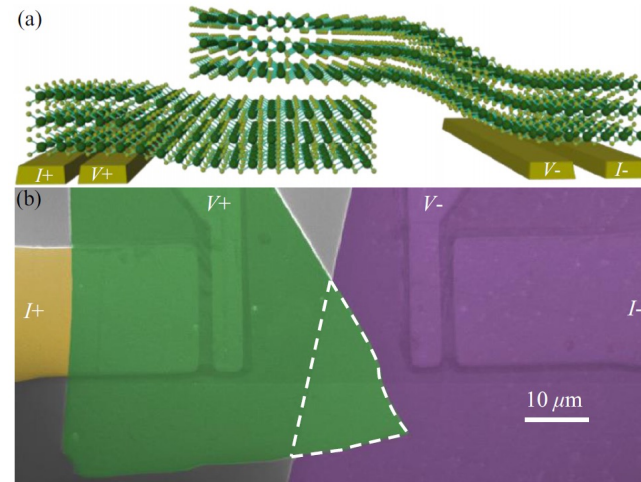
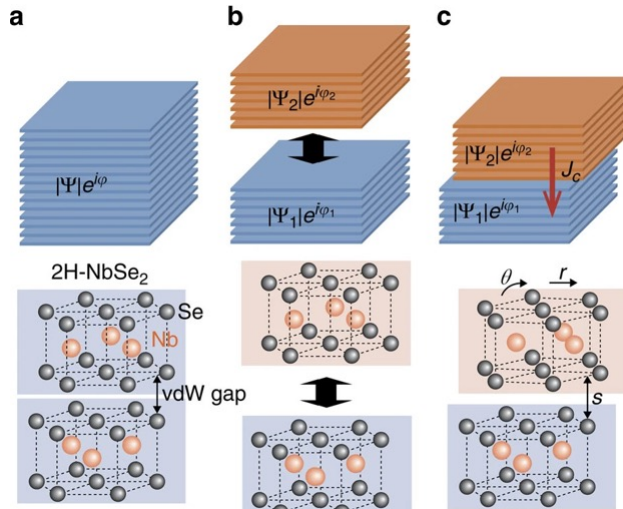
INFRARED NBSE2 DETECTORS



Estimated intrinsic τ : ~ 0.5 ns



MICROWAVE / SUB - THZ RANGE



Yabuki, N., Moriya, R., Arai, M. *et al.* Supercurrent in van der Waals Josephson junction. *Nat Commun* **7**, 10616 (2016). <https://doi.org/10.1038/ncomms10616>

Shixian Chen, Wanghao Tian, Zuyu Xu, Ping Zhang, Hongmei Du, Zihan Wei, Dingding Li, Yangyang Lv, Hancong Sun, Yong-Lei Wang, Dieter Koelle, Reinhold Kleiner, Huabing Wang, and Peiheng Wu *Phys. Rev. B* **104**, 214512