



# Low-temperature quantum transport in CVD-grown single crystal graphene

Stefano Guiducci

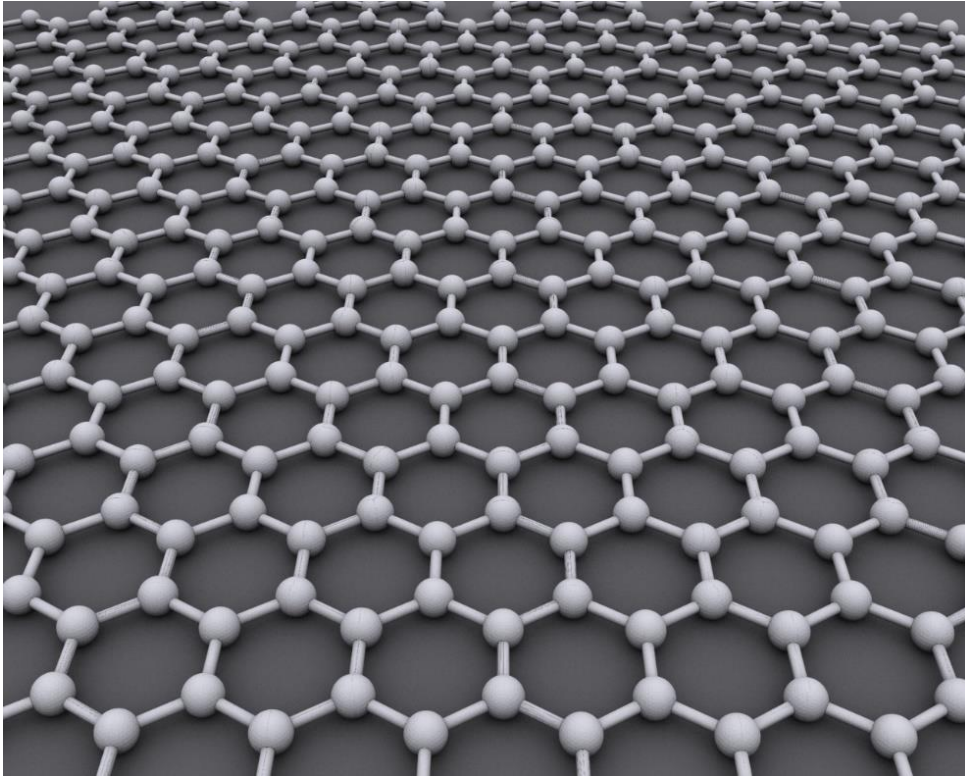


06/10/16

# Outline

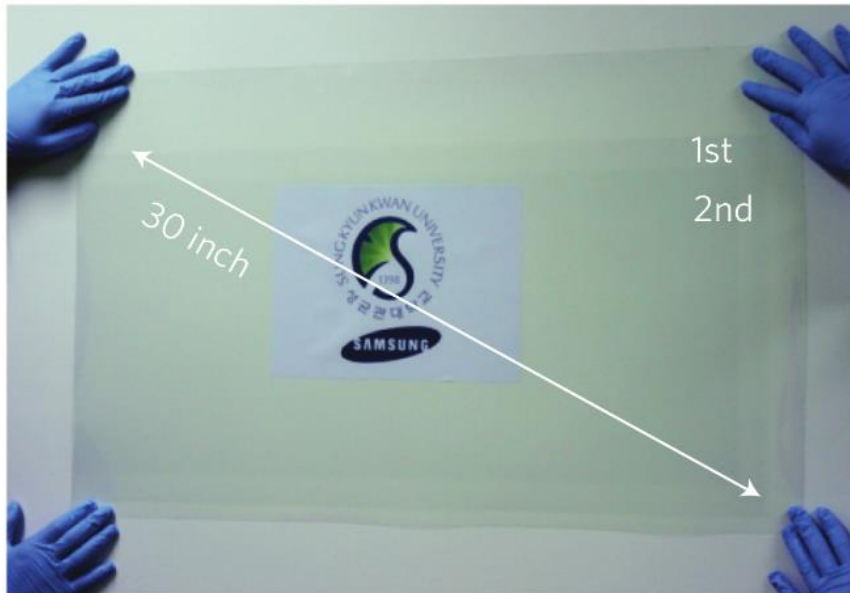
- Sample preparation.
- Sample measurements and results.
- More advanced devices and future developments.
- Conclusions and acknowledgements.

# Graphene

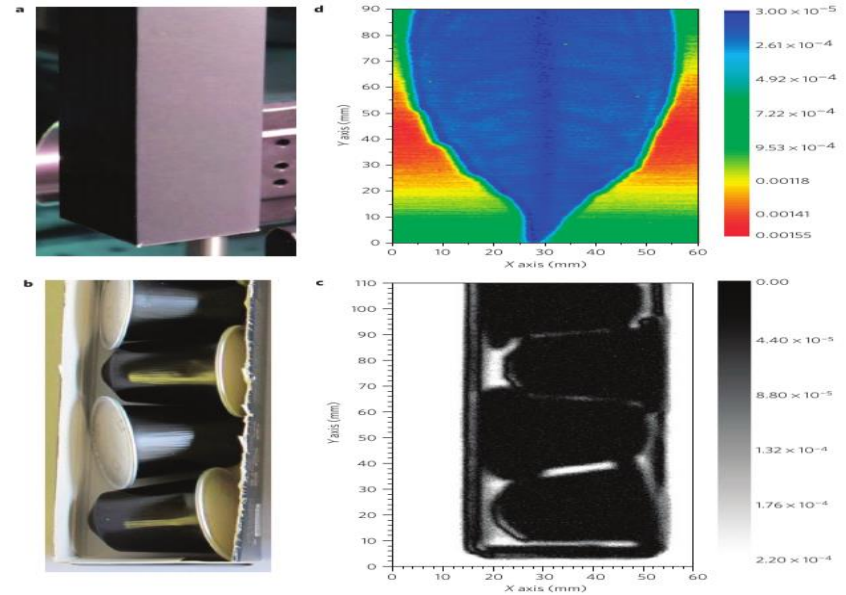


- Mechanical properties: «the strongest material ever tested». Breaking strength 200 times higher than steel.
- High optical transparency.
- High thermal and electrical conductivity.
- Record transport mobilities, ballistic transport at RT.

# Graphene

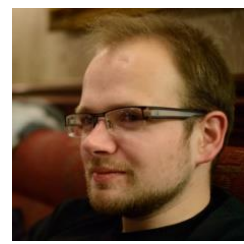


S. Bae et al., *Nat. Nanotechnology*, **5**, 1-5 (2010)

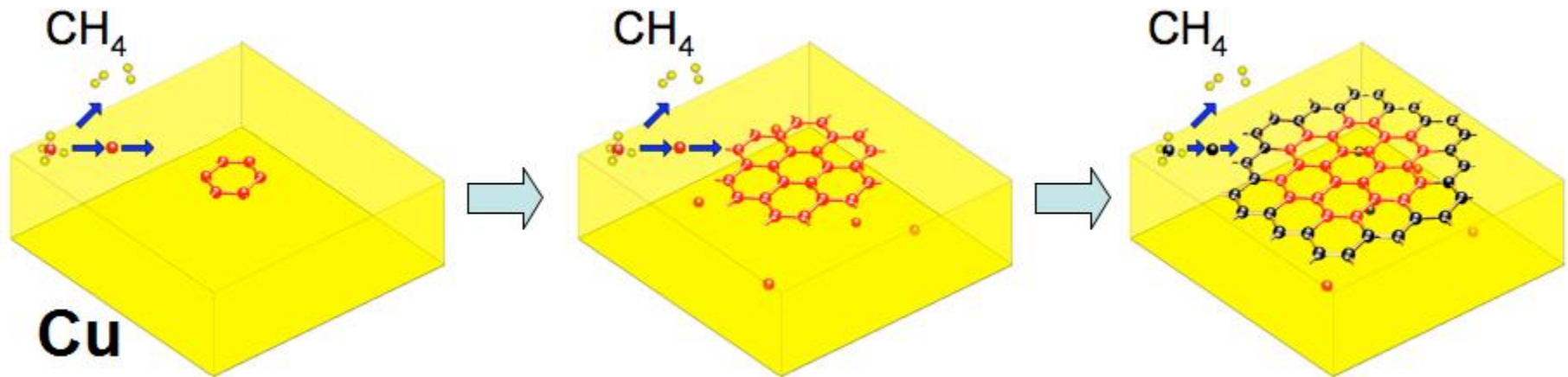
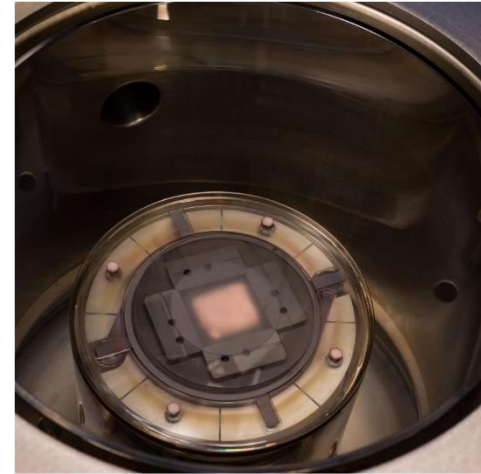


L. Vicarelli et al., *Nat. Materials*, **11**, 865 (2012)

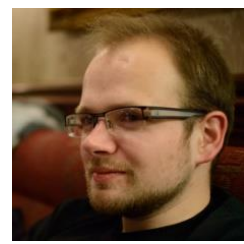
# CVD graphene growth



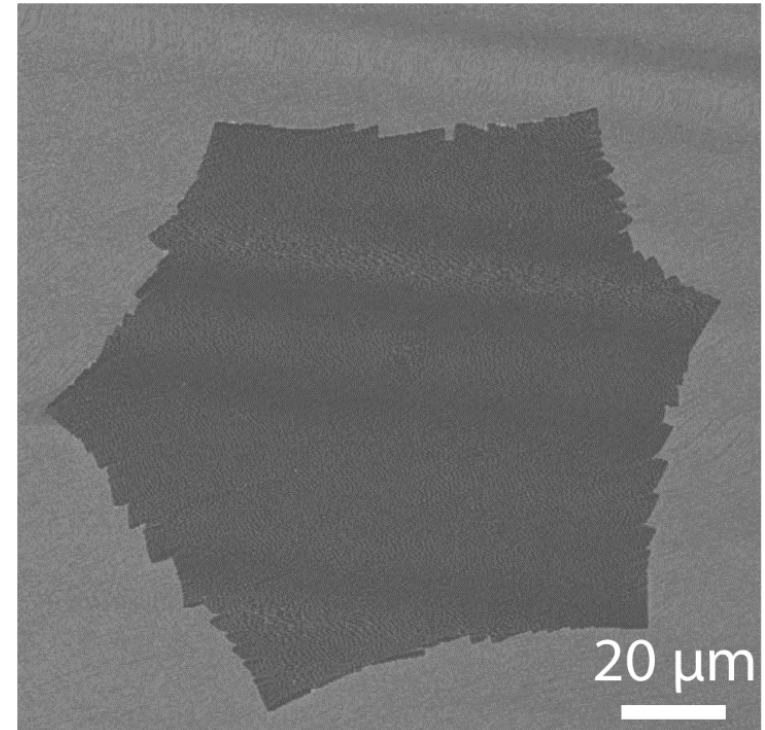
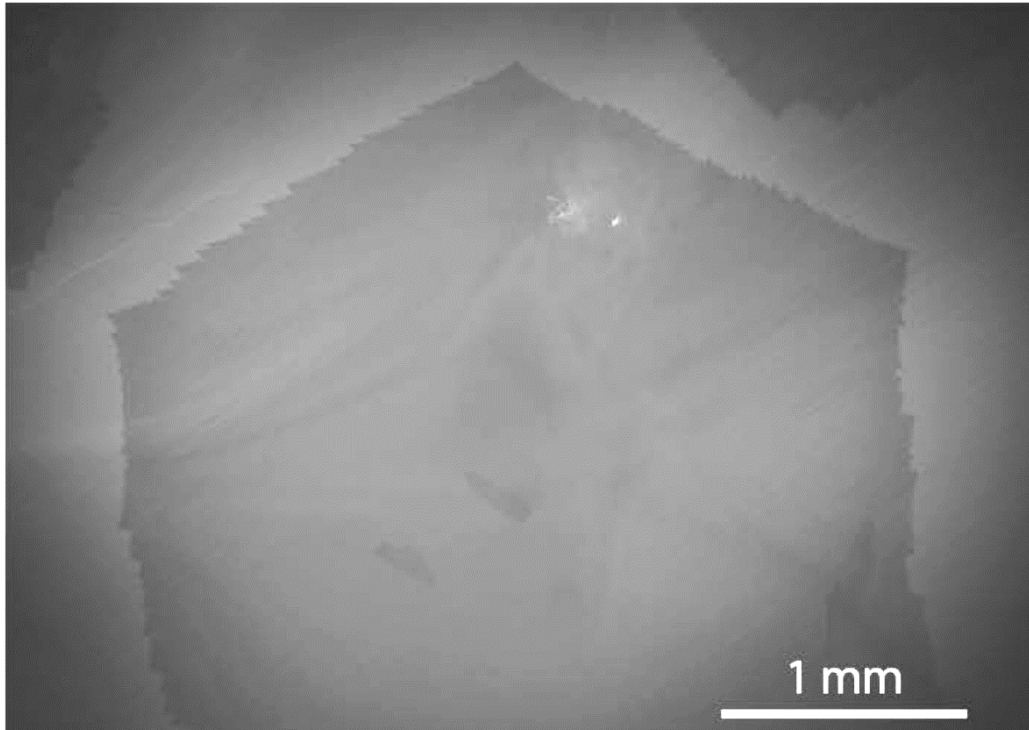
V. Miseikis



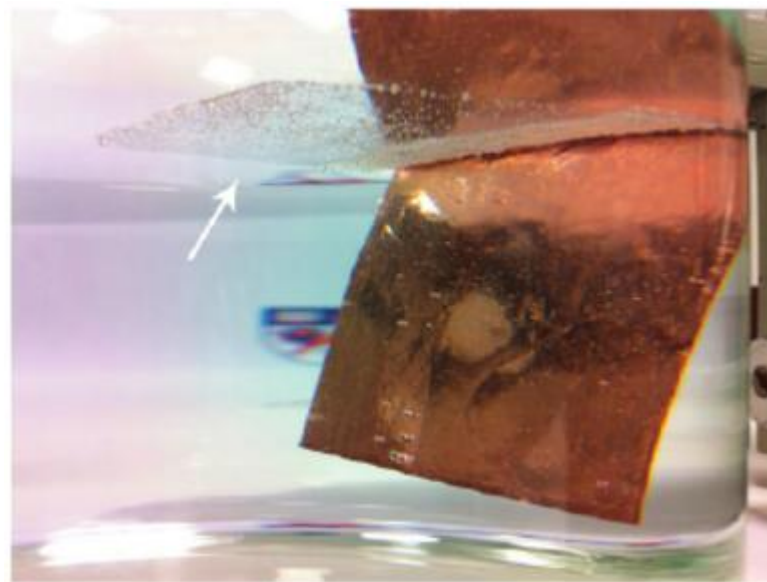
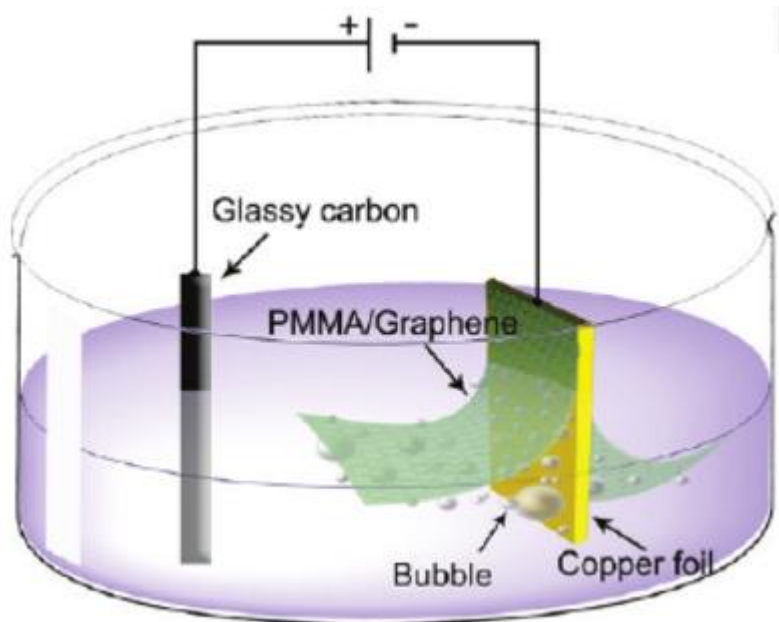
# CVD graphene growth



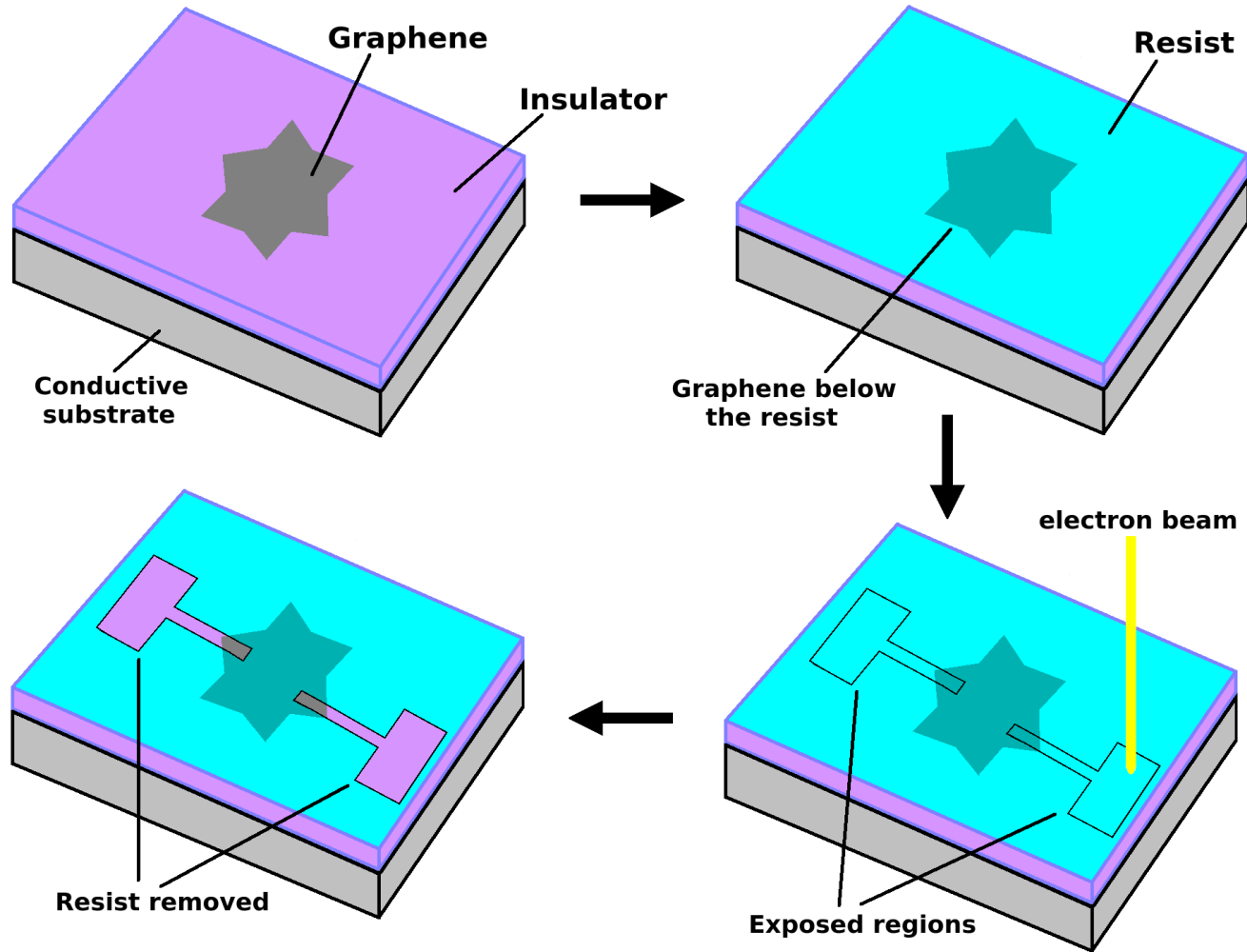
V. Miseikis



# Sample preparation

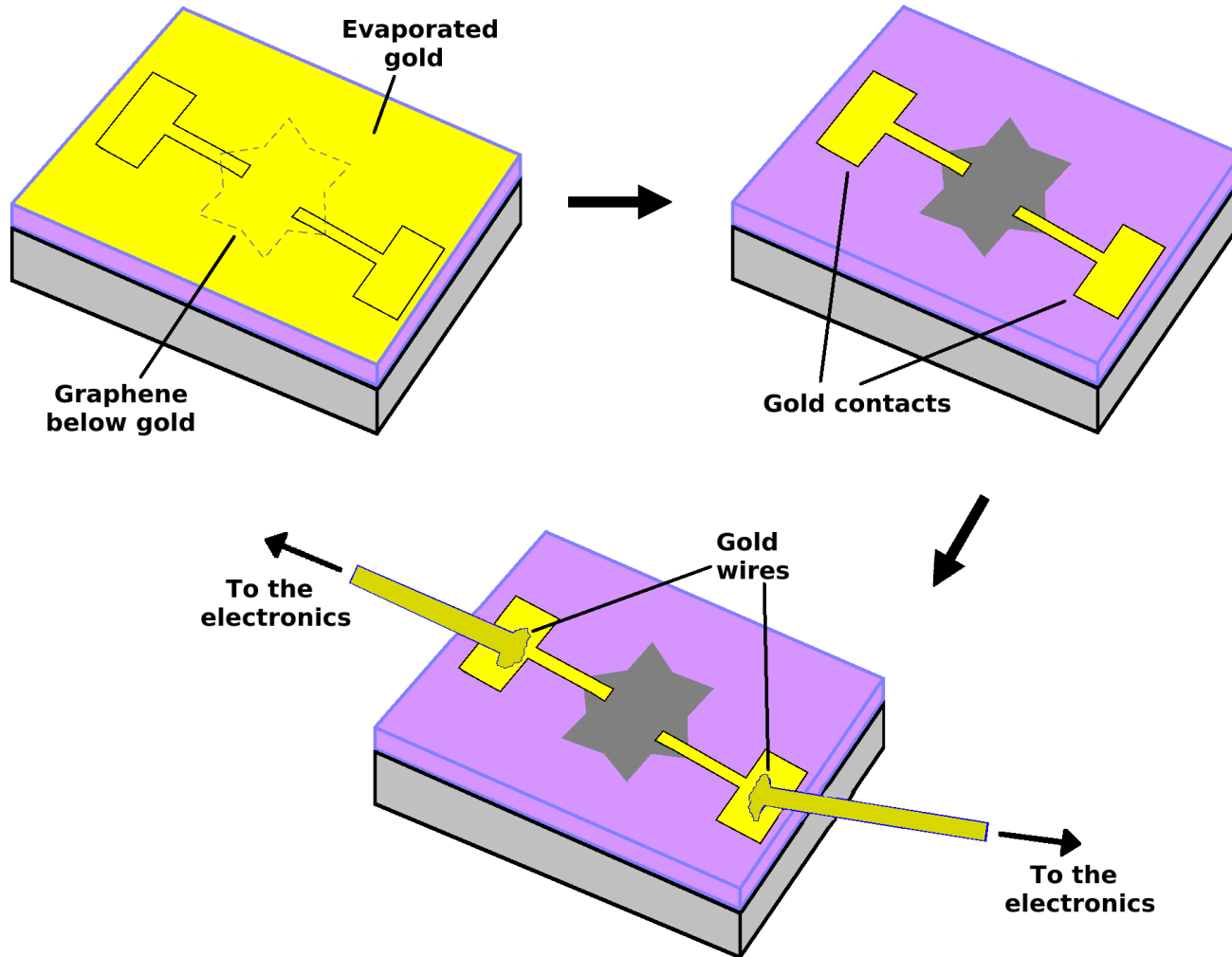


# Sample preparation

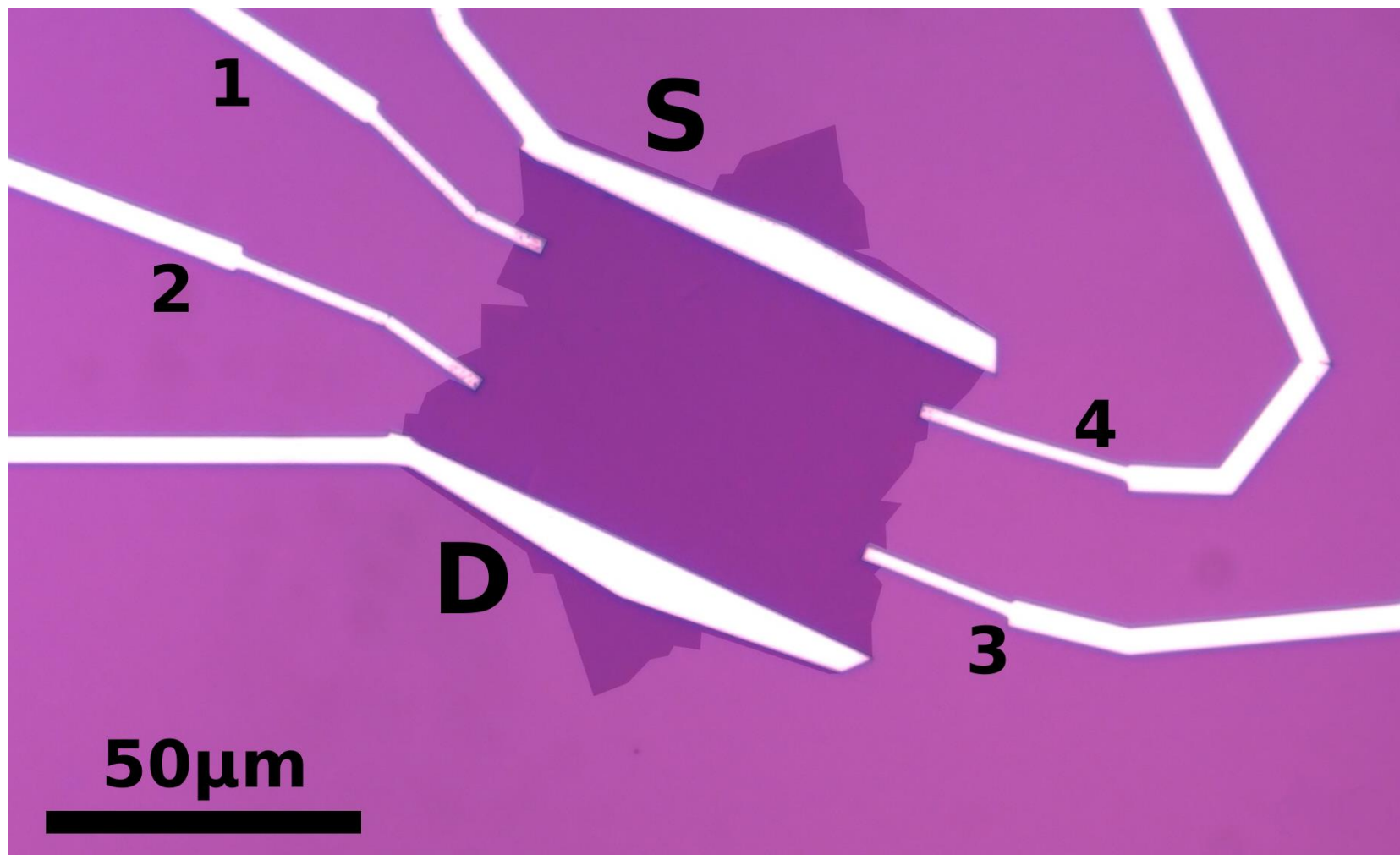




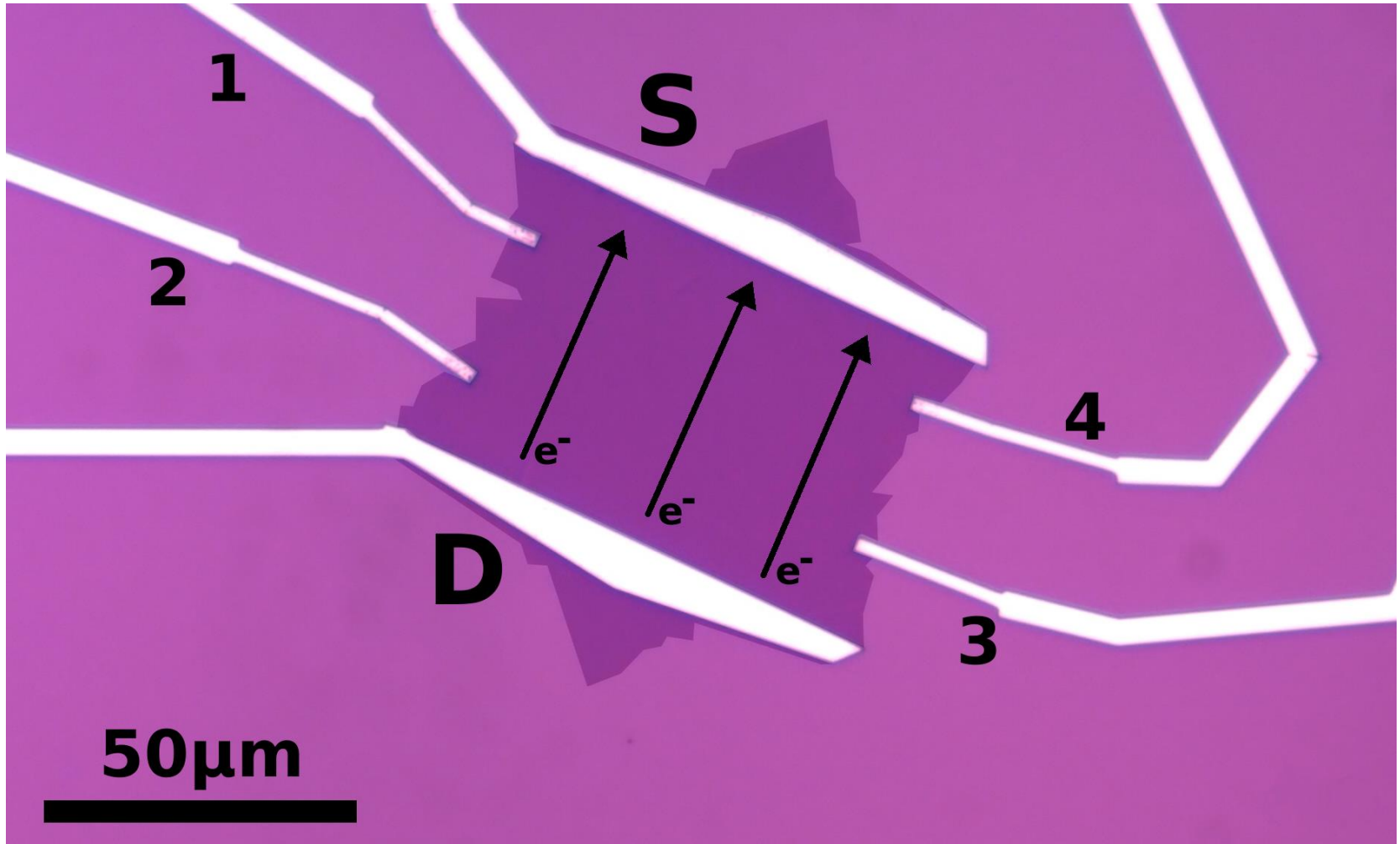
# Sample preparation



# Final device



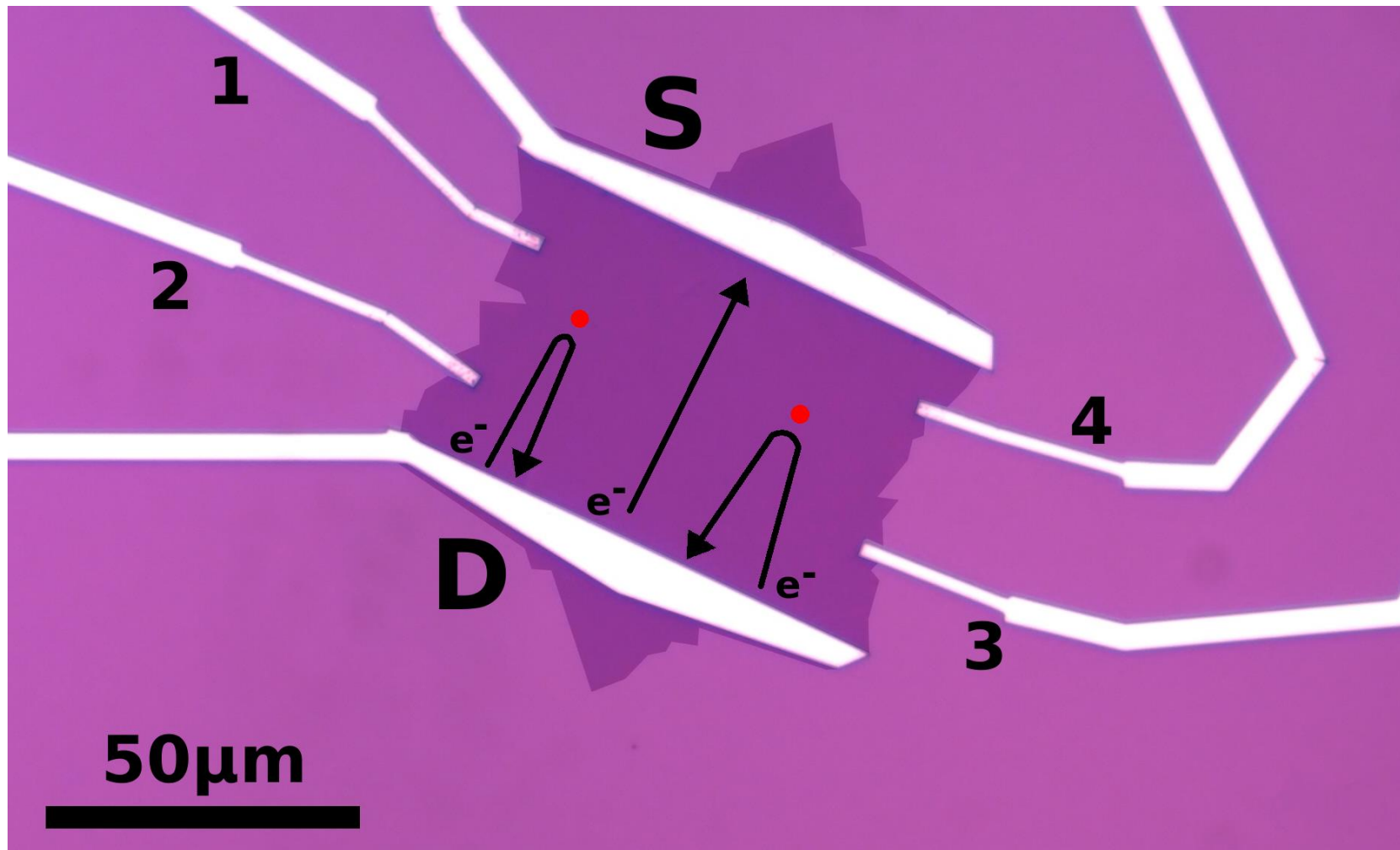
# Electron transport



S. Xiang, V. Miseikis, L. Planat, S. Guiducci, S. Roddaro, C. Coletti, F. Beltram, S. Heun,  
Nano Research 2016, 9 (6): 1823-1830

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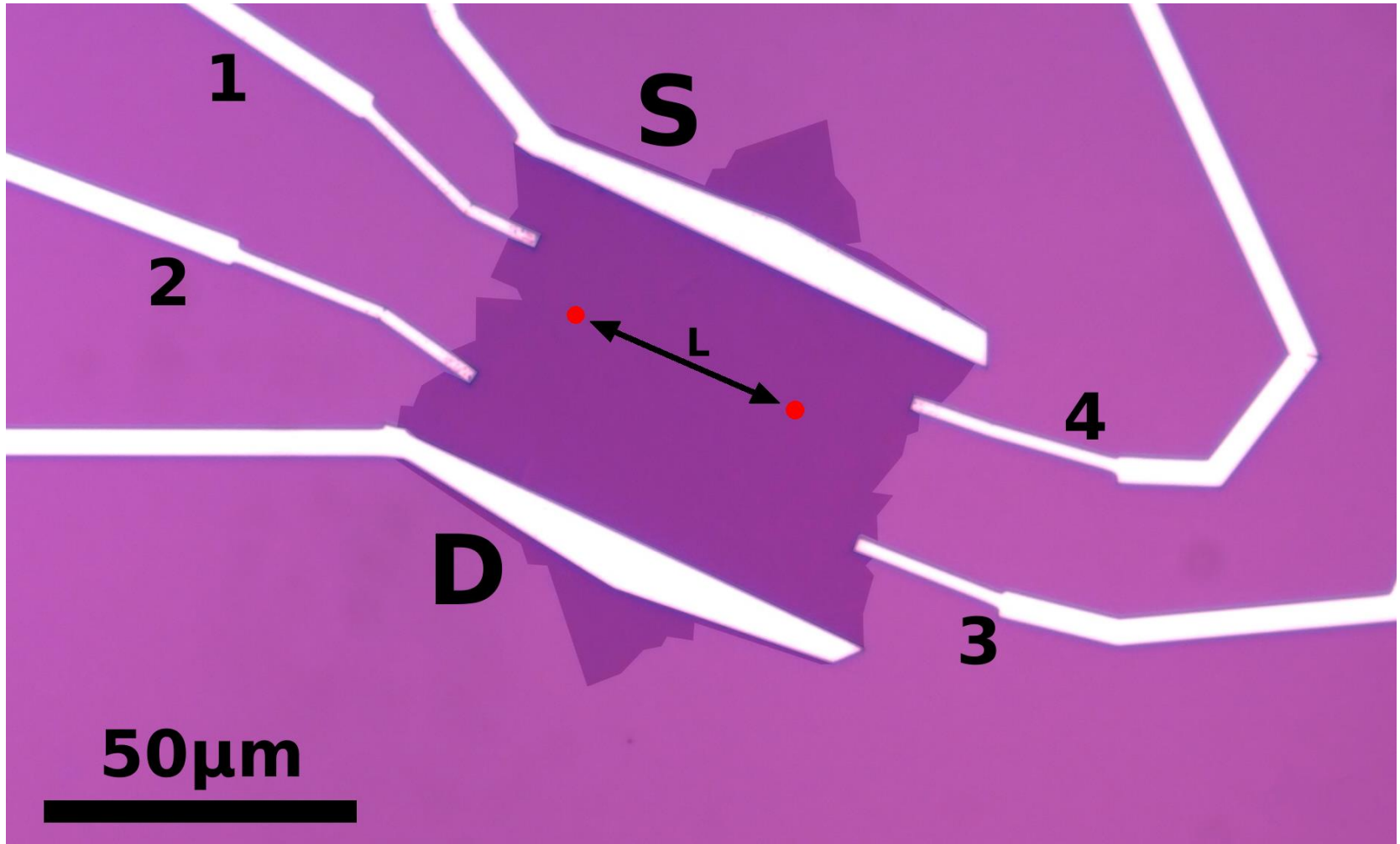
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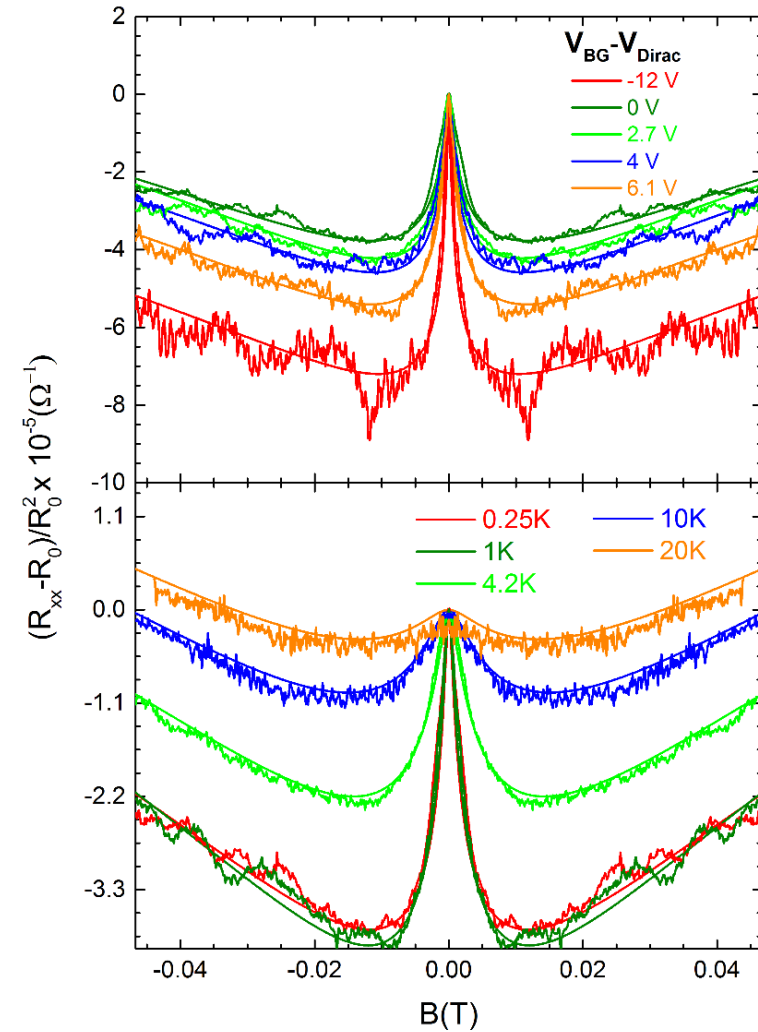
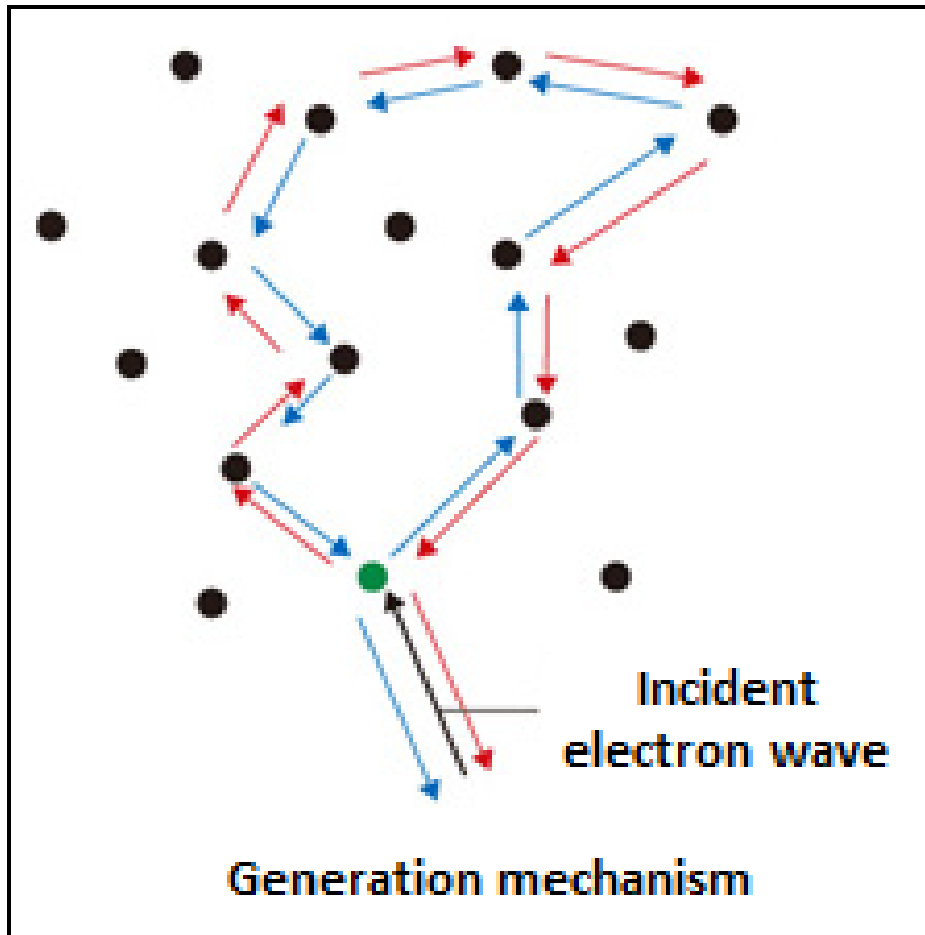
# Electron transport



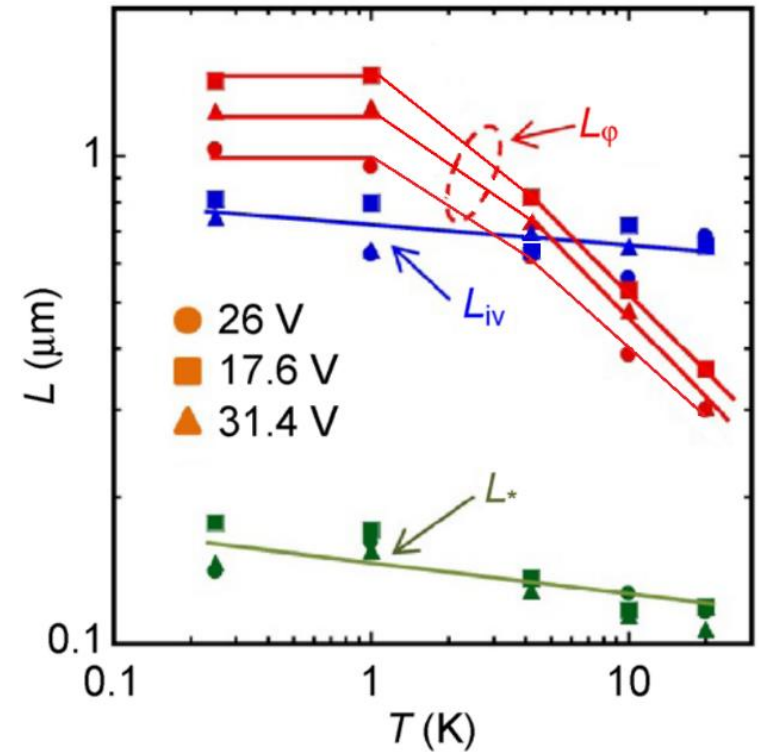
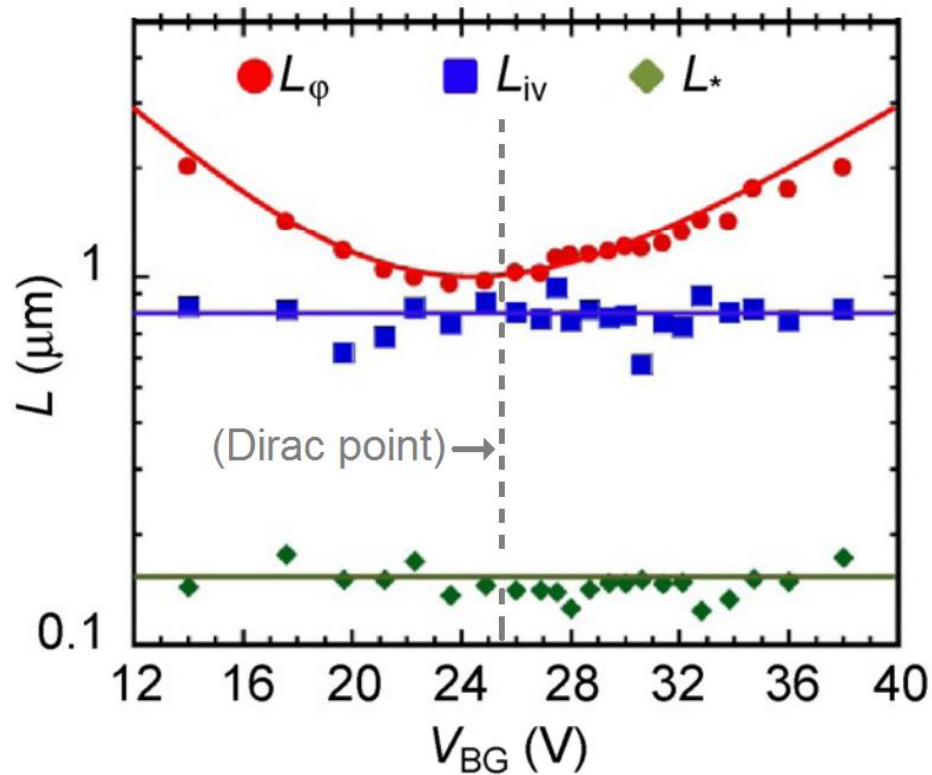
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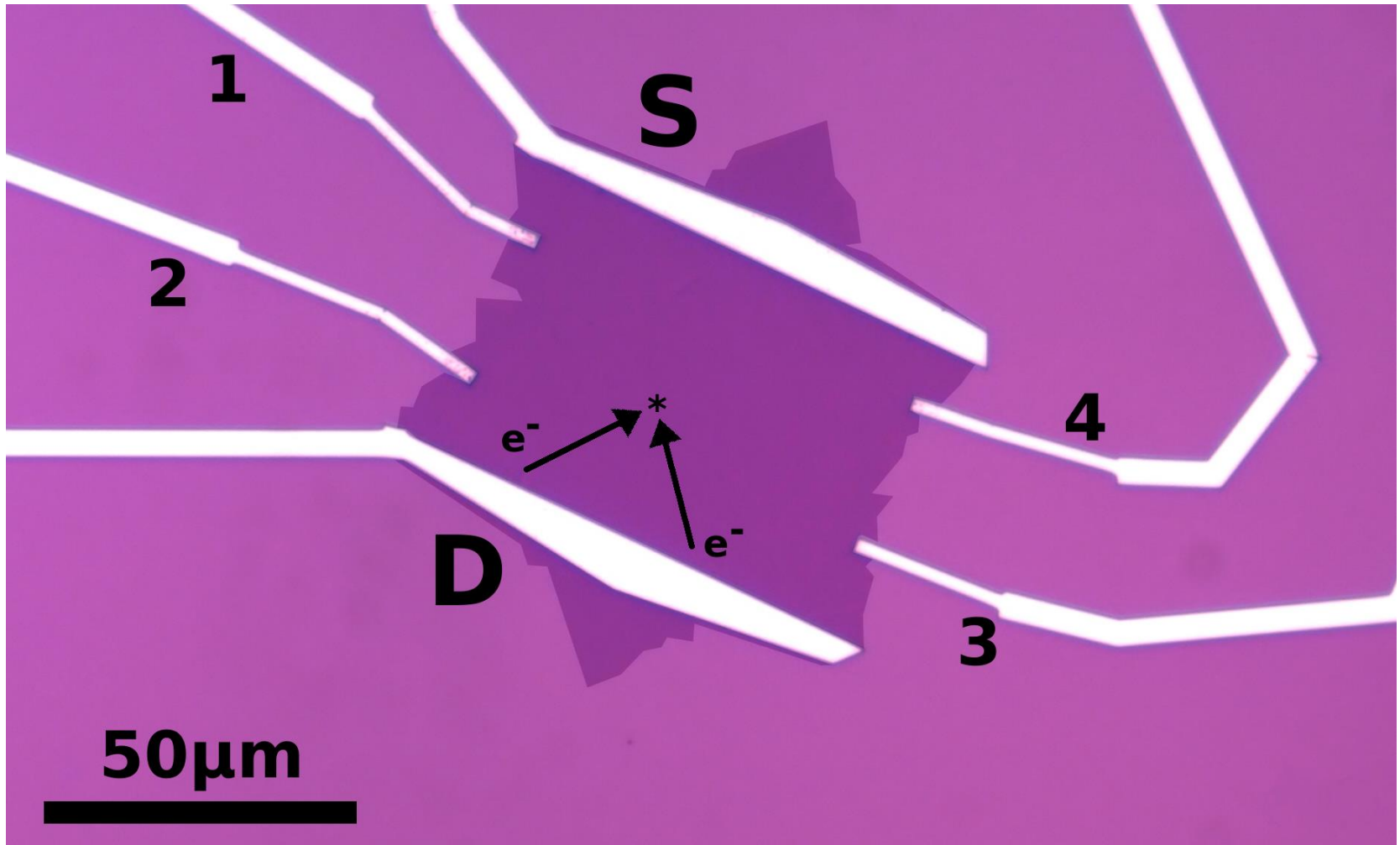
# Weak localization



# Weak localization



# Electron transport



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# Quantum Hall

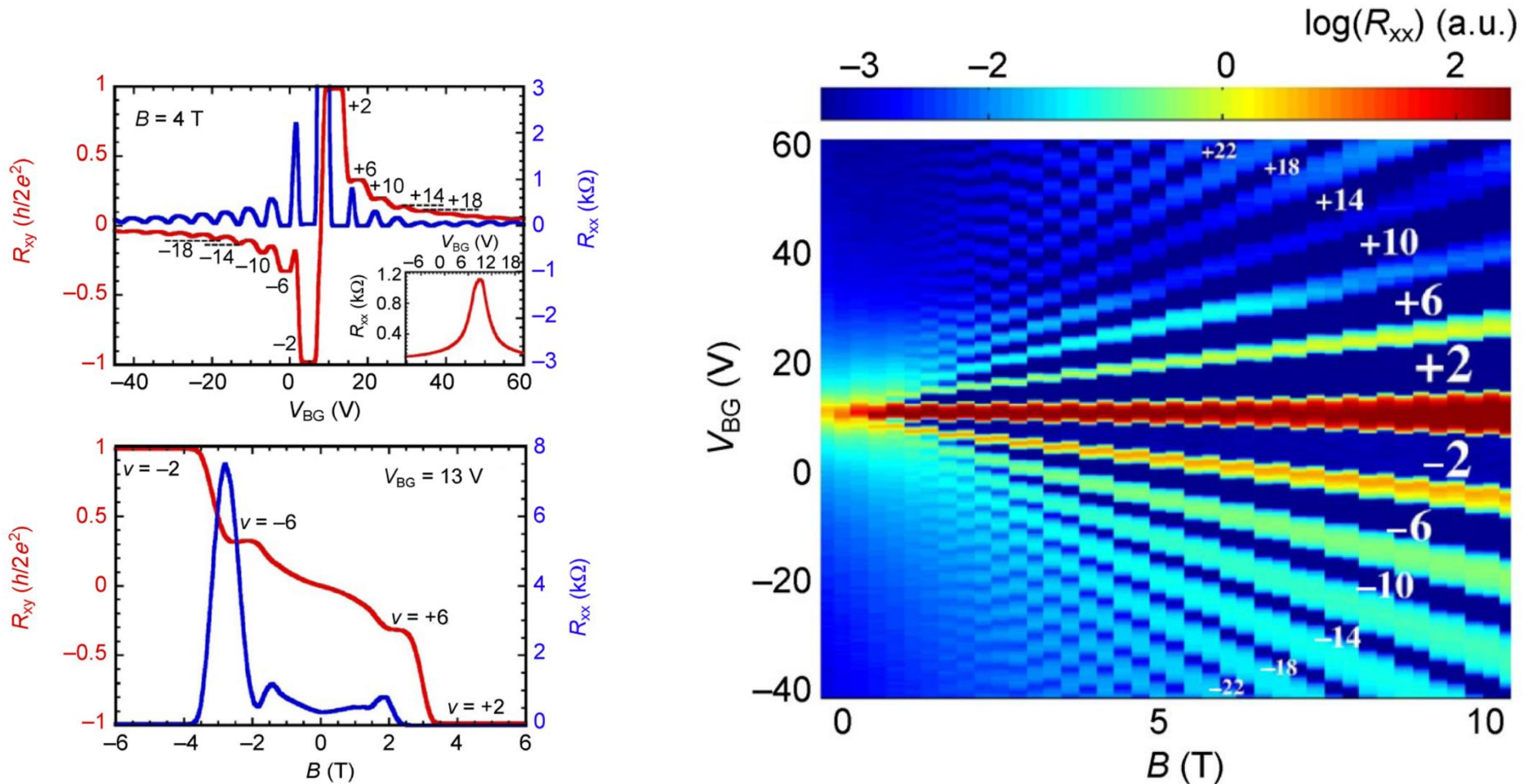


ISTITUTO  
NAZIONALE  
DI RICERCA  
METROLOGICA



Quantum Hall resistance standard in graphene devices under relaxed experimental conditions.  
R. Ribeiro-Palau et al., Nature Nanotechnology **10**, 965-971 (2015)

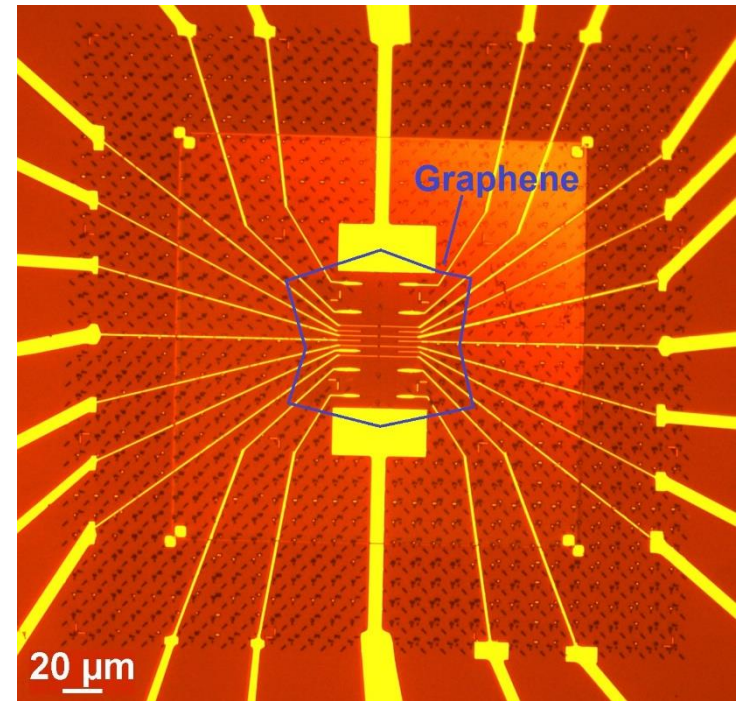
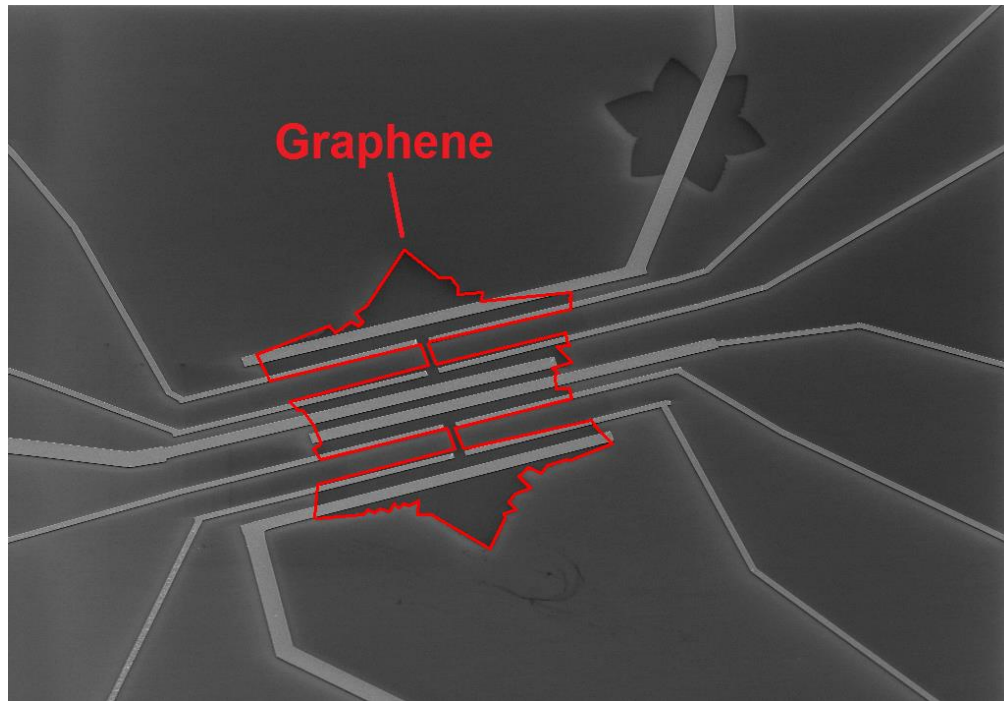
# Quantum Hall



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# More advanced devices



# Conclusions

- We successfully fabricated graphene-based devices.
- We did electrical measurements that show:
  - a) The main mechanisms that control the electron transport in different regimes (results published).
  - b) The quality of the graphene is very high.
- We fabricated more advanced devices for more detailed and refined measurements.
- We plan to go even further by using advanced microscopy techniques (SGM) and hBN substrates.



# Fundings



# Acknowledgements

SGM group

S. Heun



S. Roddaro



S. Xiang



L. Bours



L. Planat

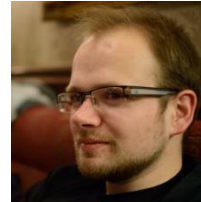


Graphene group (IIT)

C. Coletti



V. Miseikis

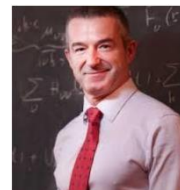


CNR-nano and SNS

L. Sorba



F. Beltram





Thank you for your attention!