SAND2020-2395C

Magneto-transport of electrons in near surface InAs quantum wells in contact with NbTiN

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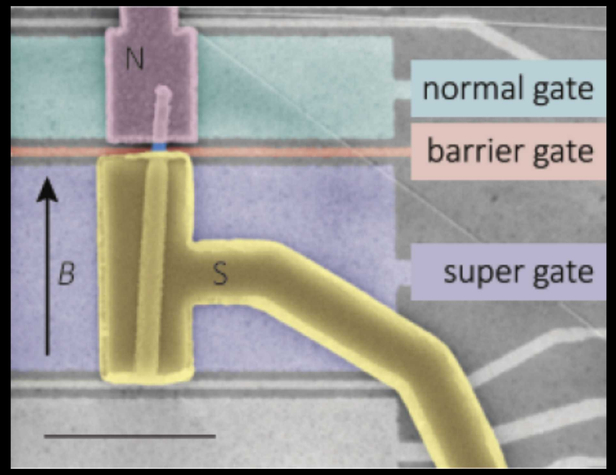
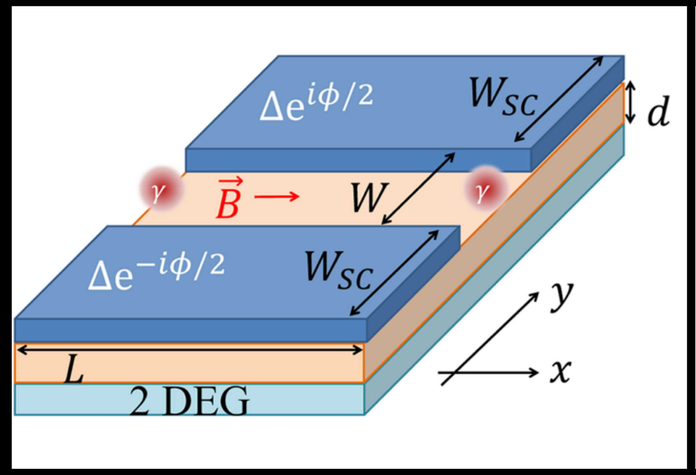
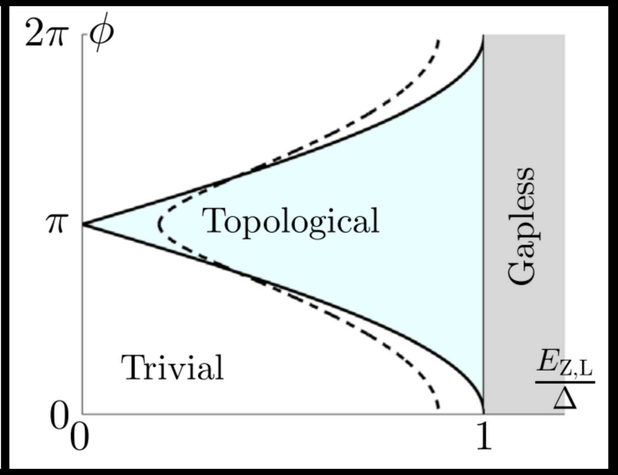
Motivation

Majorana fermions 1D vs 2D

- Strong motivation toward universal topological quantum computation.





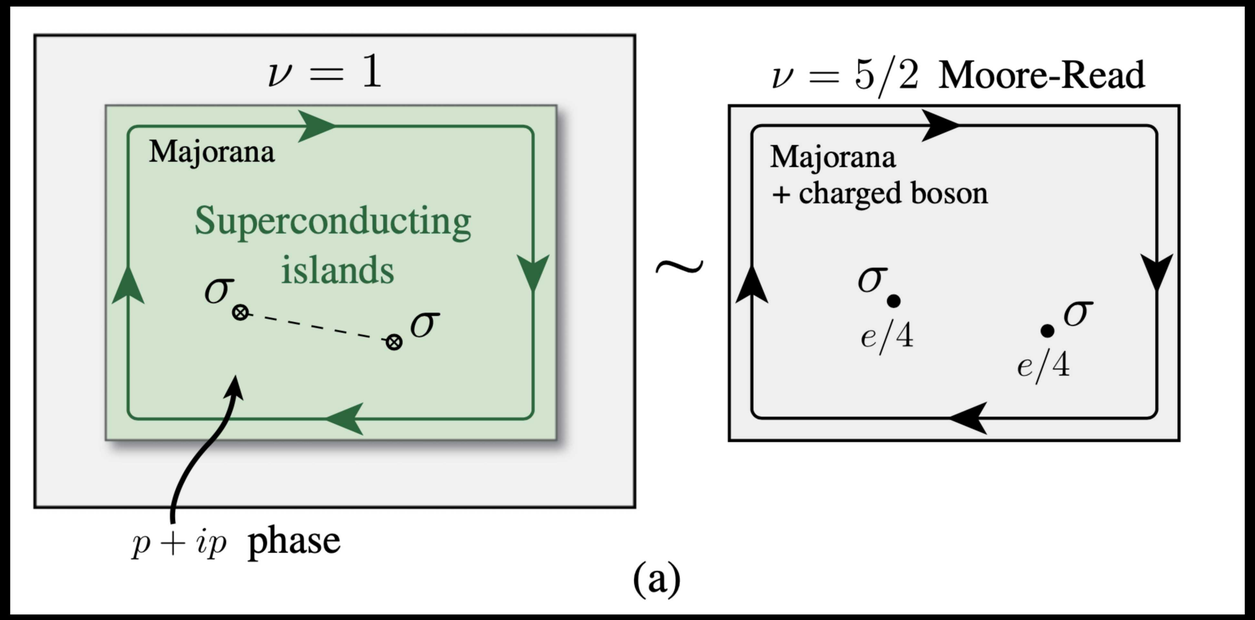


- ❑ 1D platform: bottom-up approach
- ❑ Simple theory works well;
- ❑ 2D platform: top-down approach
- ❑ Simulations are needed.

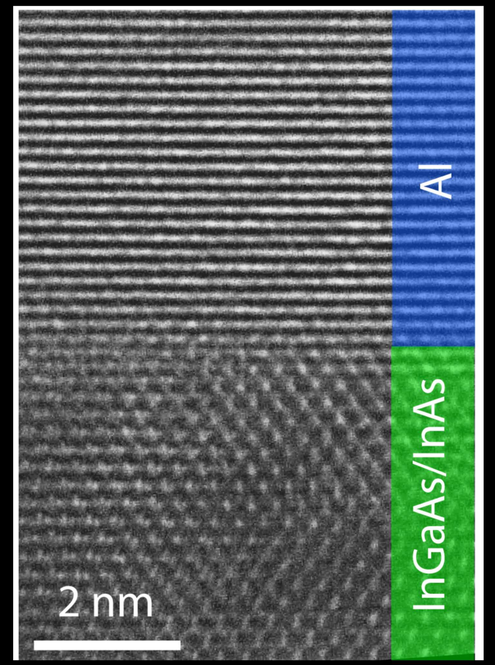
M. T. Deng et al., Science **354**, 1557 (2016)

M. Hell et al., PRL **118**, 107701,2017
,F. Pientka et al., PRX *7, 021032 (2017).*

Motivation

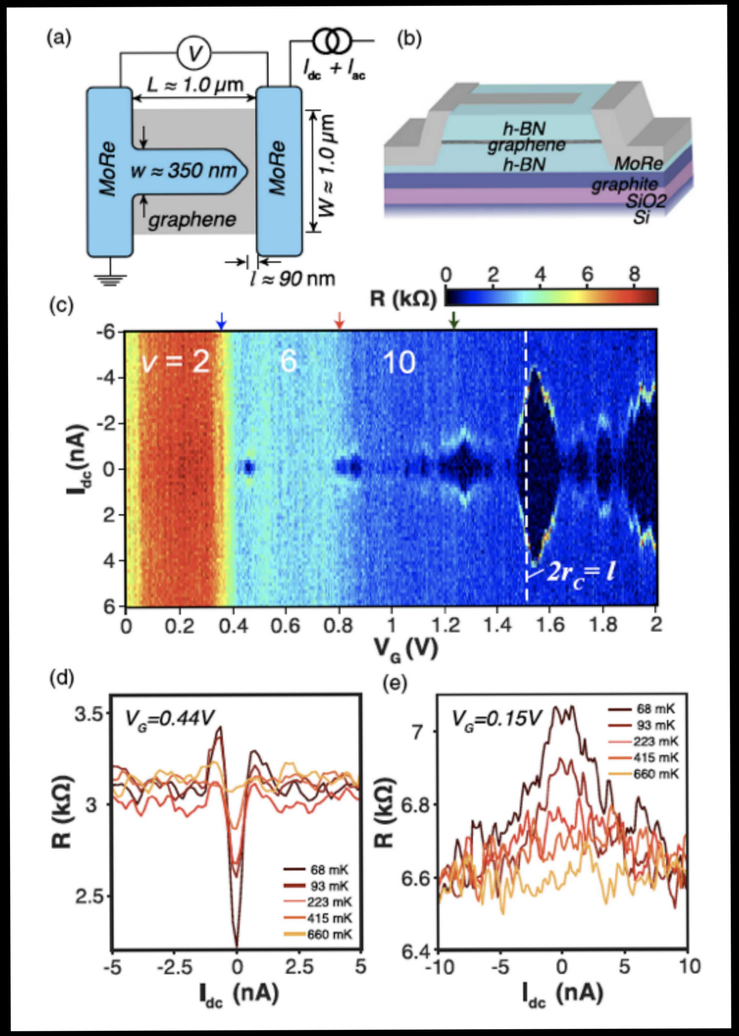


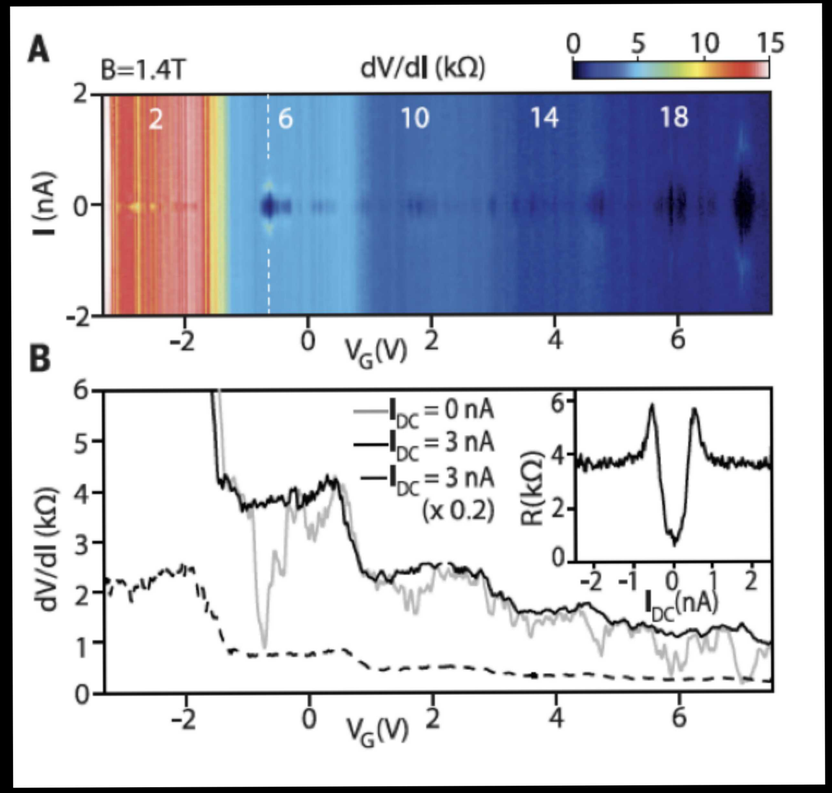
- Surface InAs quantum wells are promising material for topological superconductivity (e.g. Majorana fermions).

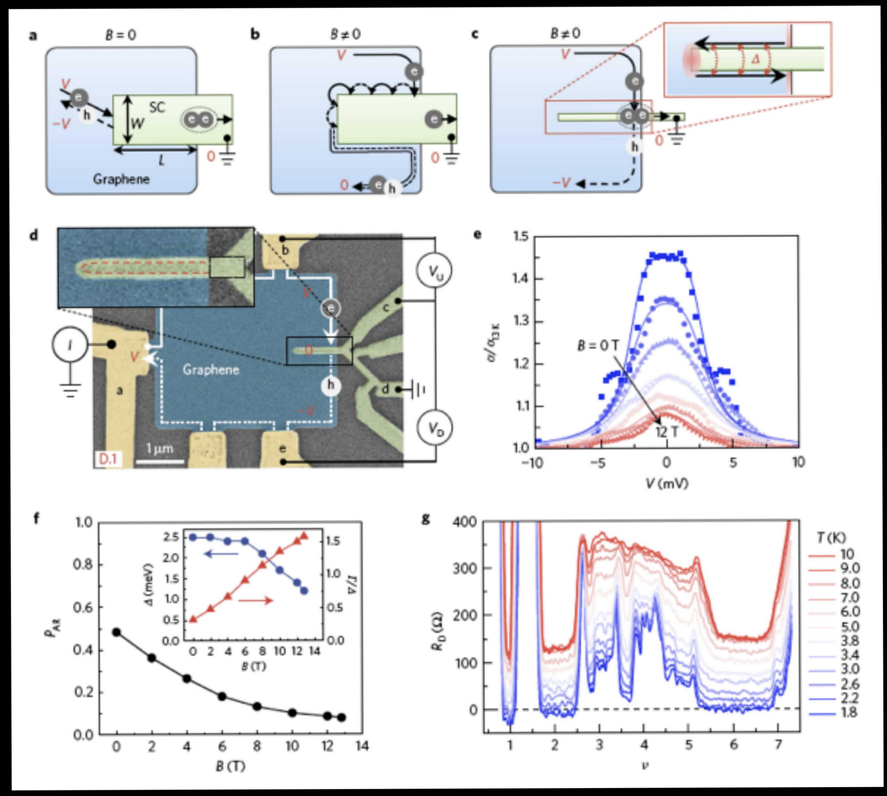


ROGER S. K. MONG et al. PHYS. REV. X 4, 011036 (2014)

Previous work







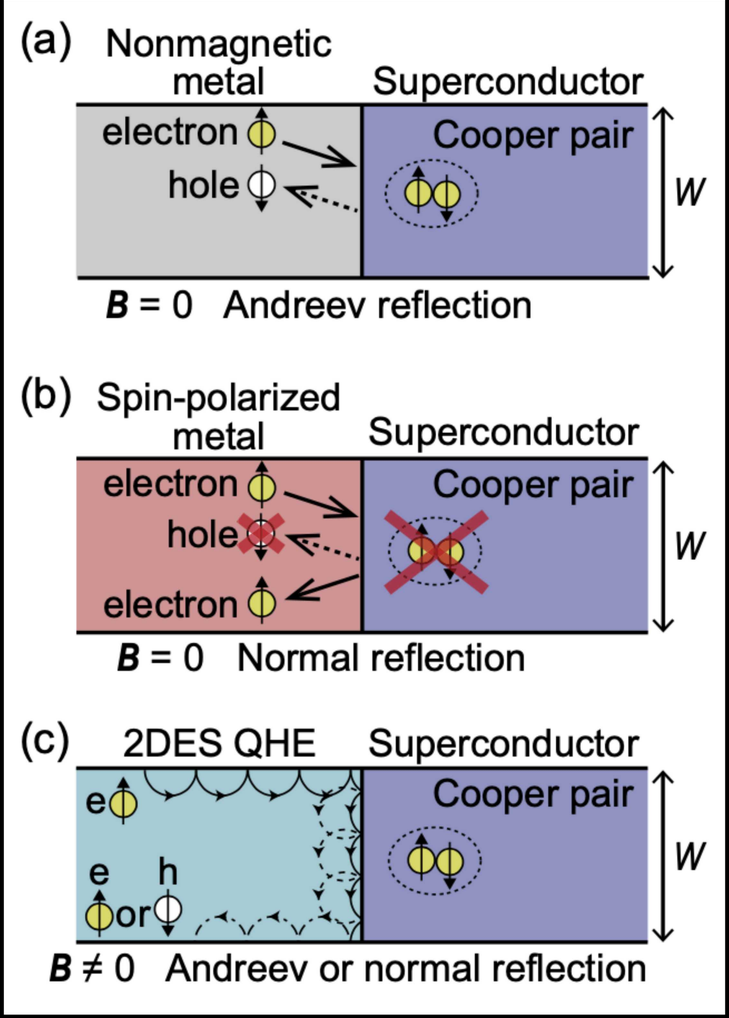
M. T. Wei et al PRB (2019)

F. Amet et al Science (2016)

G. Lee et al. Nature Physics (2017)

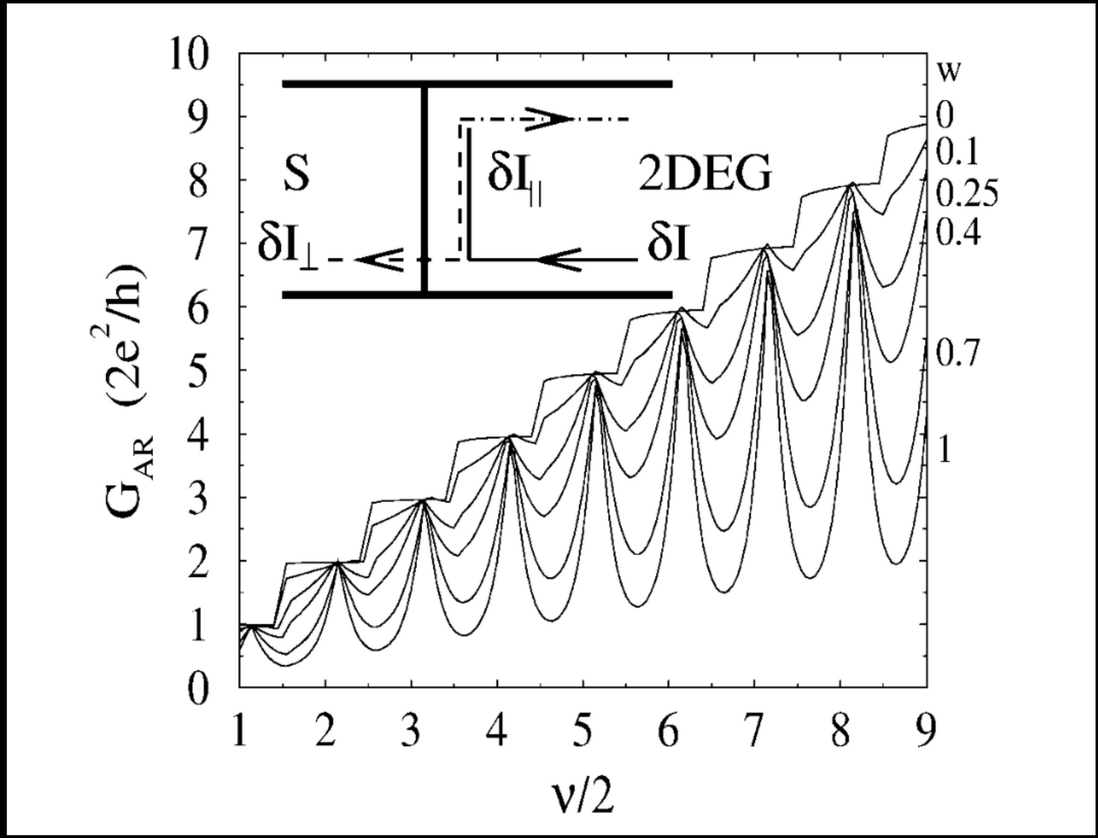
Theory

Andreev Reflection



Conduction enhancement

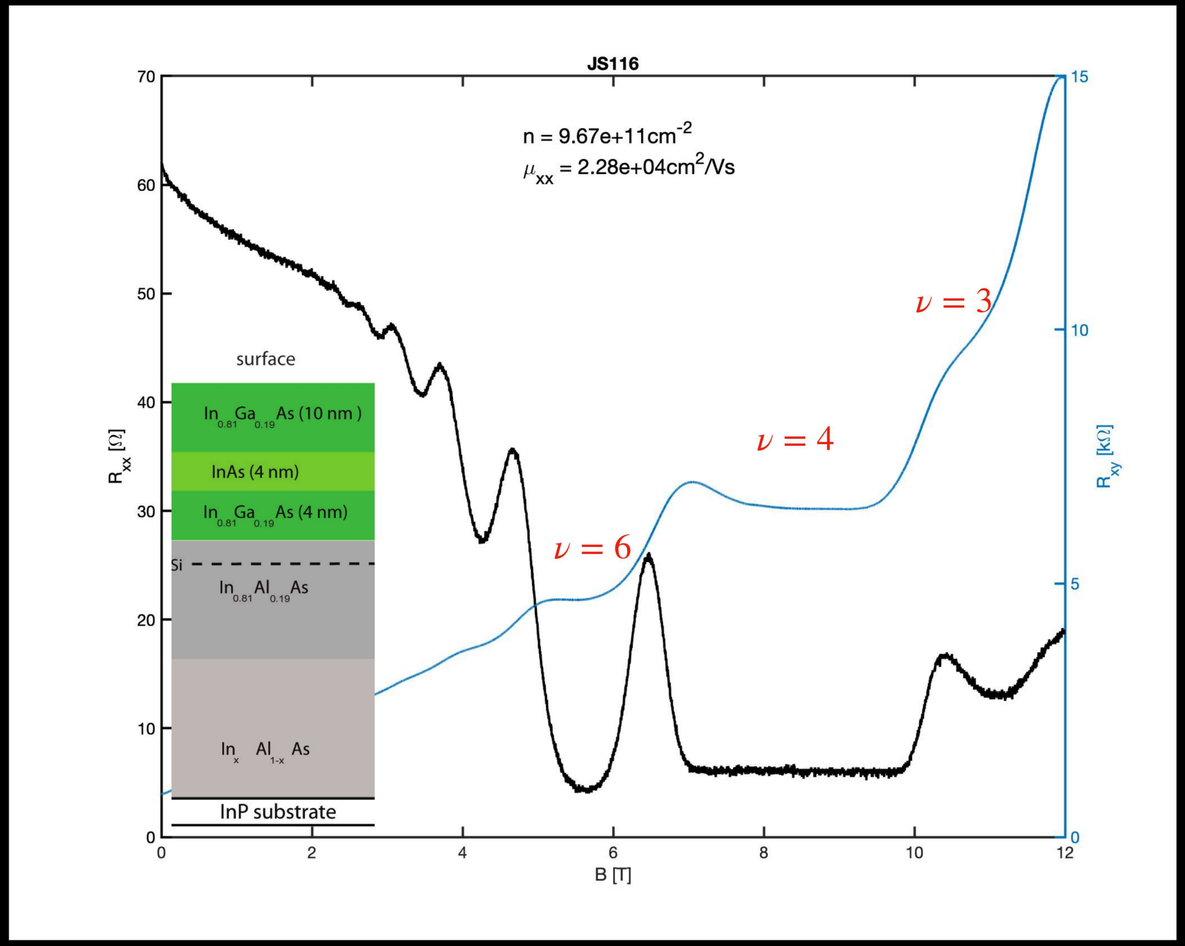
No scattering at the S-N interface (w=0)
+
Perfectly matching fermi velocity
=
2x conduction enhancement

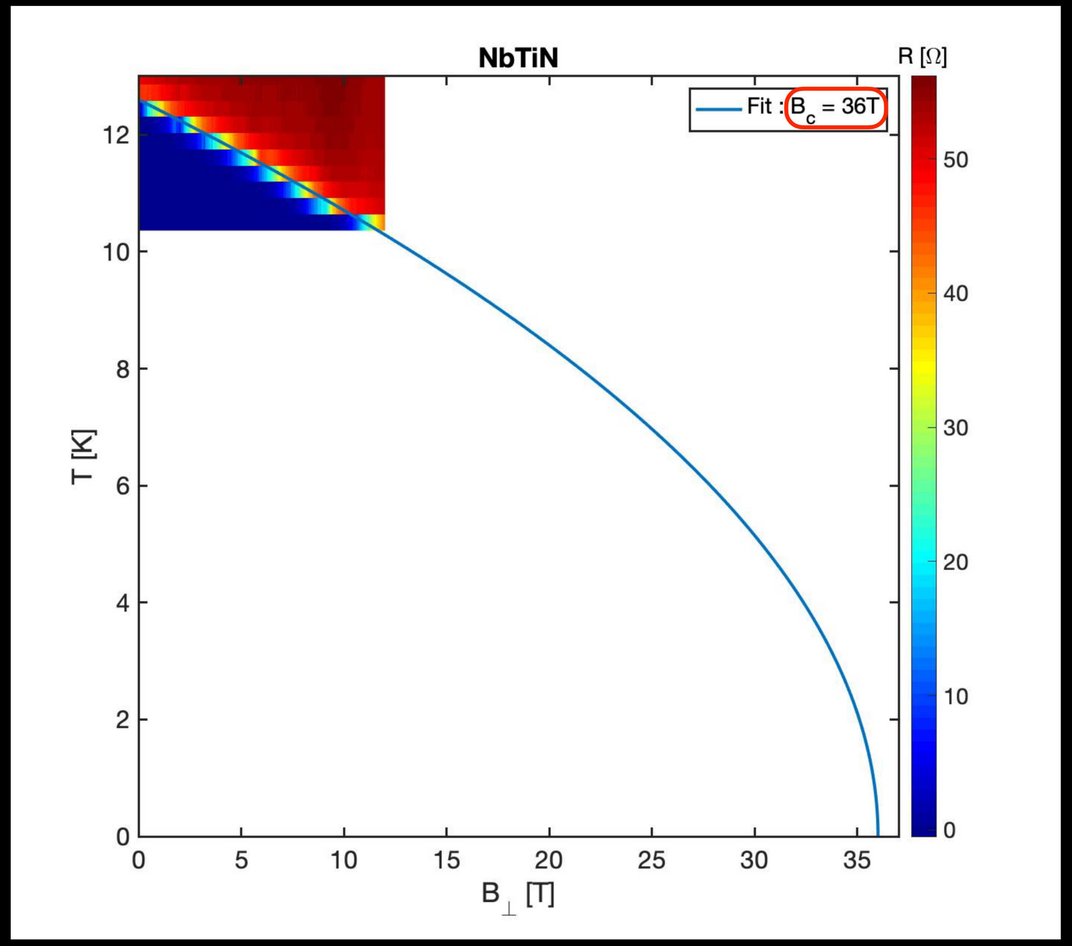


Y. Kozuka et al. JPS (2018)

H. Hoppe et al. PRL (2000)

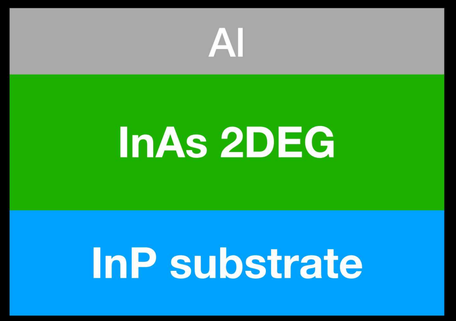
InAs 2DEG + NbTiN

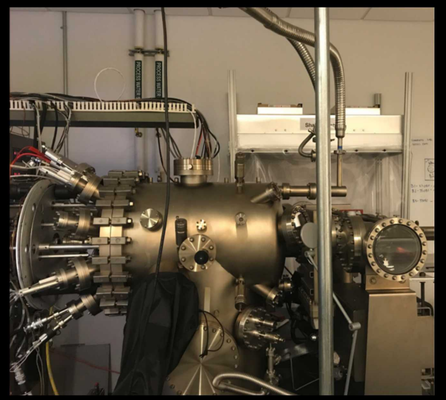




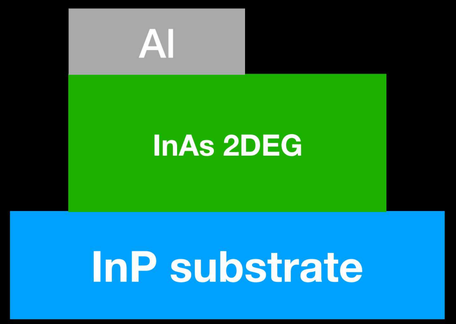
Device Fabrication

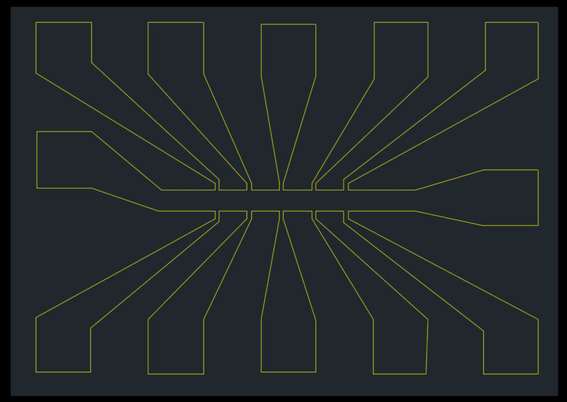
MBE grown sample



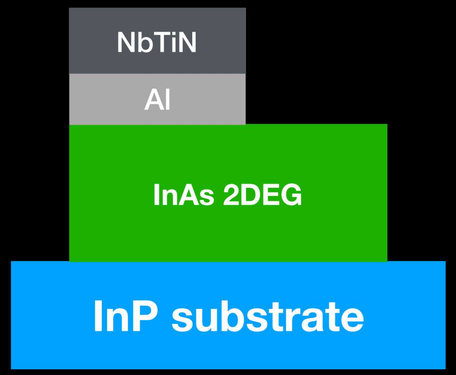


Hall-bar

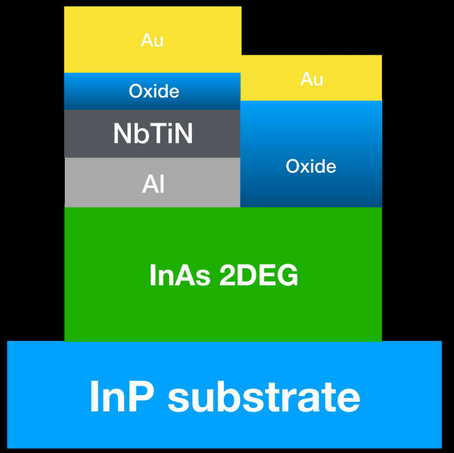


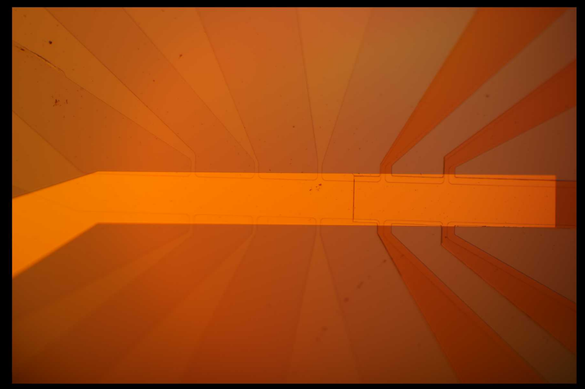


NbTiN deposition

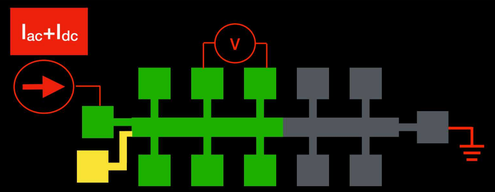


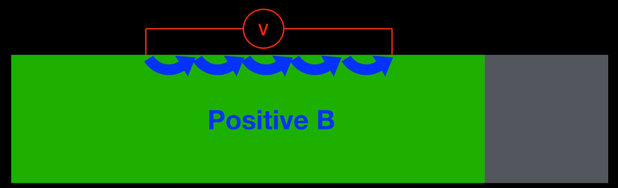
Gate

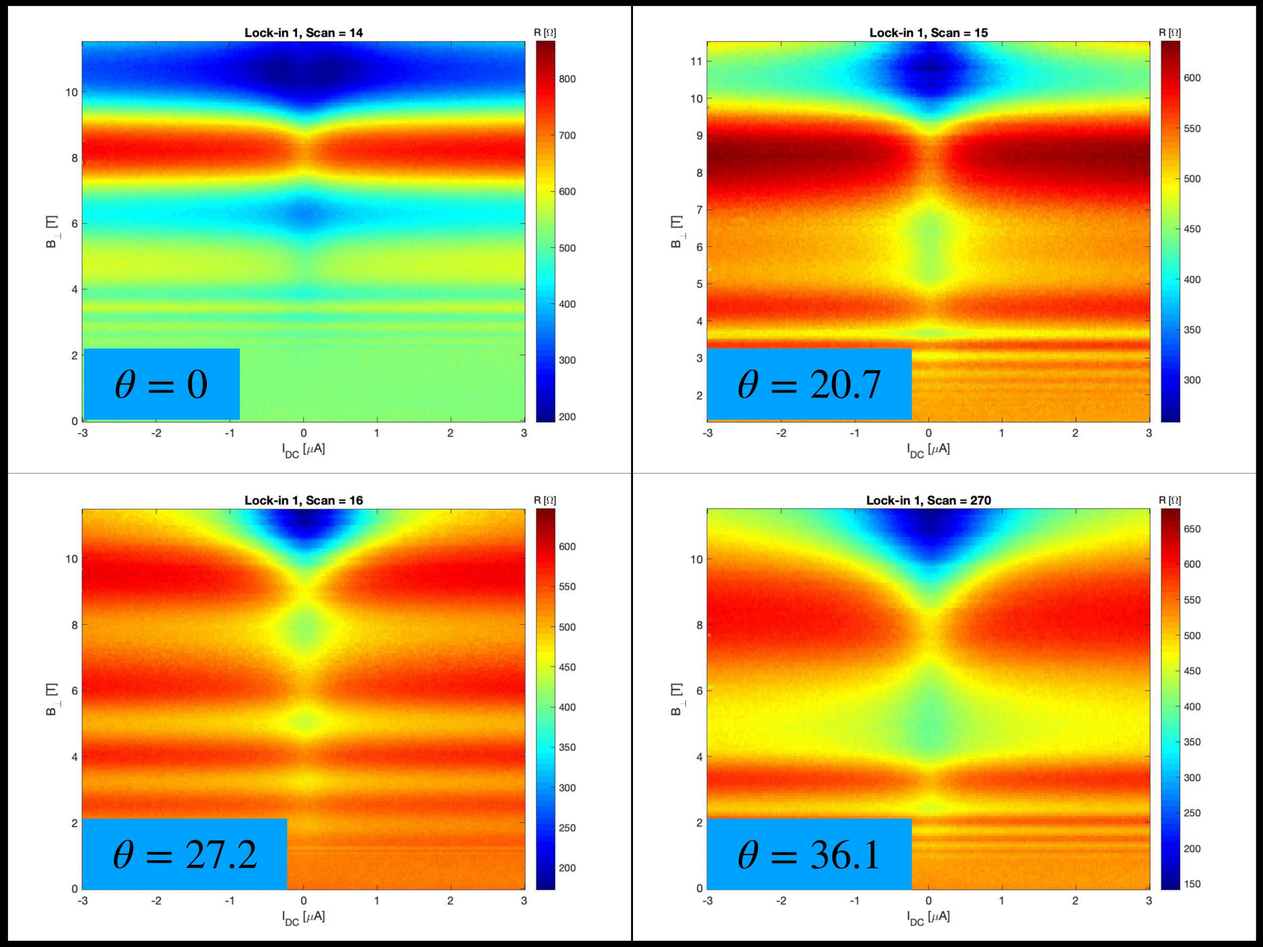


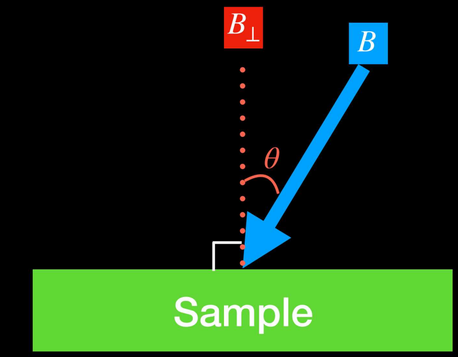


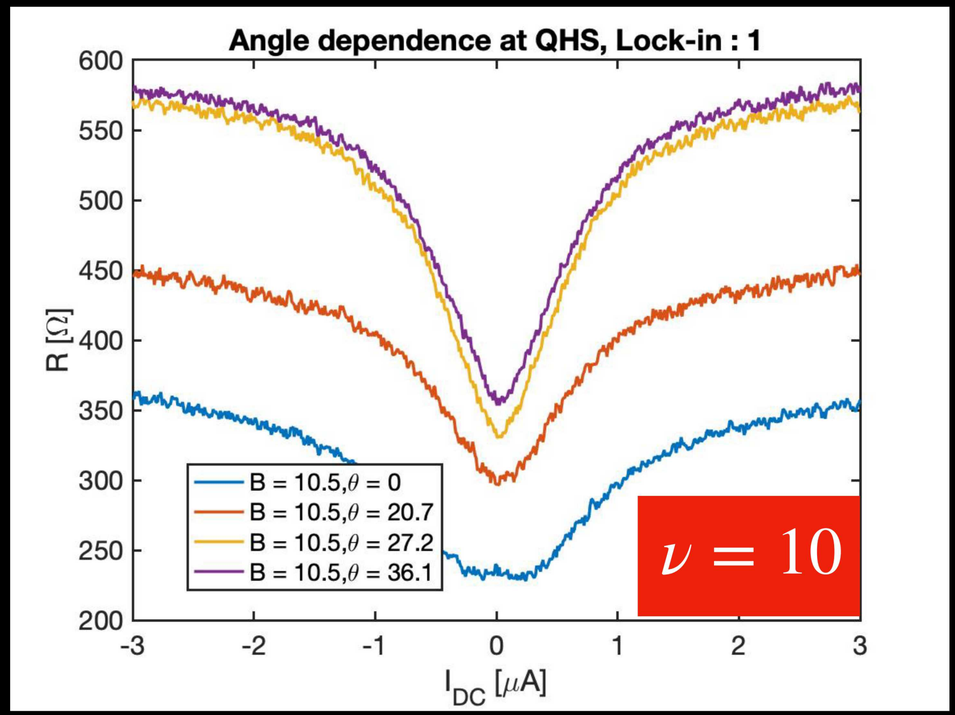
Angle Dependence











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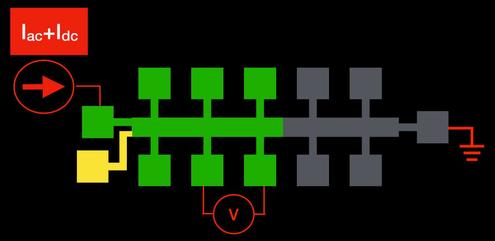

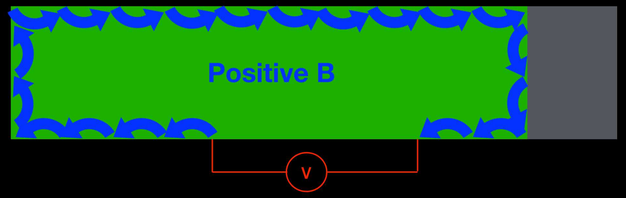

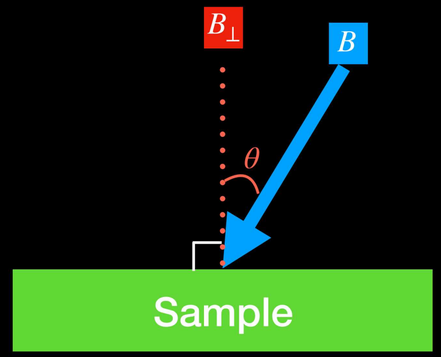

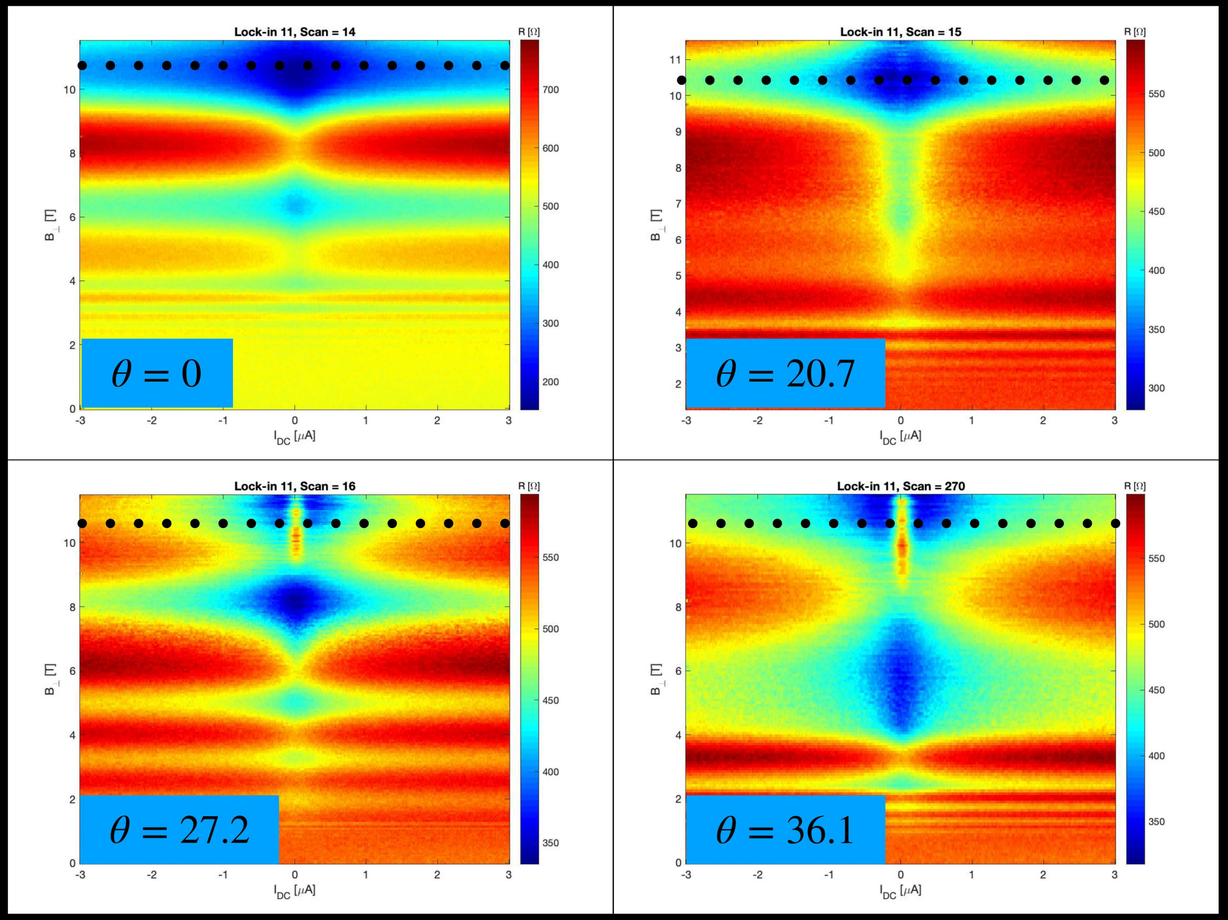

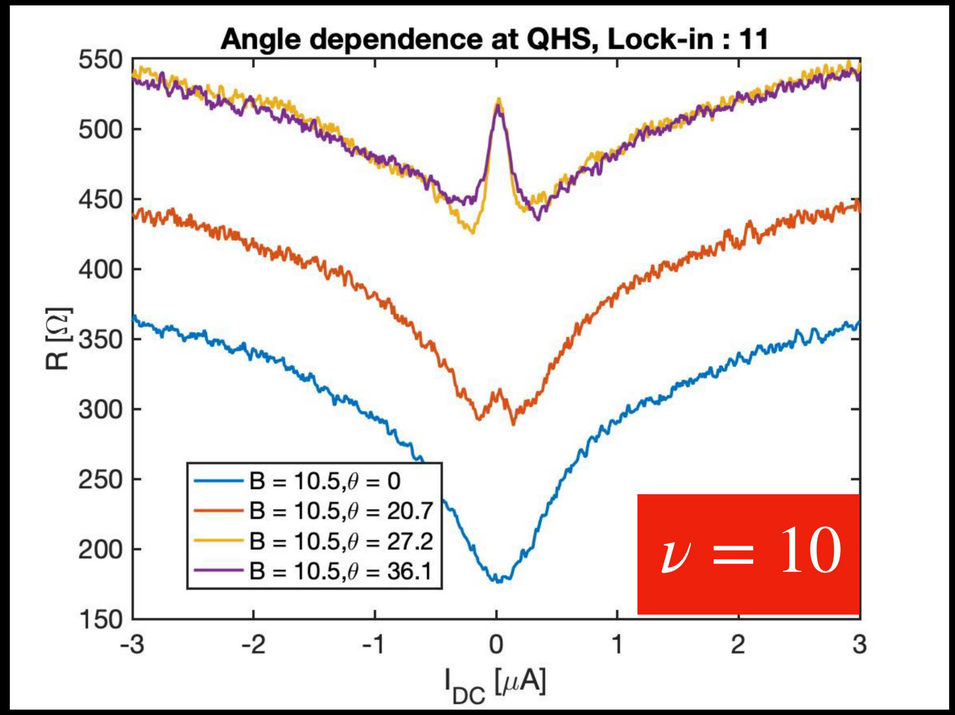

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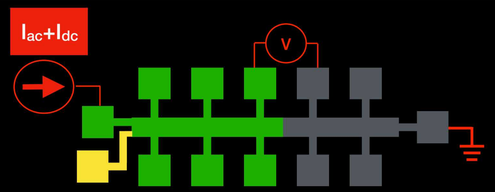

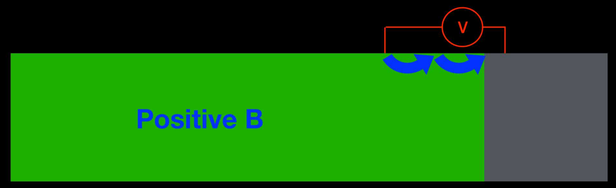

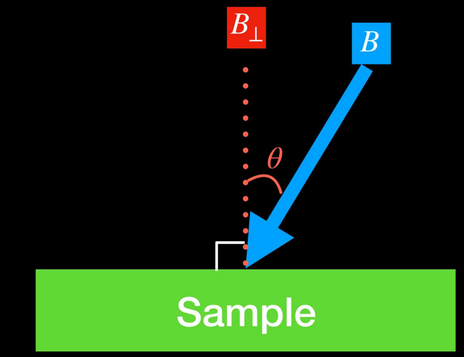

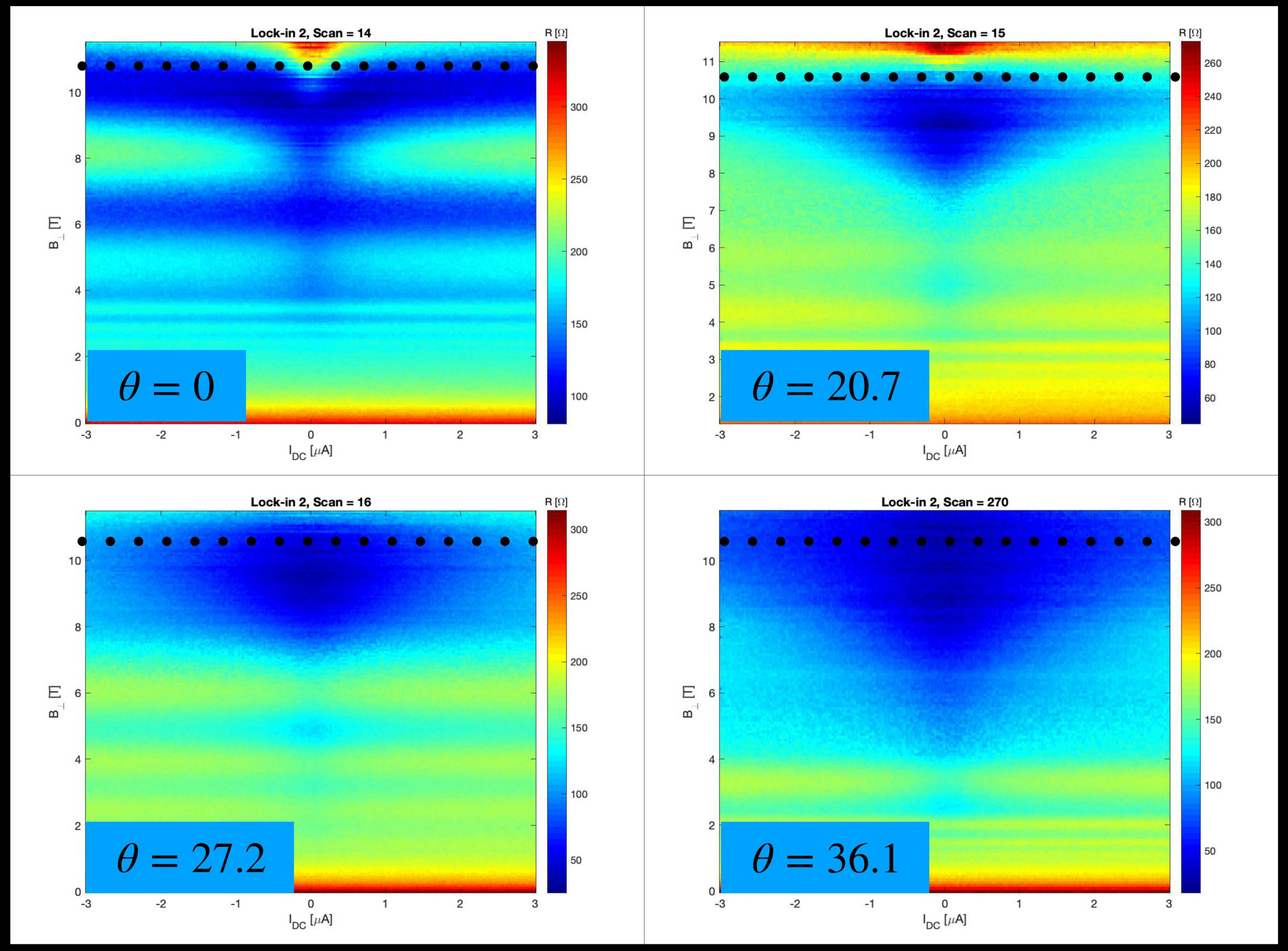

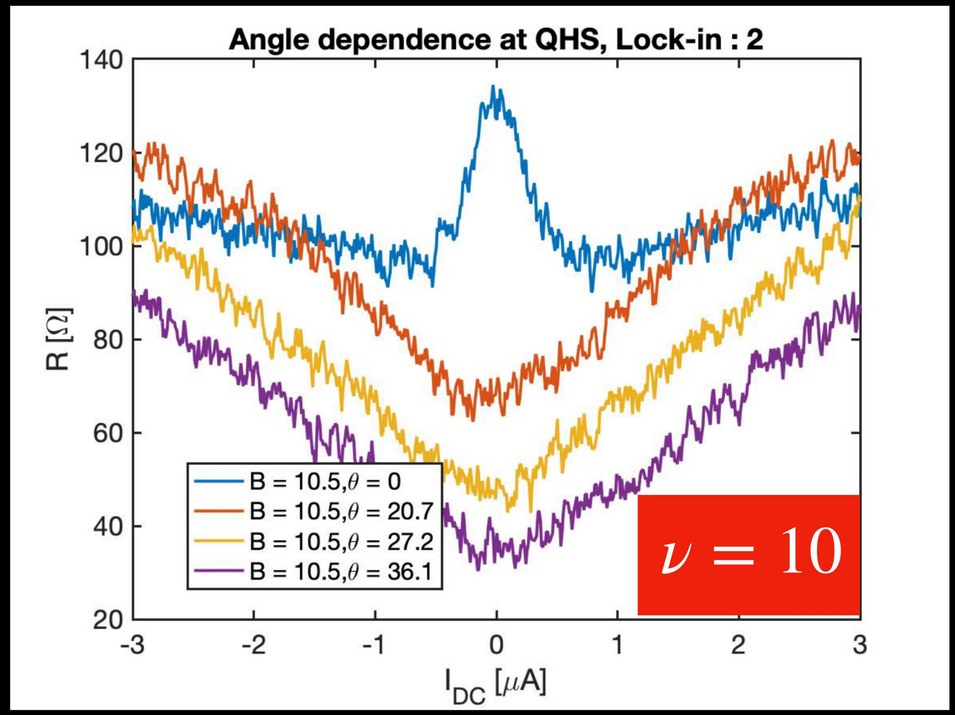

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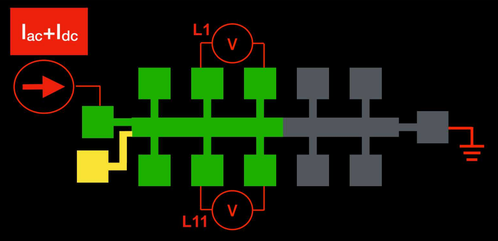

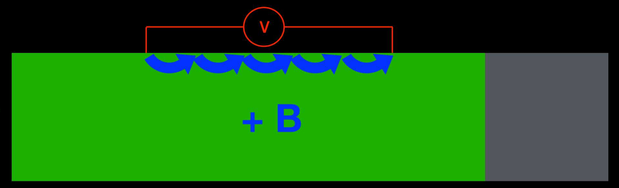

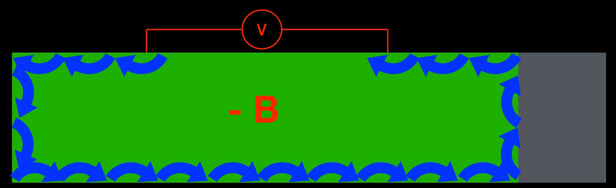

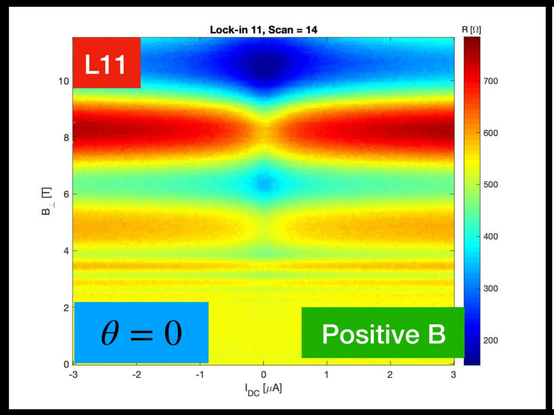

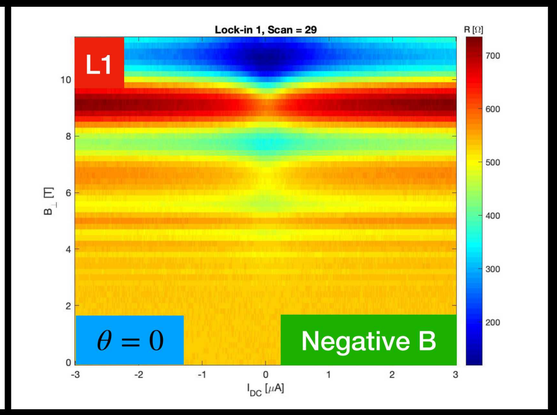

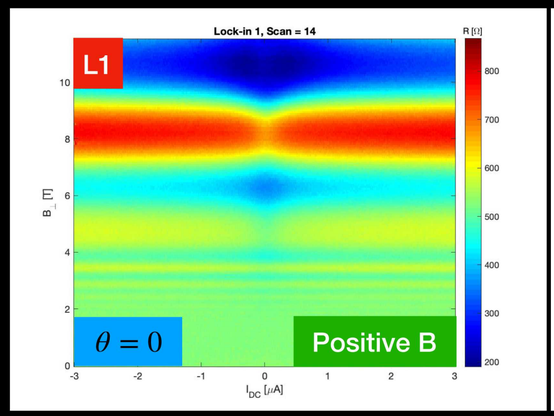

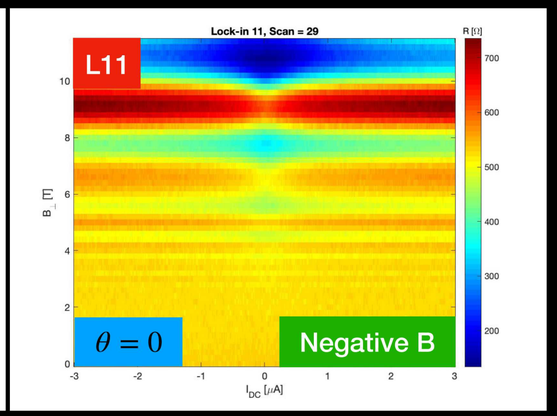

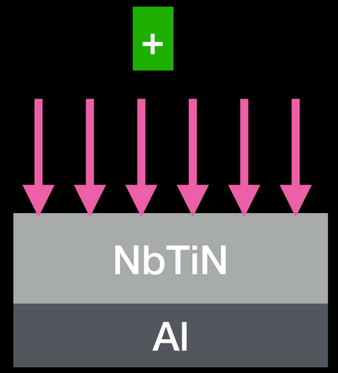

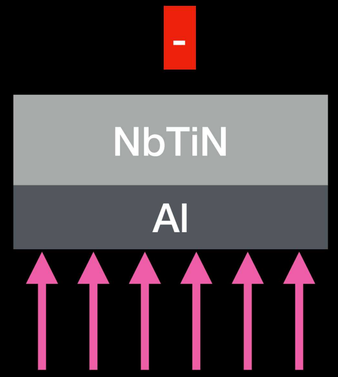

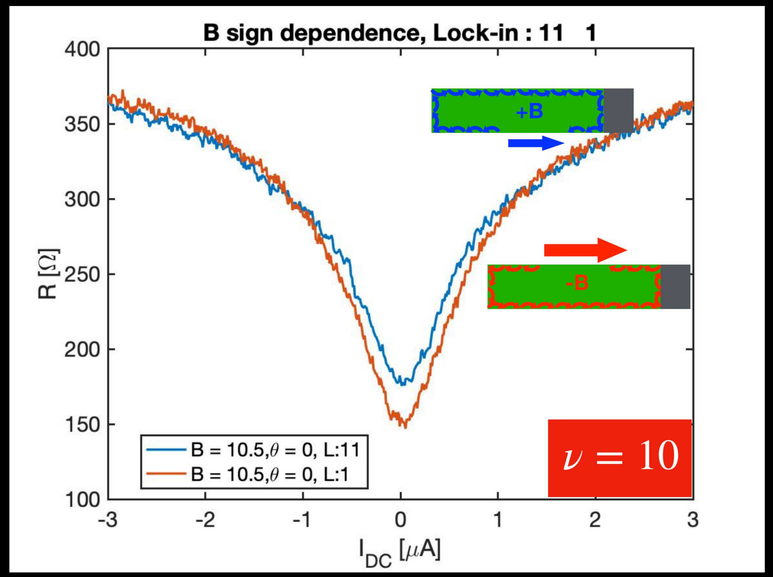

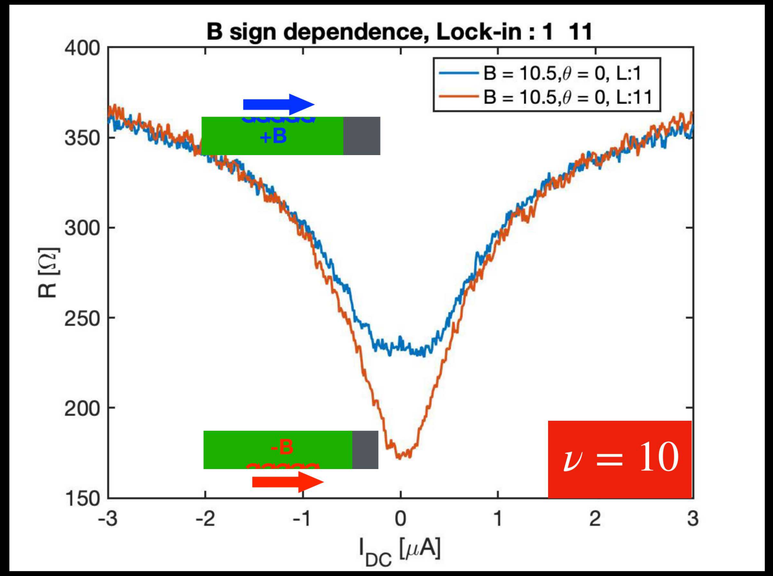

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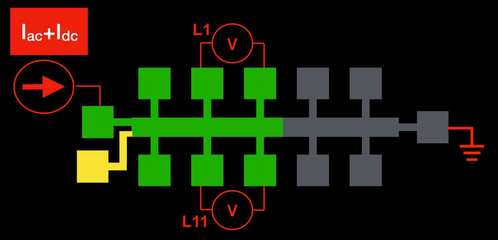
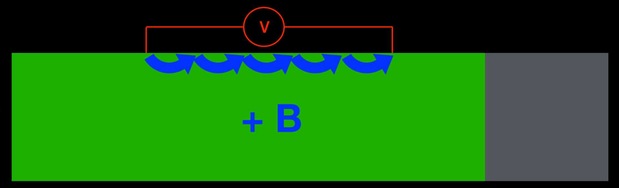
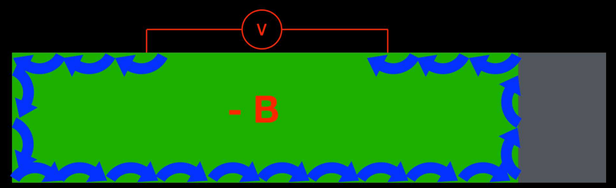
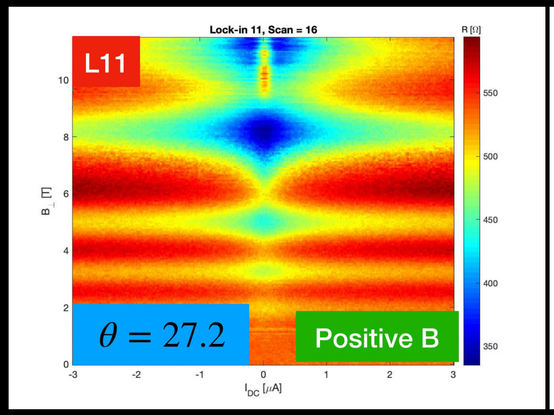
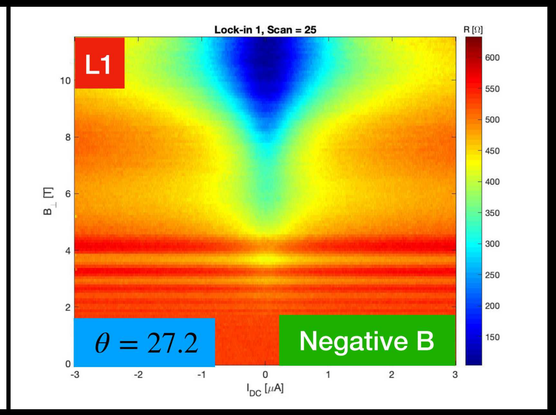
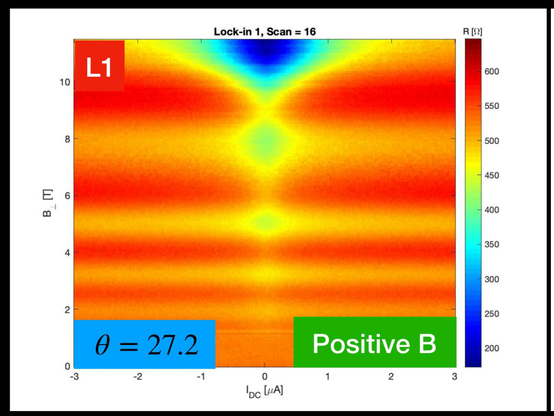


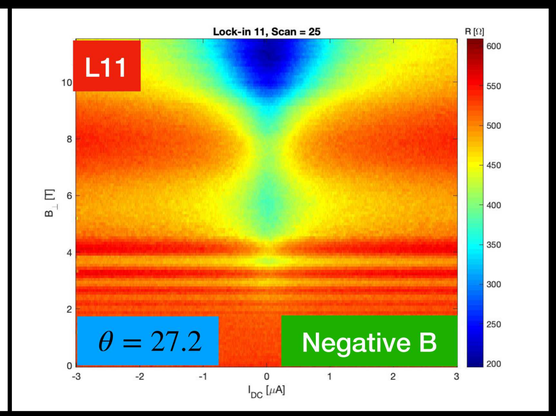


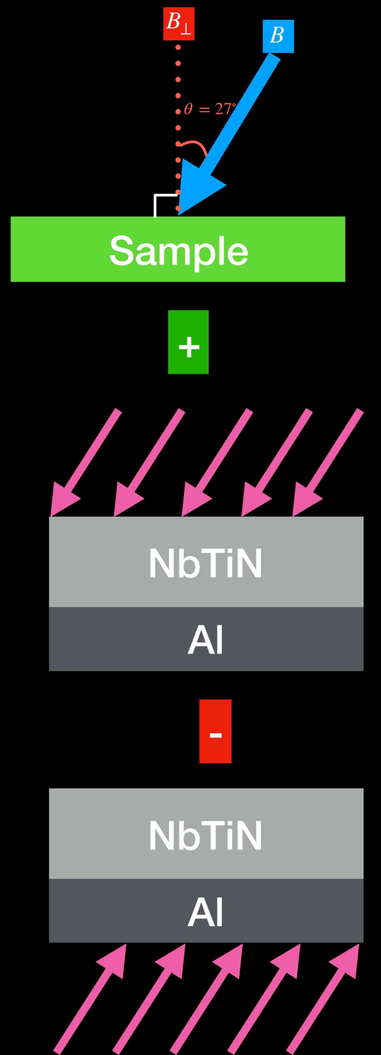


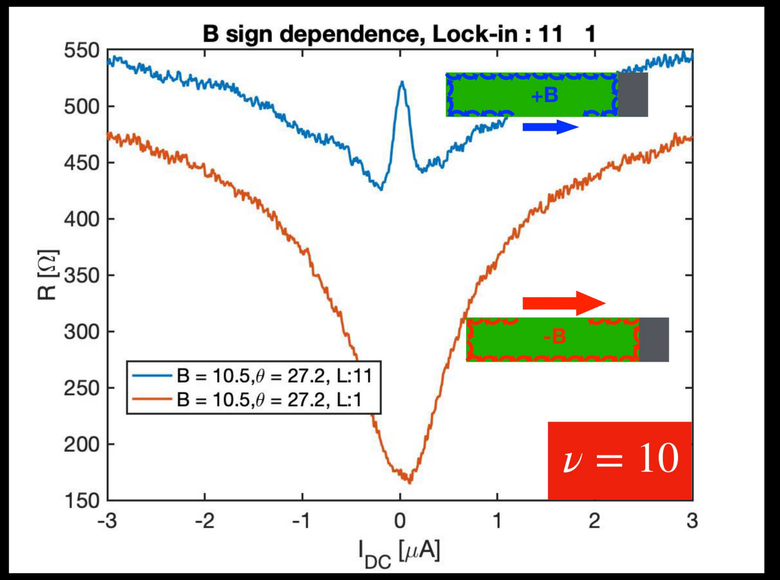


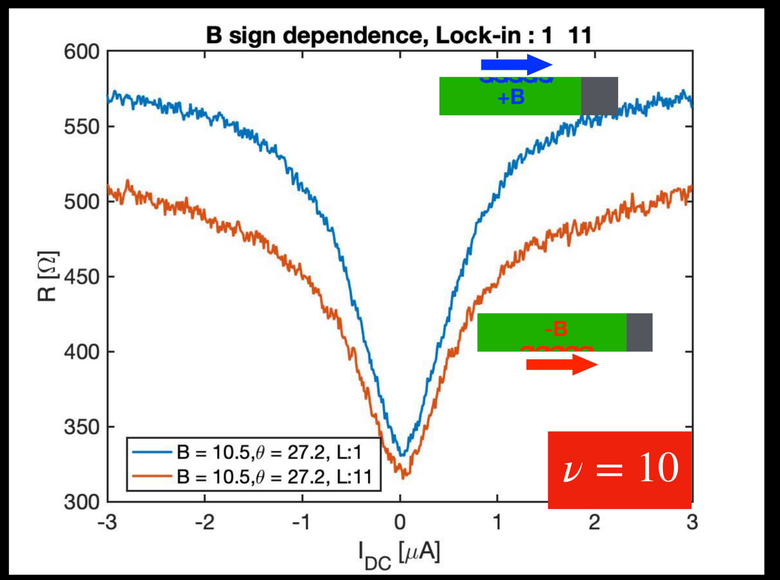




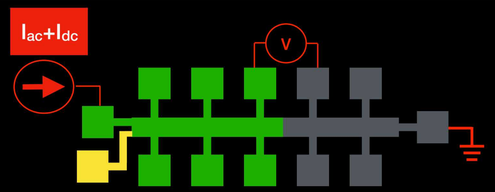


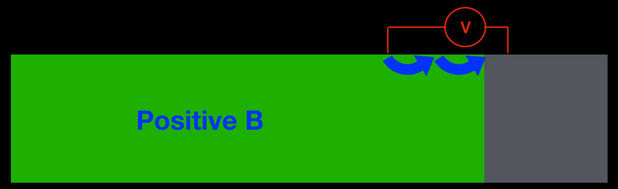


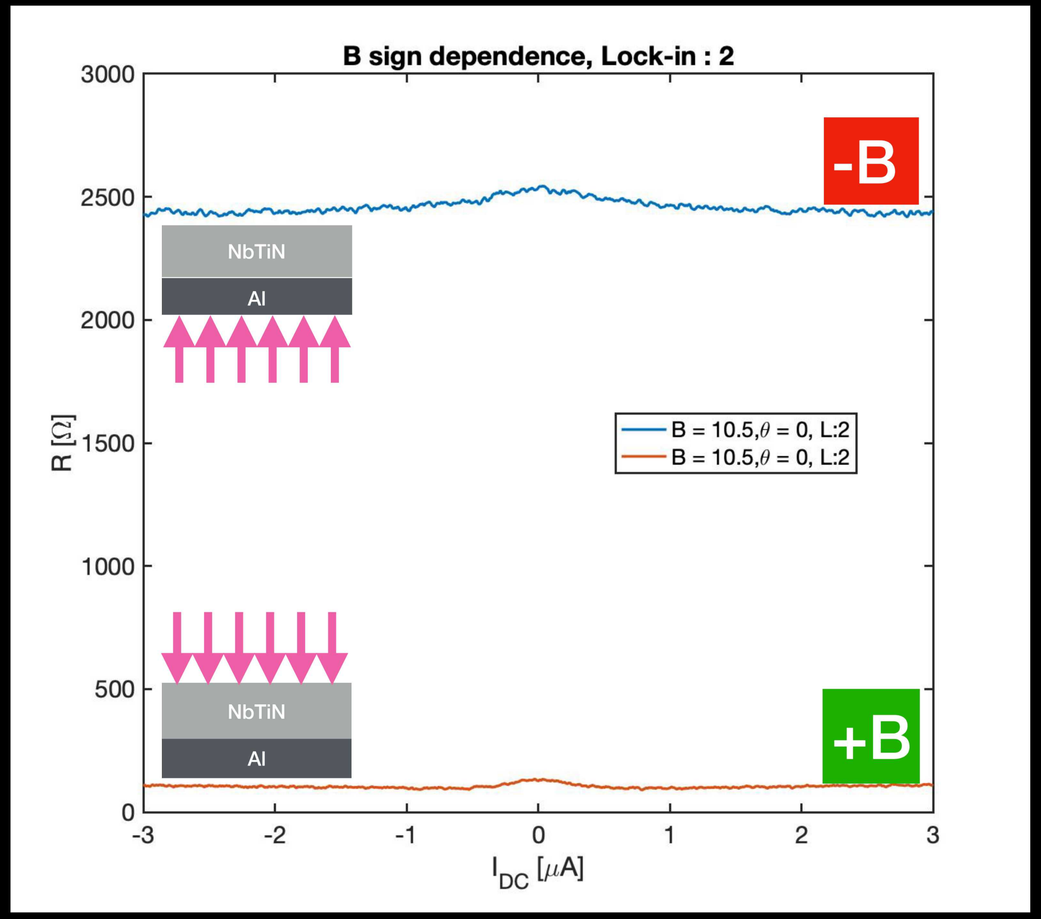


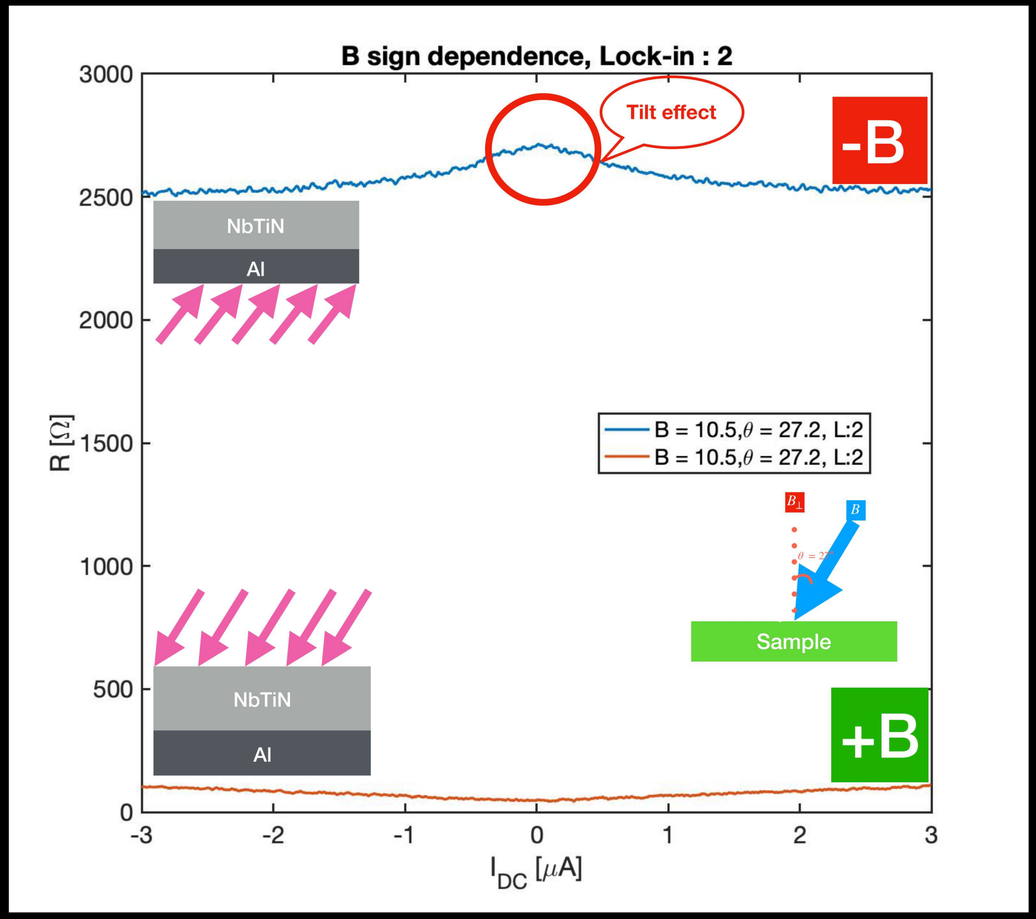


B Sign Dependence

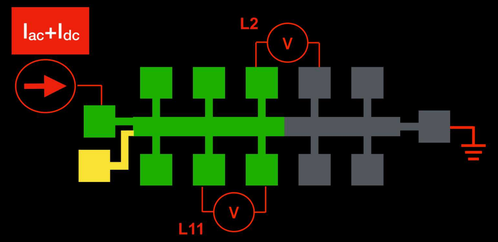


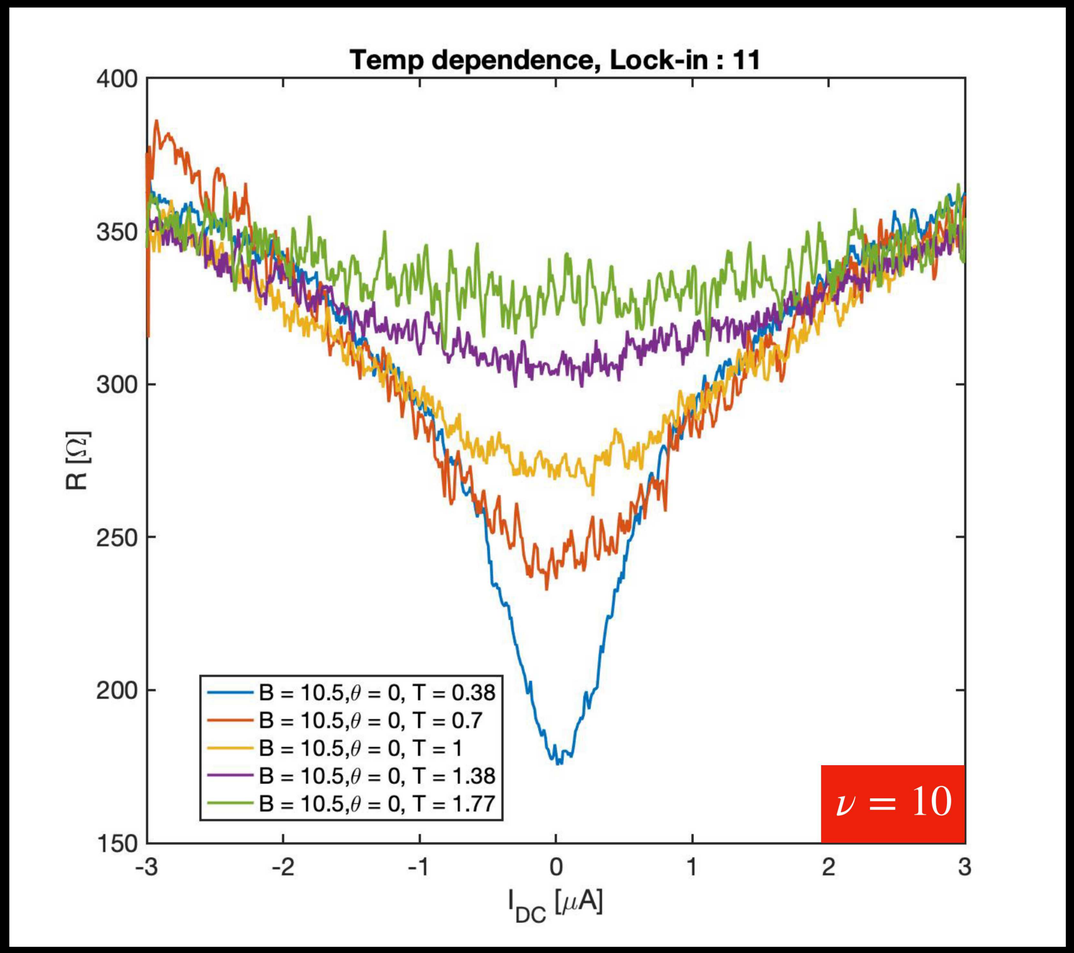


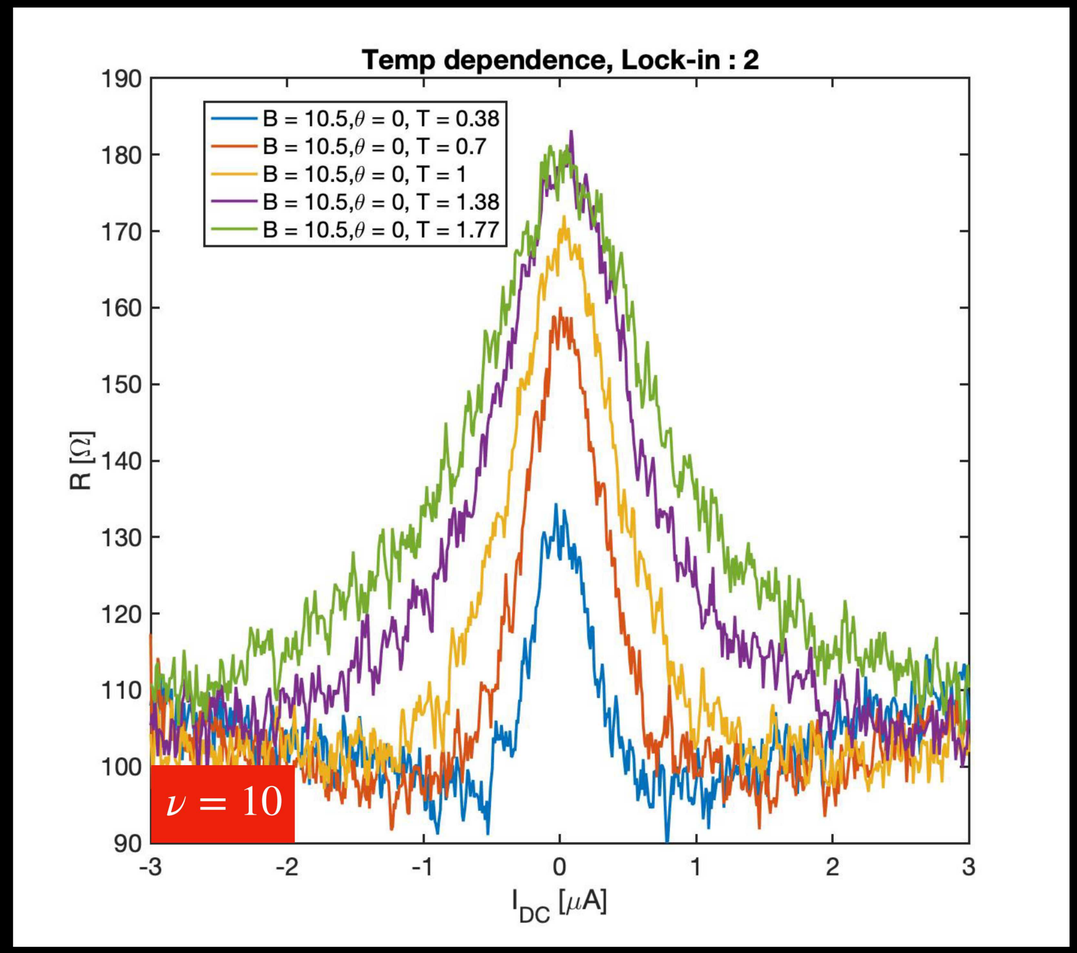




Temperature Dependence







Summary and Outlook

- Continue with better 2DEGs
- Epitaxial NbTi on Al and try subtraction device fabrication
- Add gating to the structure for in-situ changes in density and quantum Hall states

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