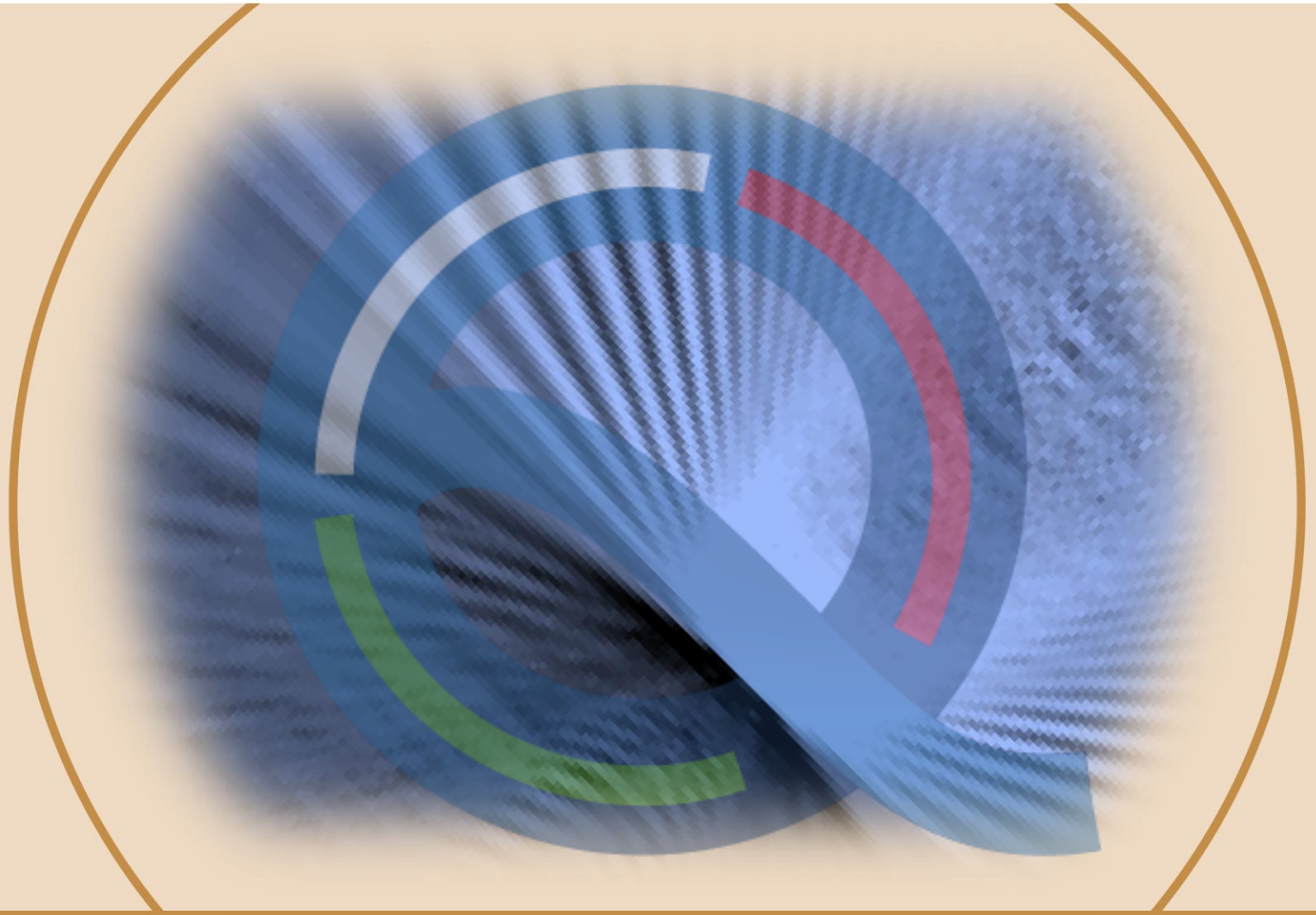
Finanziato dall'Unione europea NextGenerationEU
Ministero dell'Università e della Ricerca
Italiadomani PIANO NAZIONALE DI RIPRESA E RESILIENZA
NQSTI National Quantum Science and Technology Institute

Superconducting Quantum Interference Devices based on InSb Nanoflag Josephson Junctions



Stefan Heun CNR-NANO

06/02/2025

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Acknowledgments

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Work in Progress

PNRR MUR project PE0000023-NQSTI

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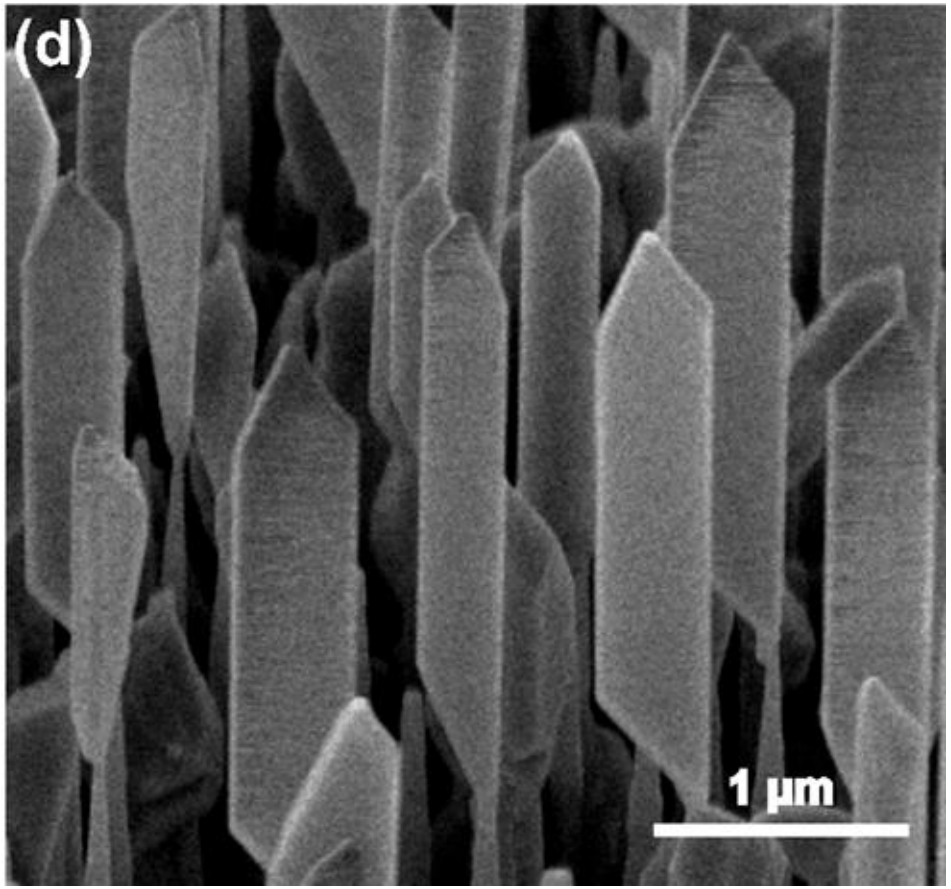
InSb Nanoflags

- Single crystal, ZB structure
- length $\sim 2.8\ \mu m$
- width $\sim 500\ nm$
- thickness $\sim 100\ nm$
- $m^* = 0.02 m_e$
- $E_g = 0.23\ eV$
- $|g^*| = 50$



ACS Appl. Nano Mater. 4 (2021) 5825−5833.

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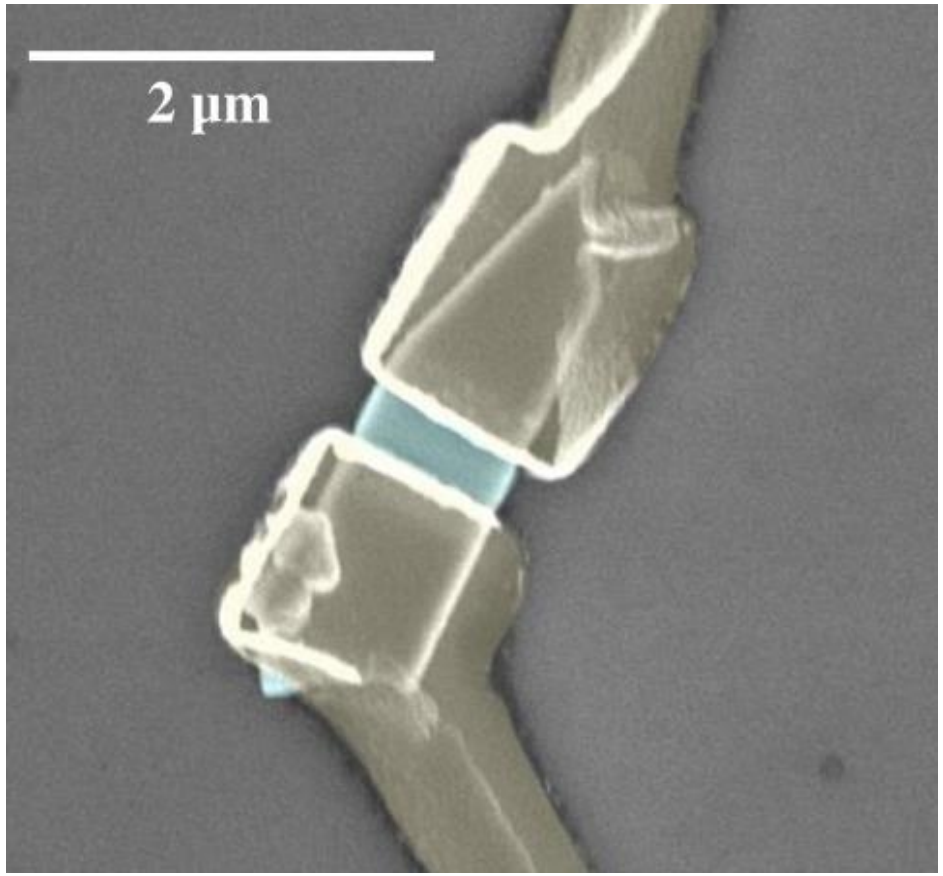
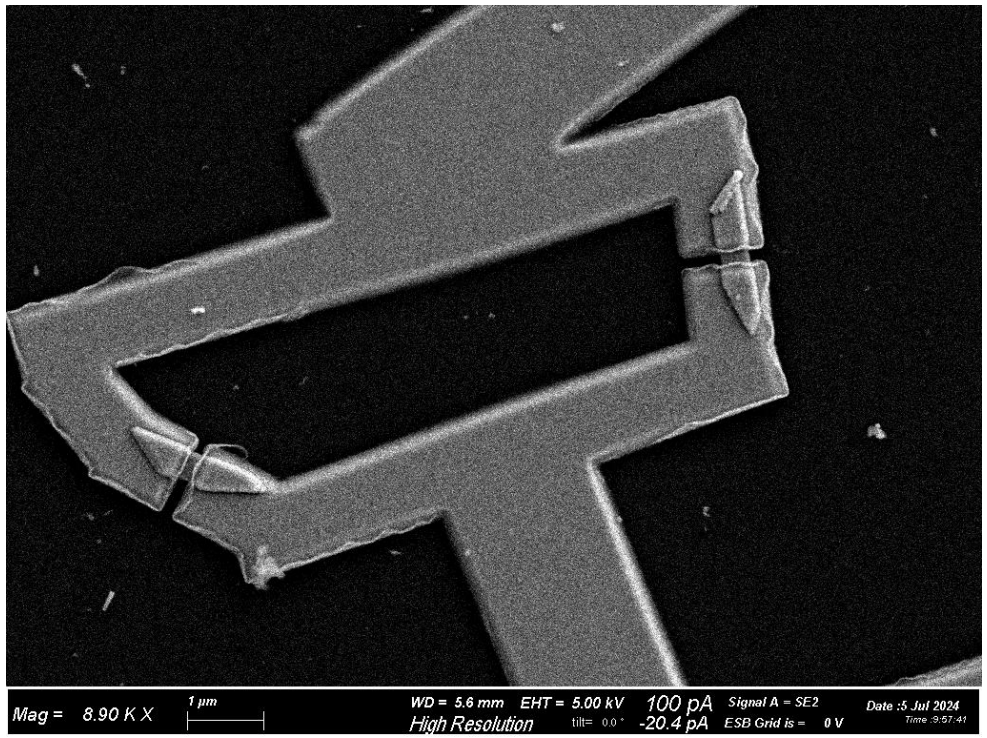


Appl. Phys. Lett. 119 (2021) 214004.

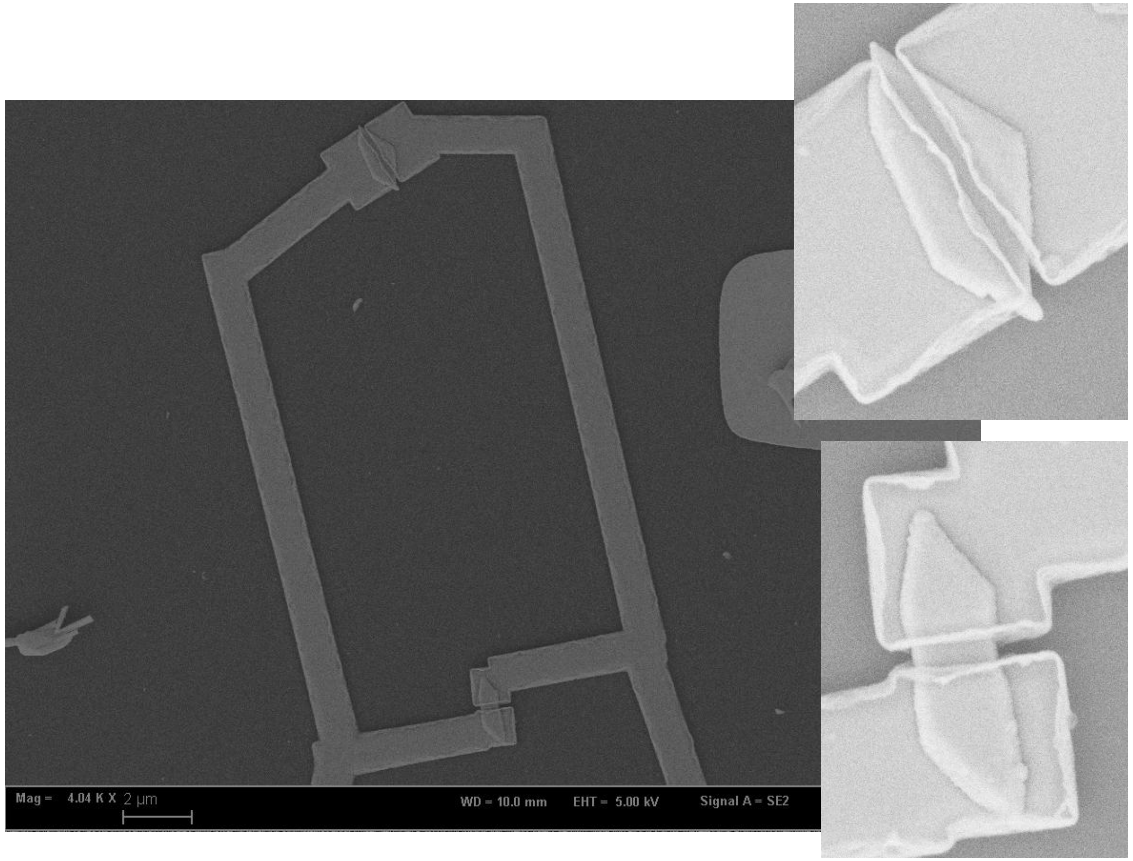
Two Josephson Junctions in parallel

Devices: Symmetric and Asymmetric SQUIDs

Symmetric SQUID



Asymmetric SQUID



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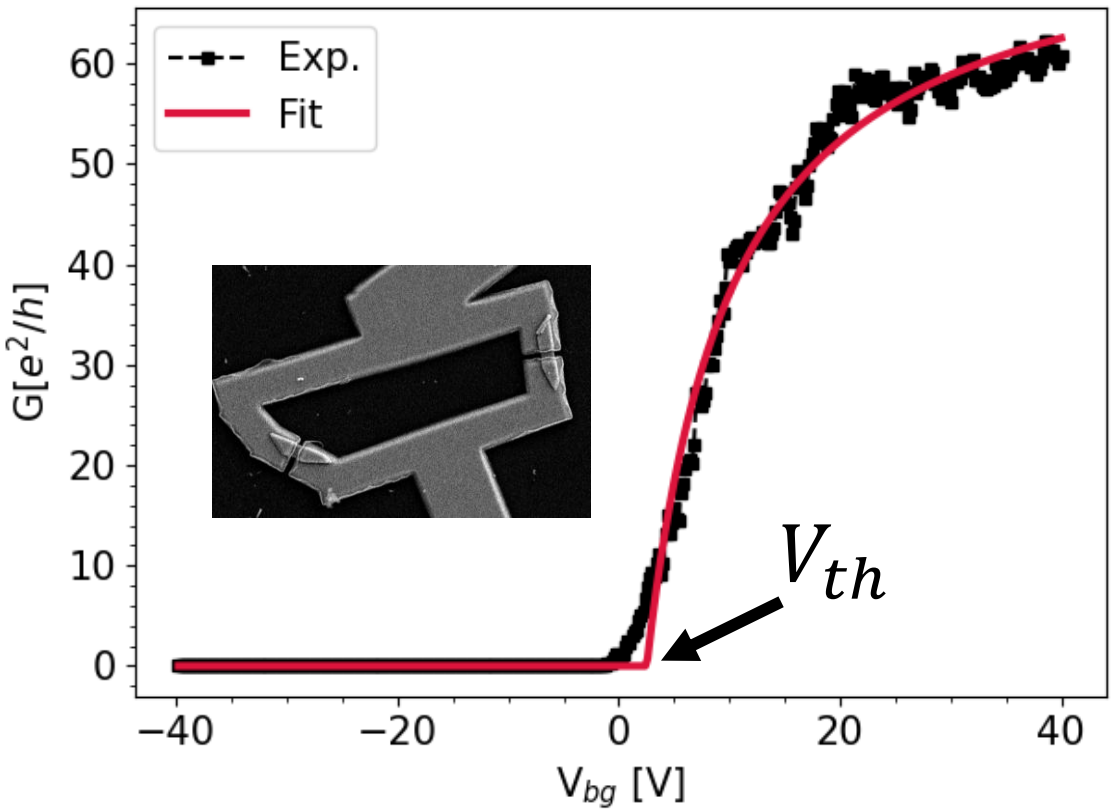
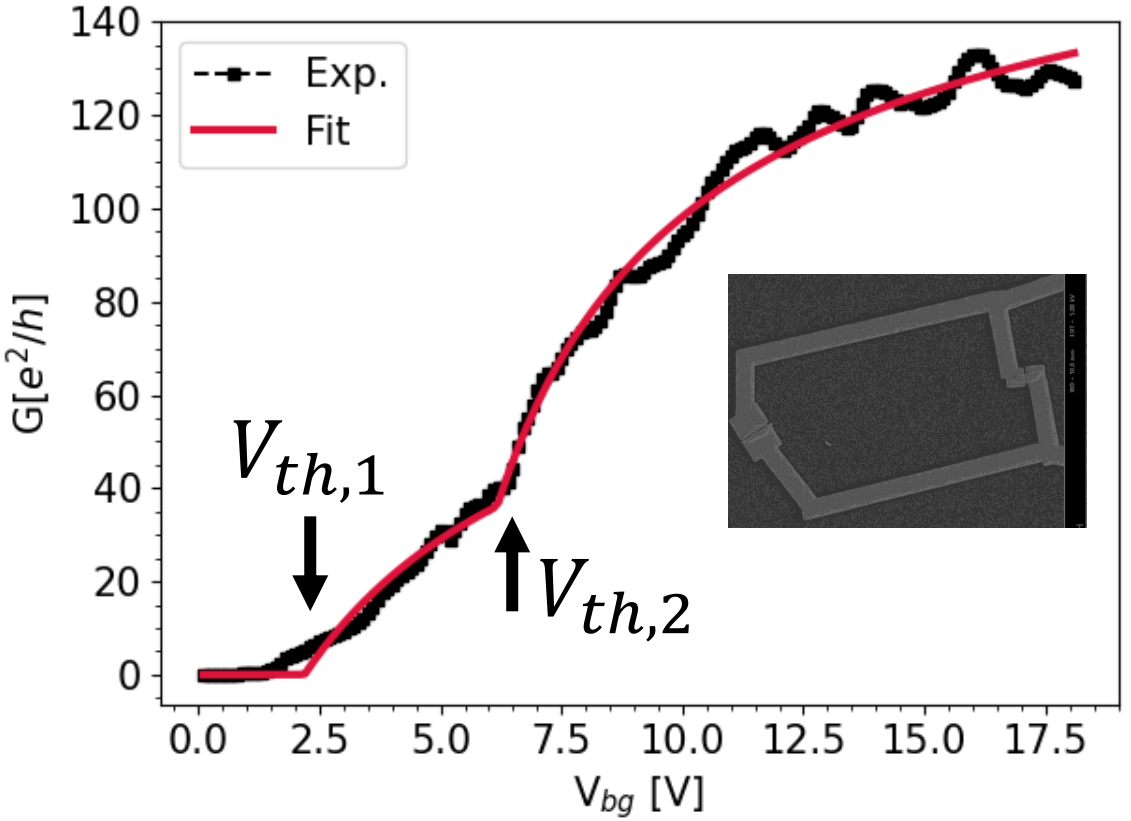
SQUID conductance

Symmetric SQUID

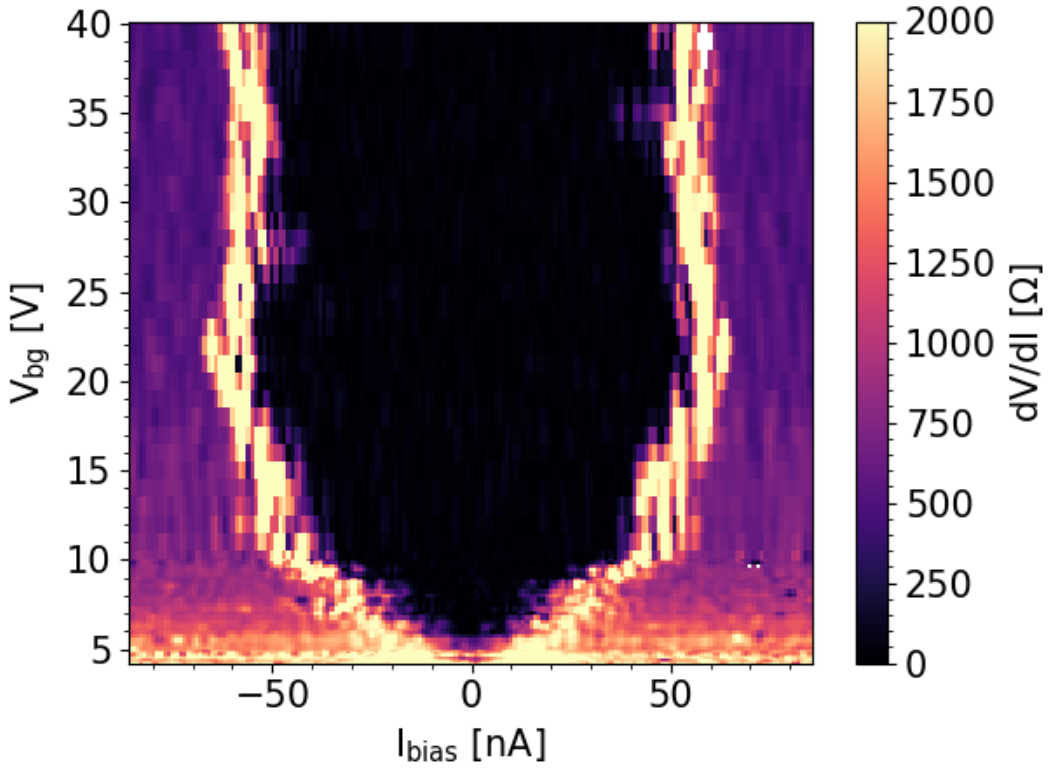


Asymmetric SQUID

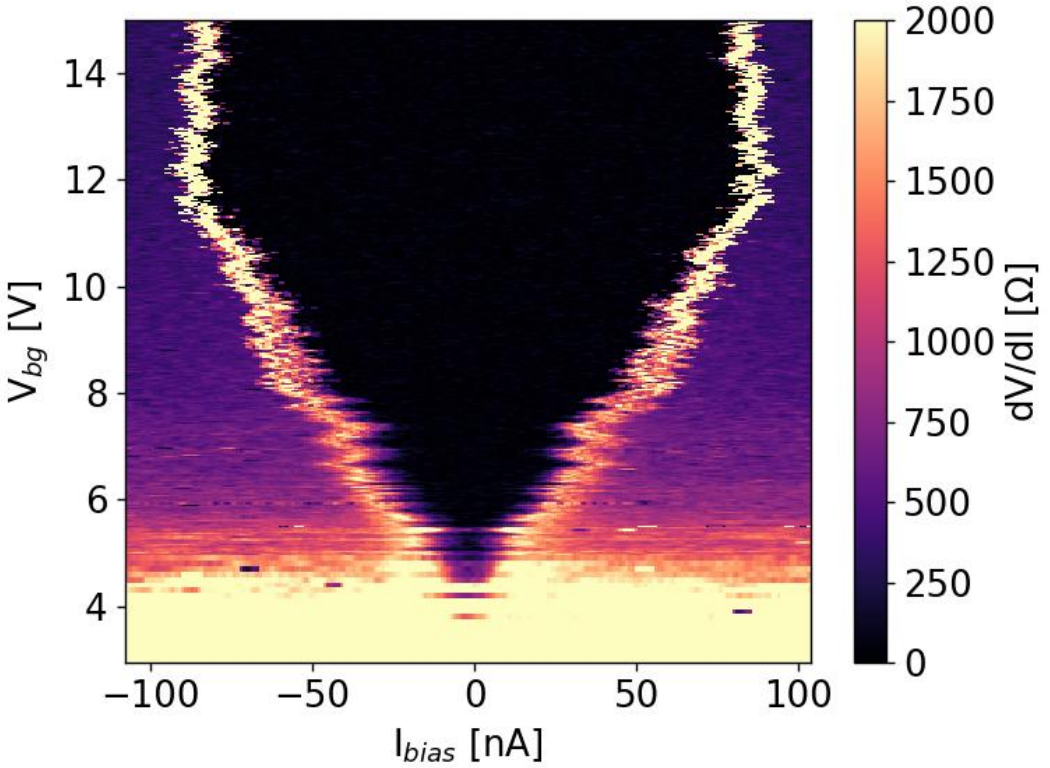


Back gate control of supercurrent @ T= 350 mK

Symmetric SQUID



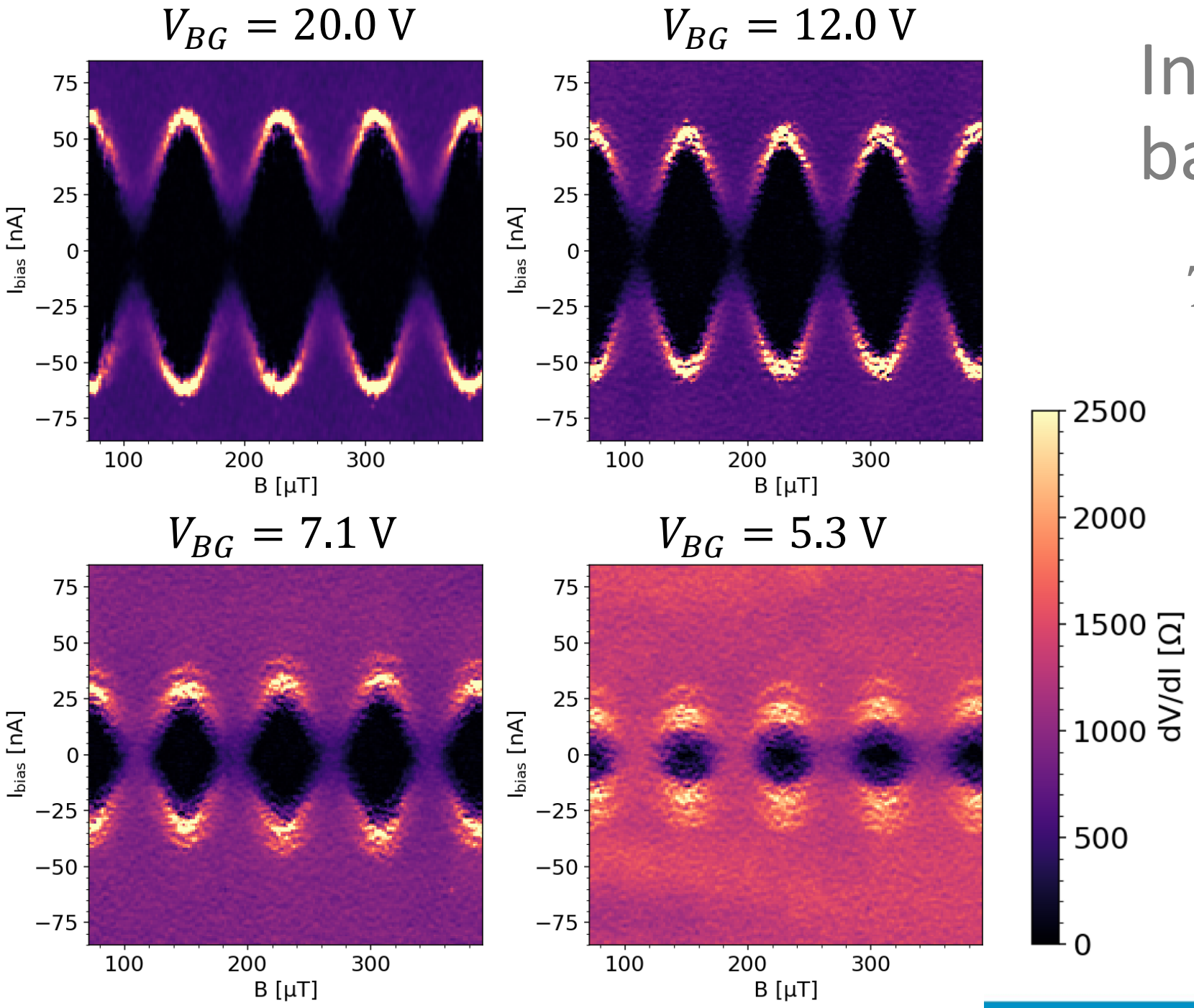
Asymmetric SQUID



Interference in the symmetric SQUID

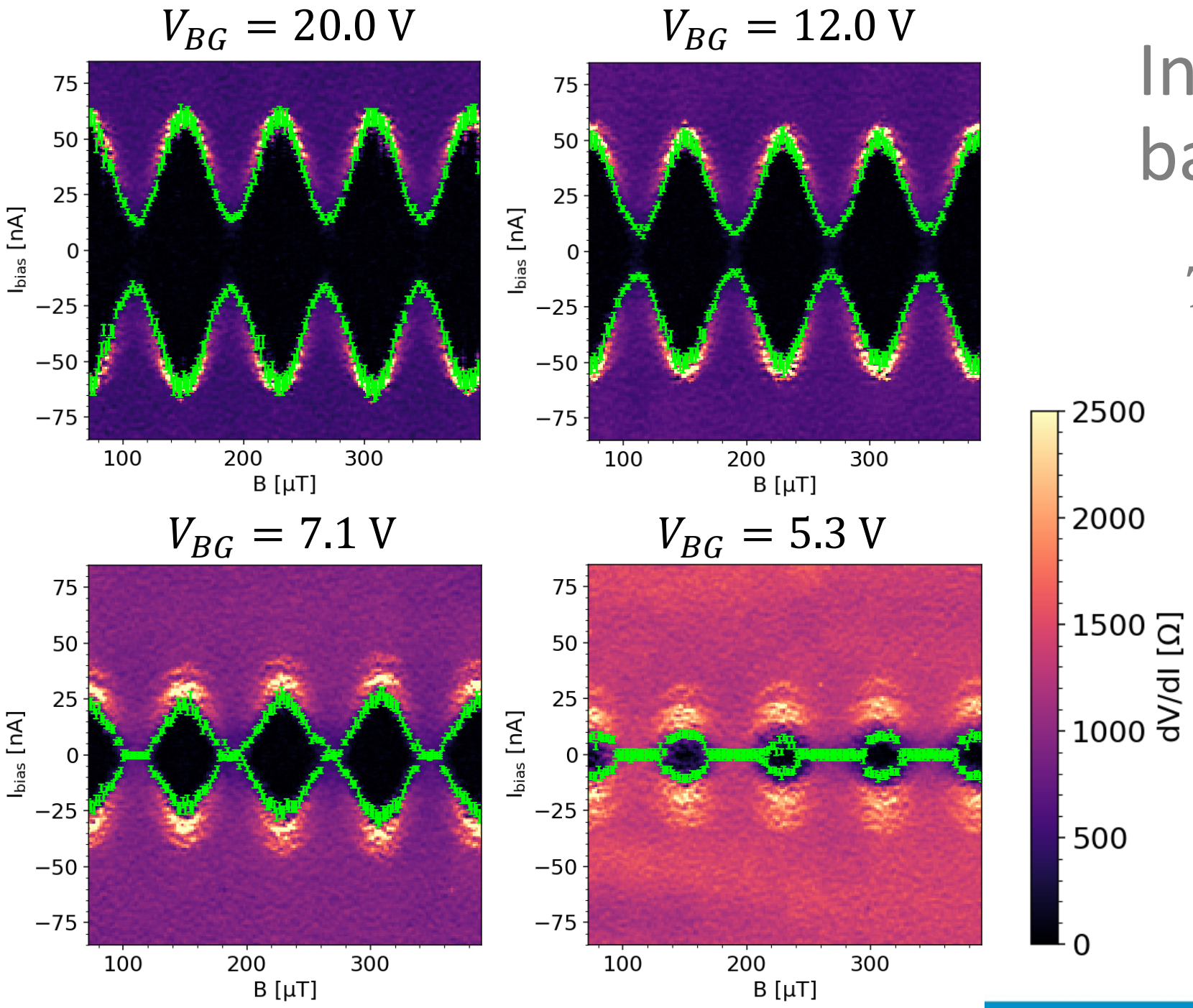
Interference vs. backgate

$T = 350\ \mathrm{mK}$



Interference vs. backgate

$T = 350\ \mathrm{mK}$

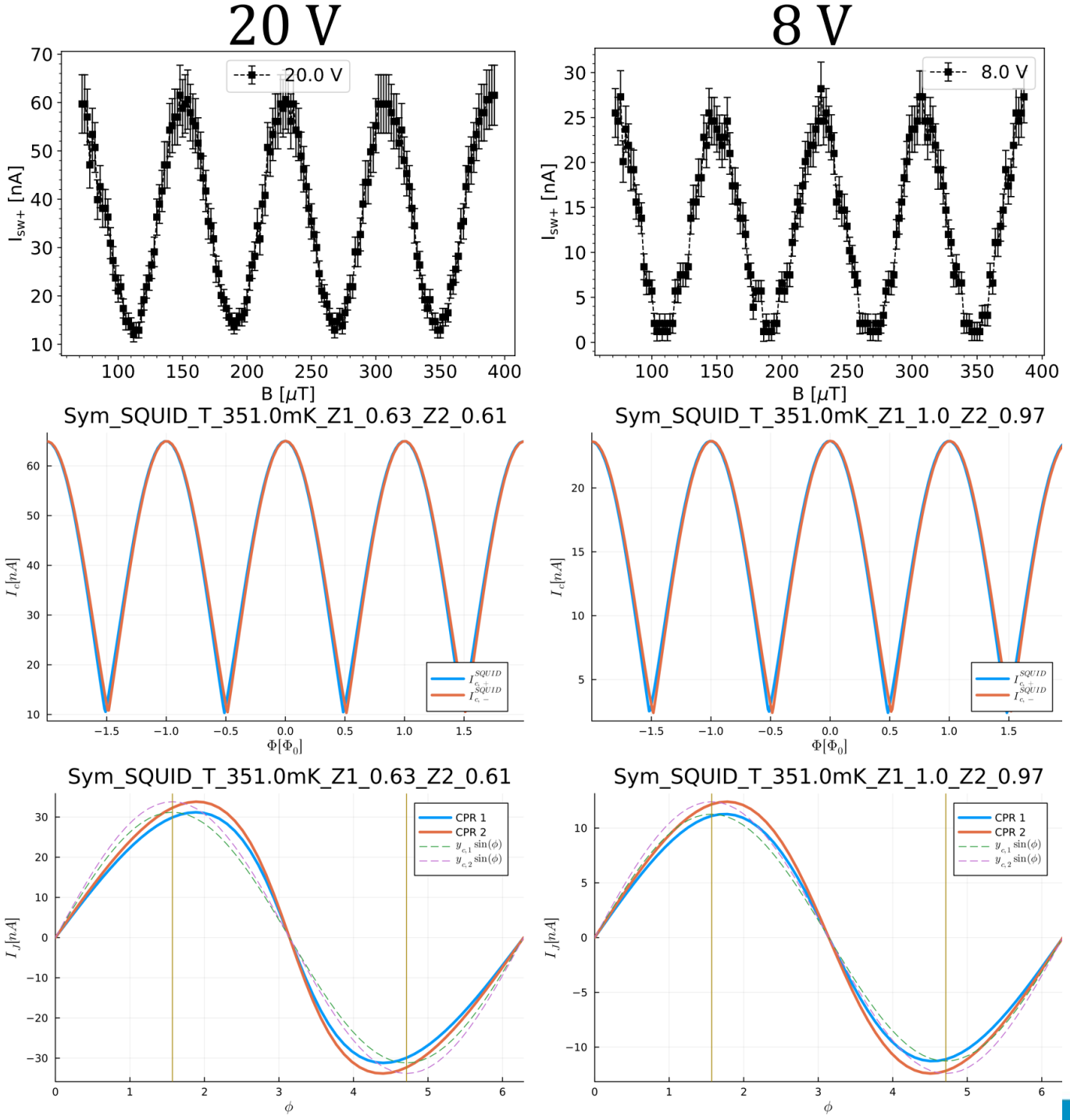


Tight-binding simulations

Exp.

Theo.

CPR



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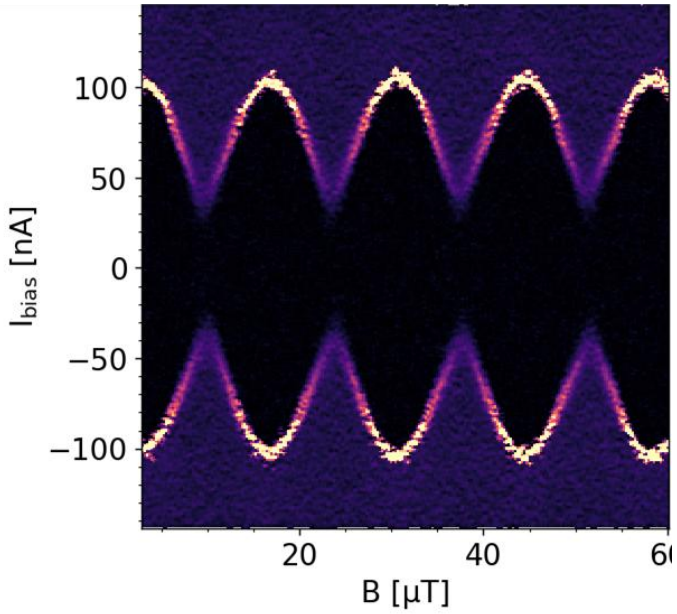
Results for the asymmetric SQUID

Interference vs. backgate

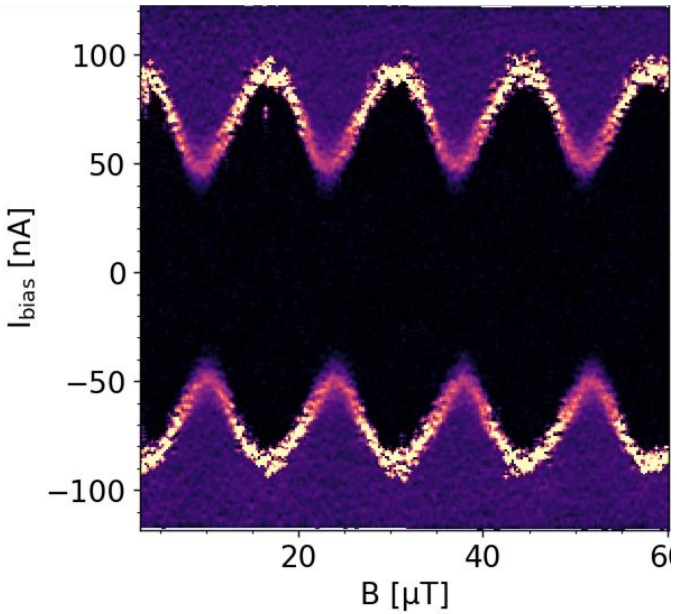
$T = 350\ \mathrm{mK}$

- Always in the asymmetric regime

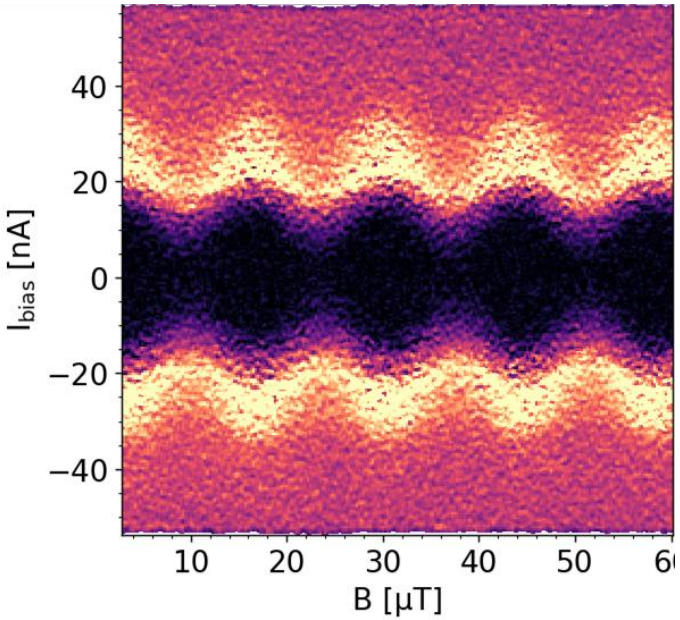
$V_{BG} = 18.0\ \mathrm{V}$

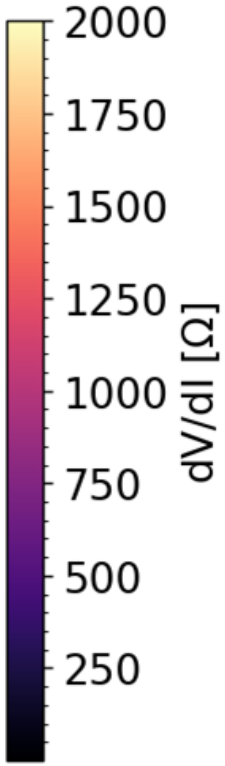


$V_{BG} = 9.0\ \mathrm{V}$



$V_{BG} = 4.5\ \mathrm{V}$





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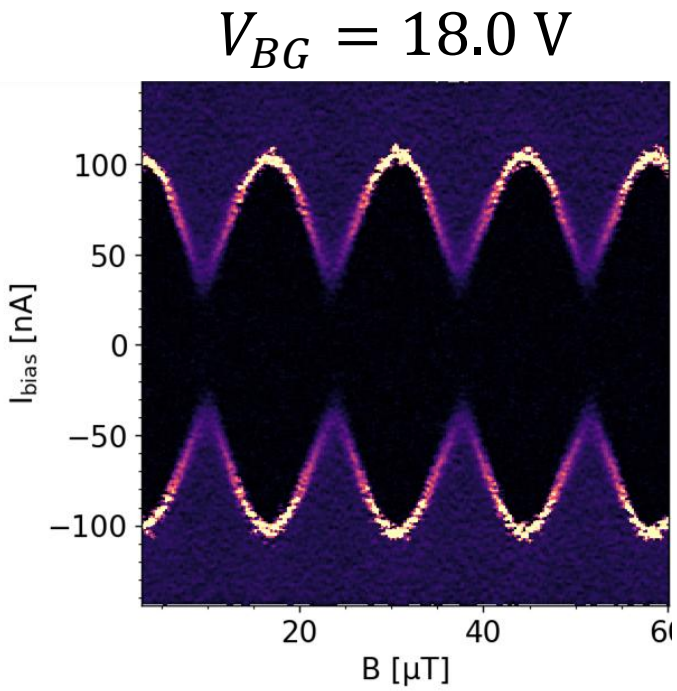
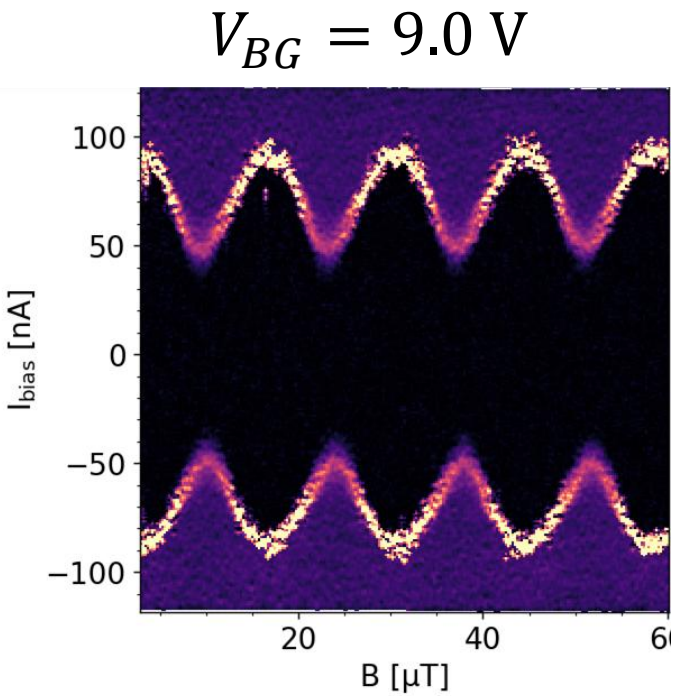
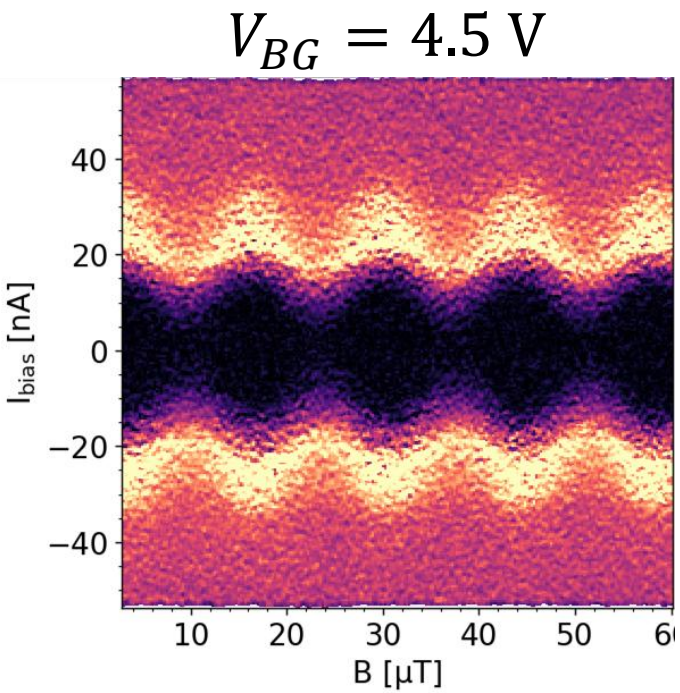
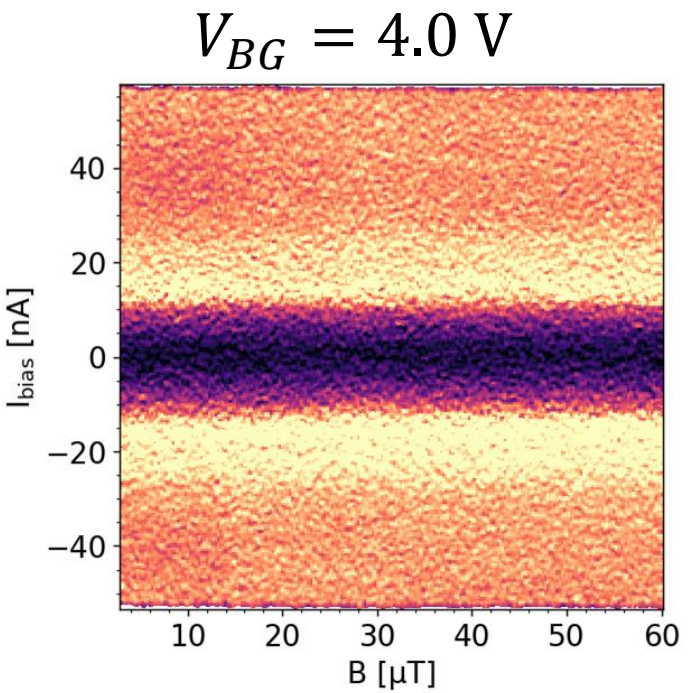
Interference vs. backgate

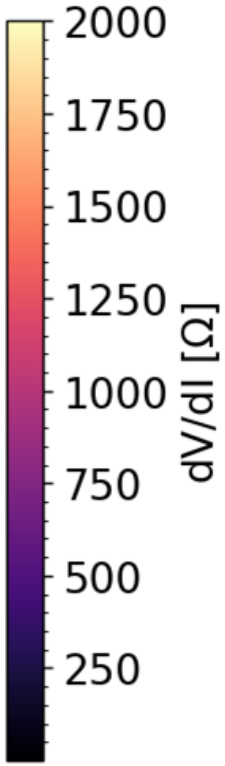
$T = 350\ \mathrm{mK}$



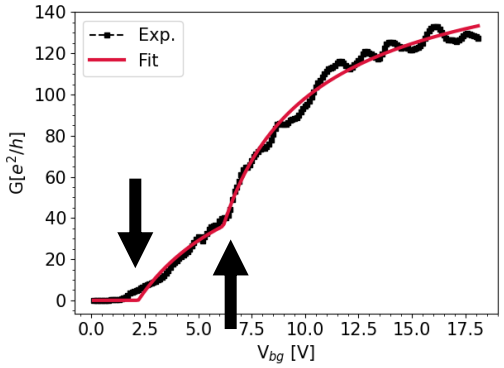








- Always in the asymmetric regime
- Loss of interference for $V_{BG} = 4.0$ V



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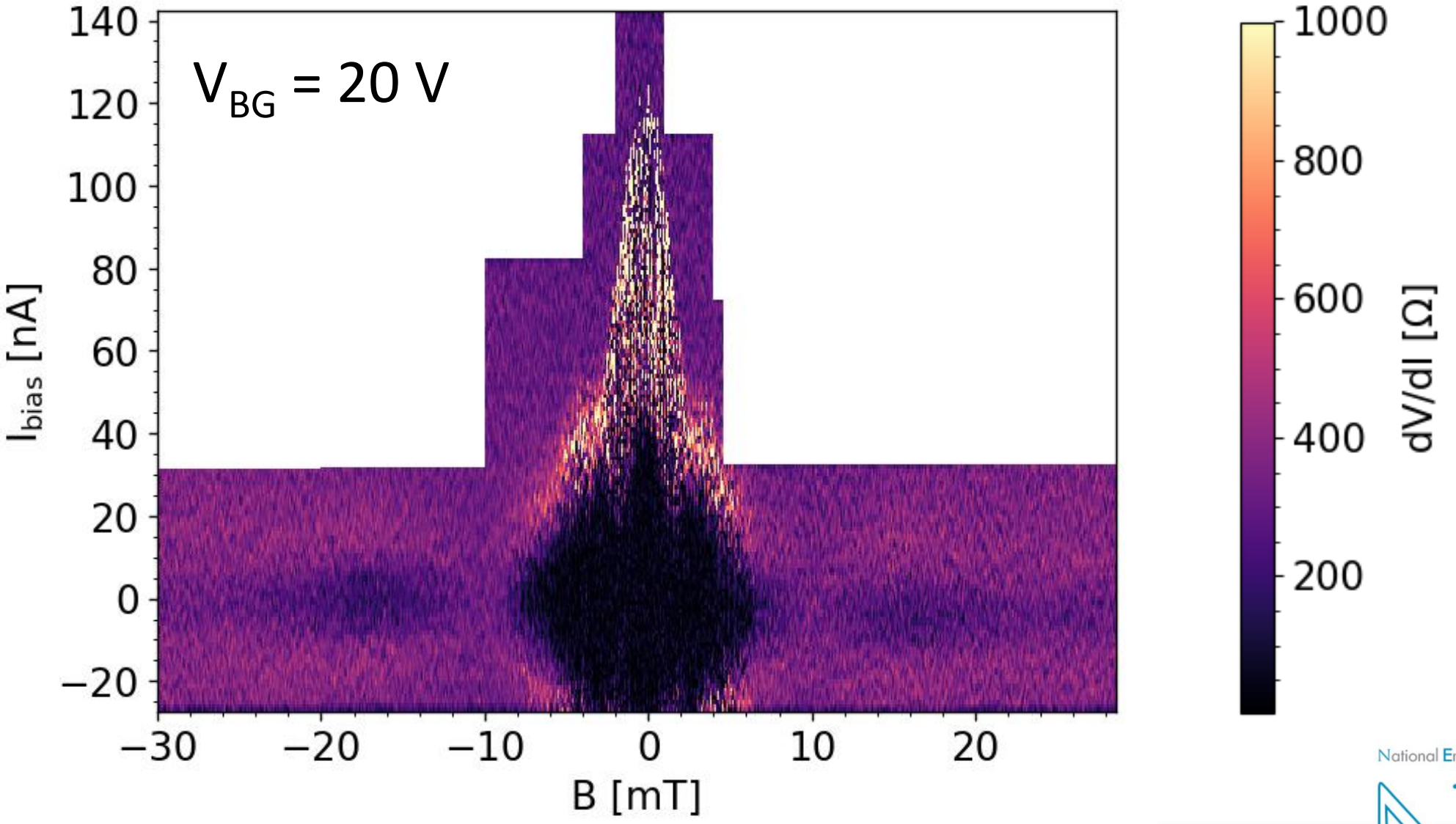
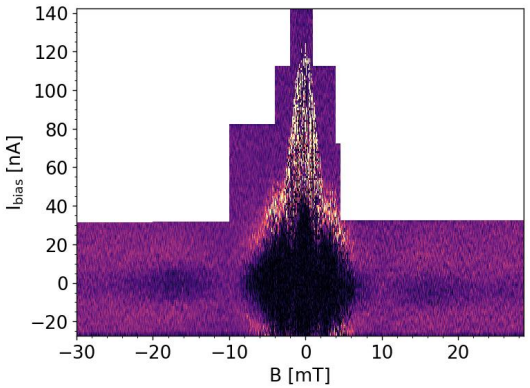
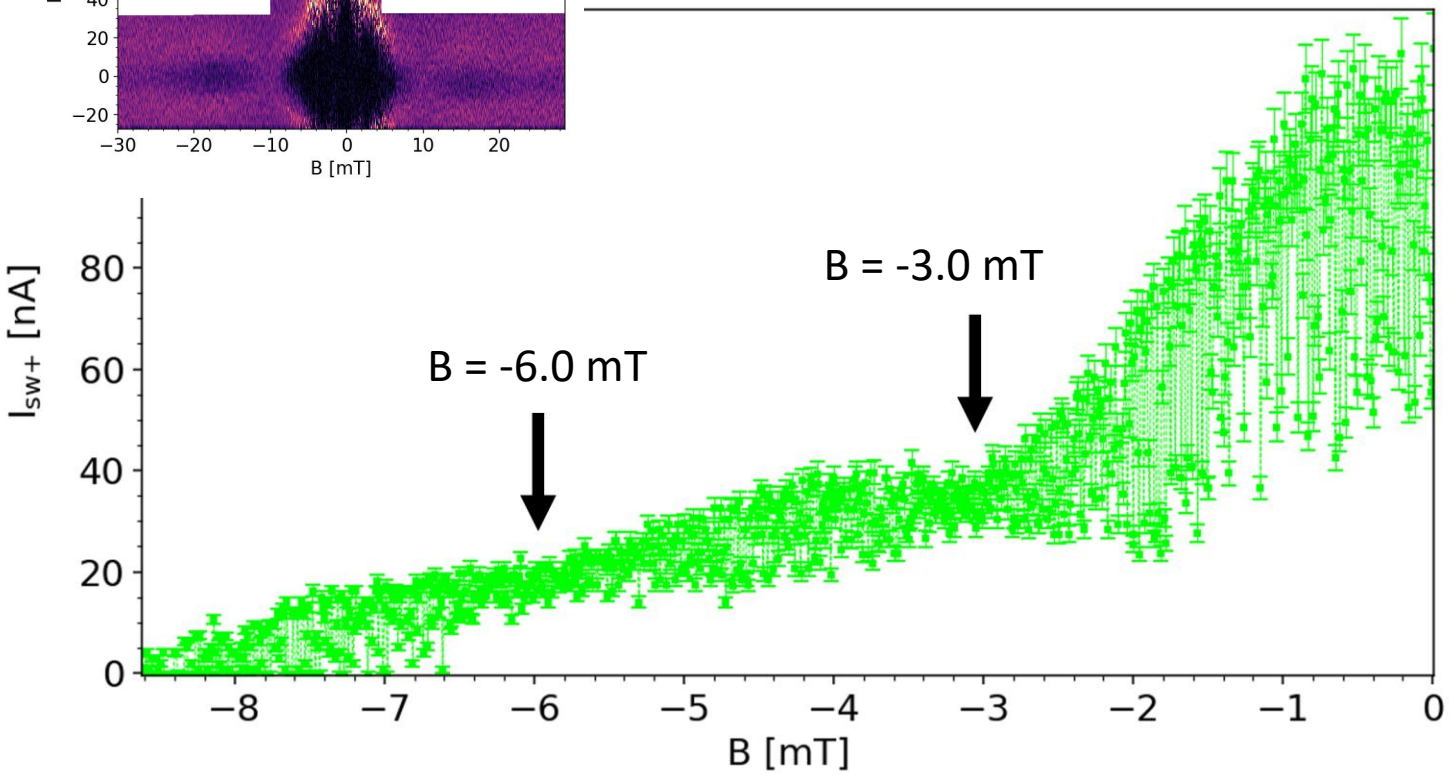
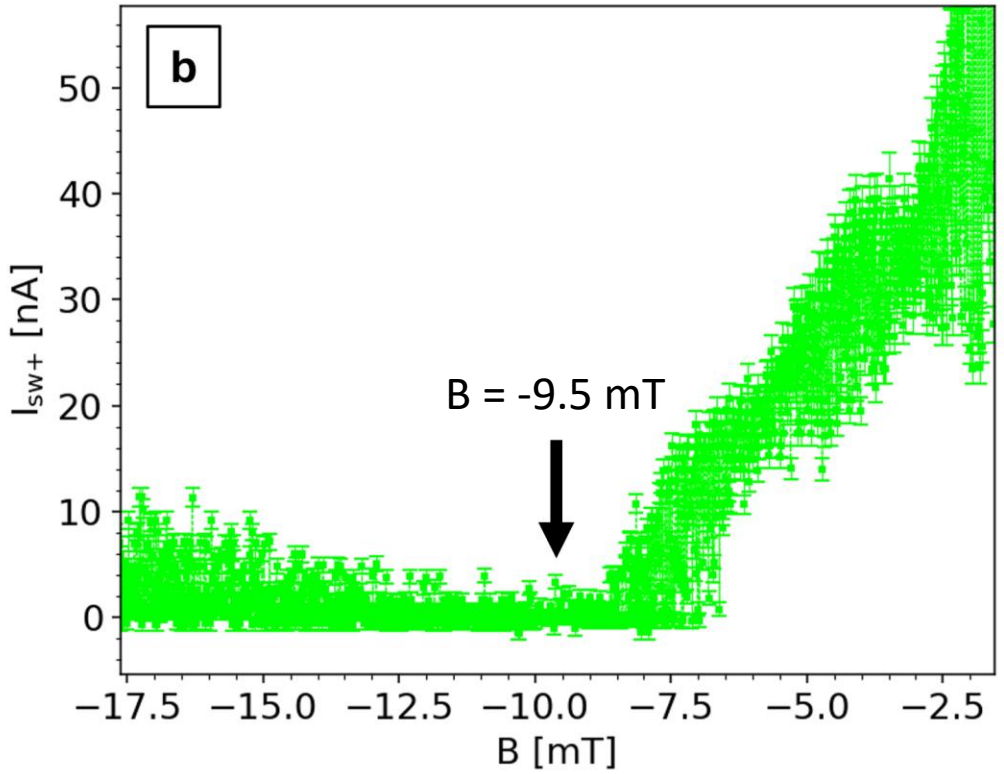
Single Junction Interference



Switching currents







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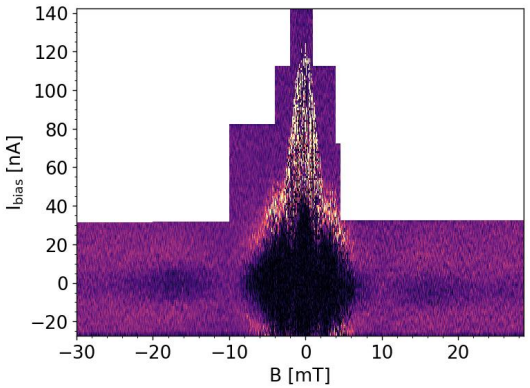
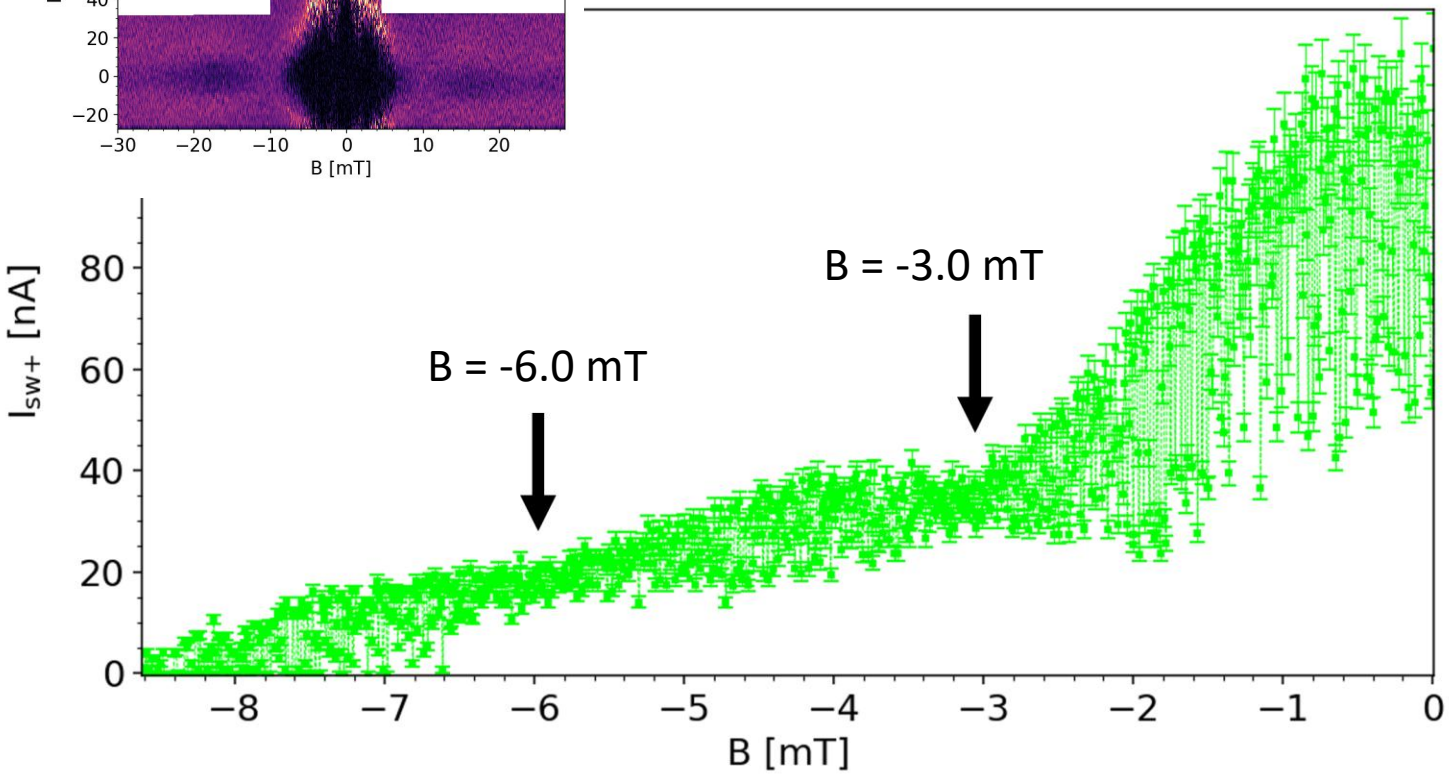
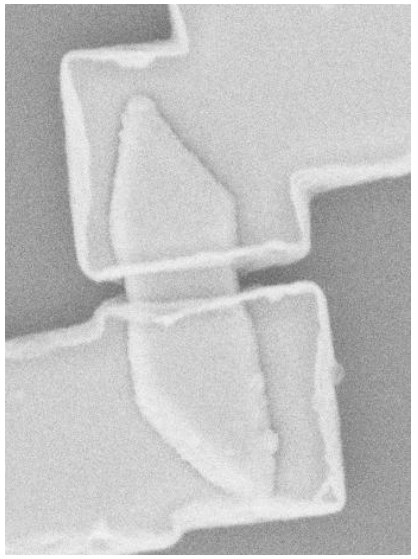
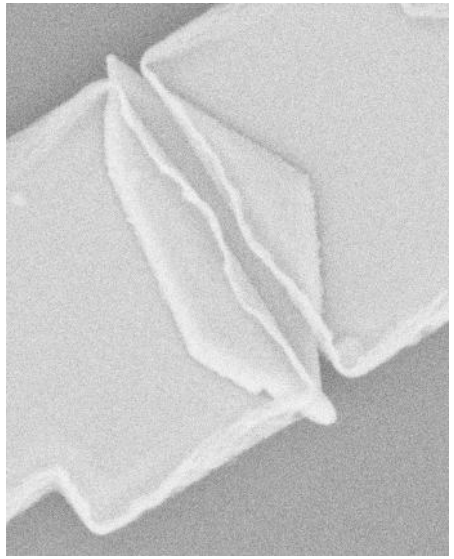
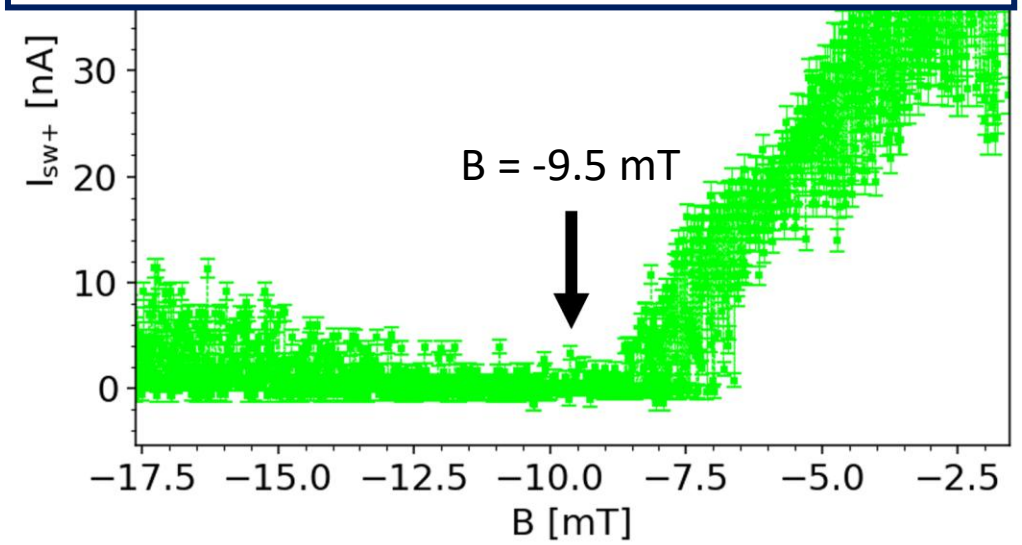








A = 0.14 μm^2 A = 0.44 μm^2



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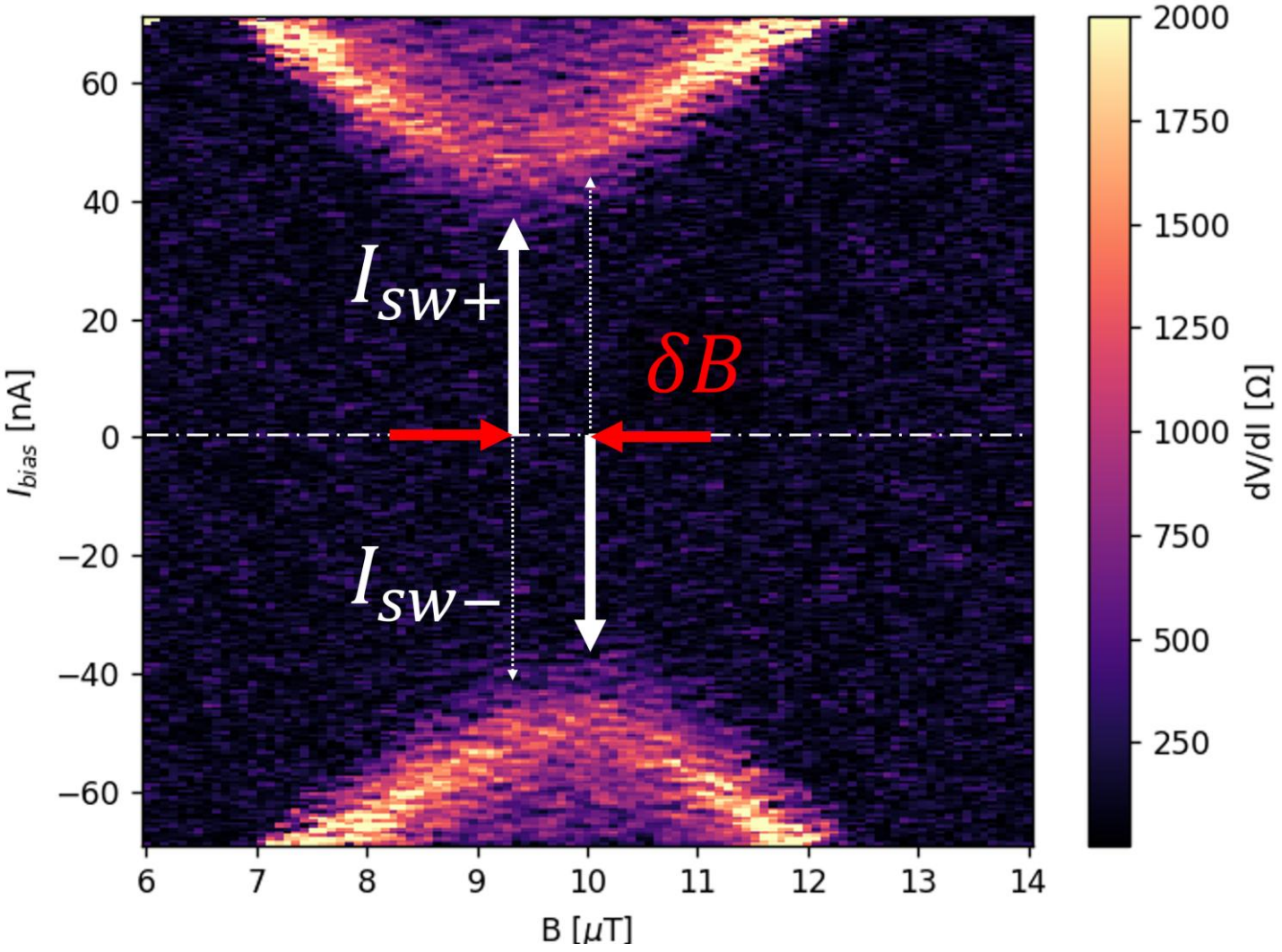
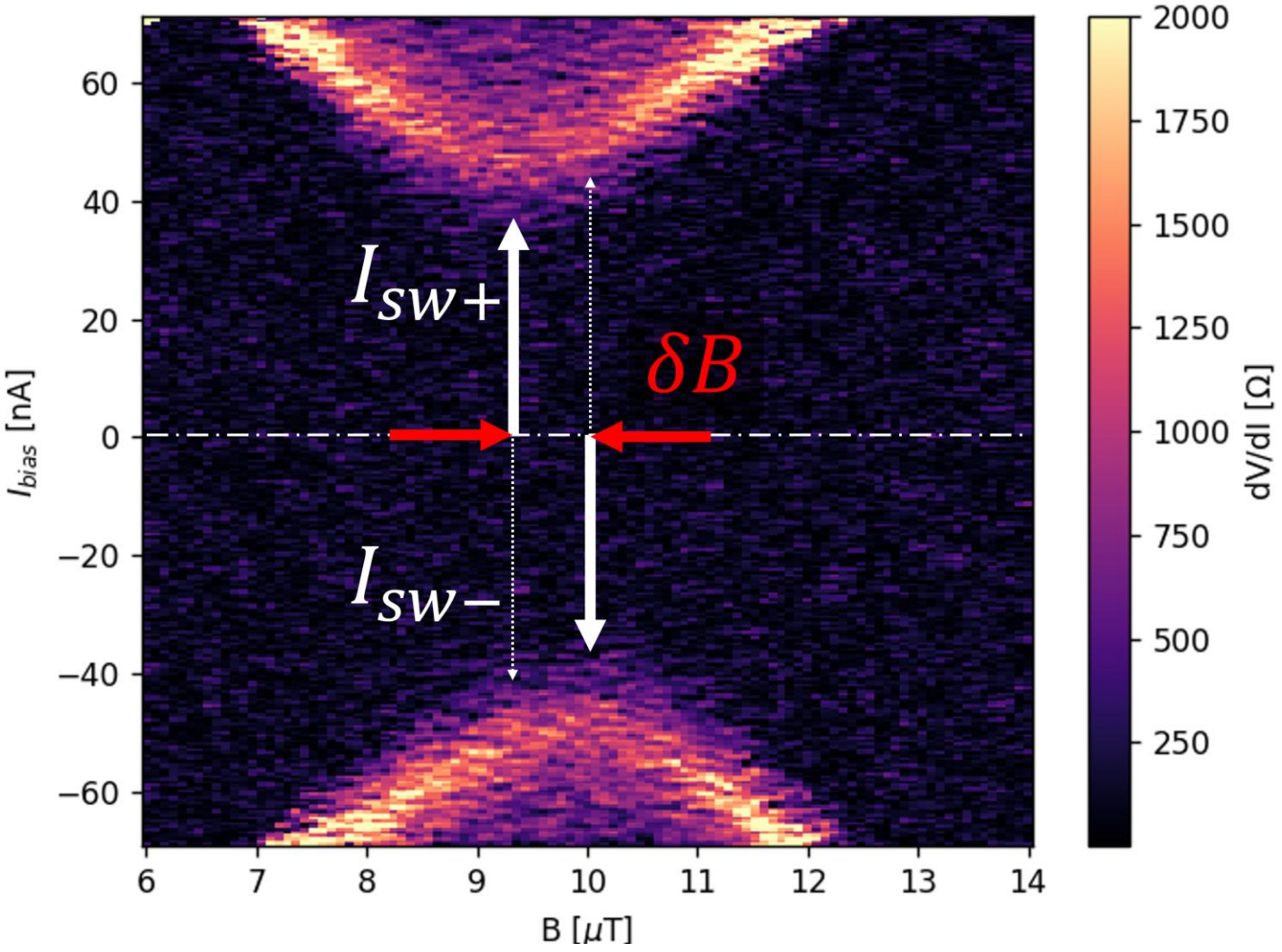
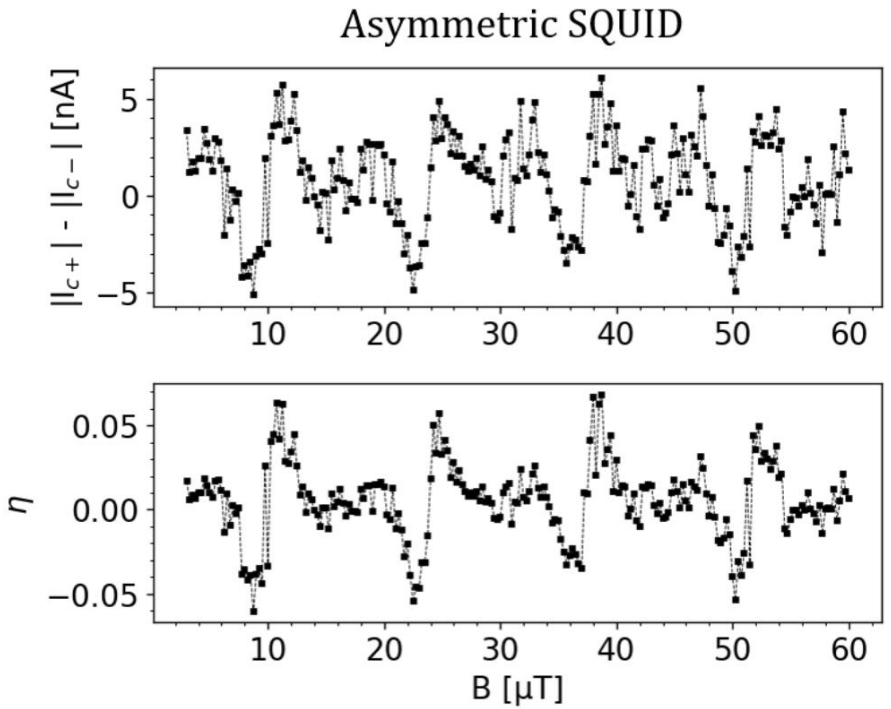
Josephson Diode Effect

Josephson Diode Effect



Josephson Diode Effect





Thank you for your attention!

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