

# Josephson effect in full-shell hybrid nanowires

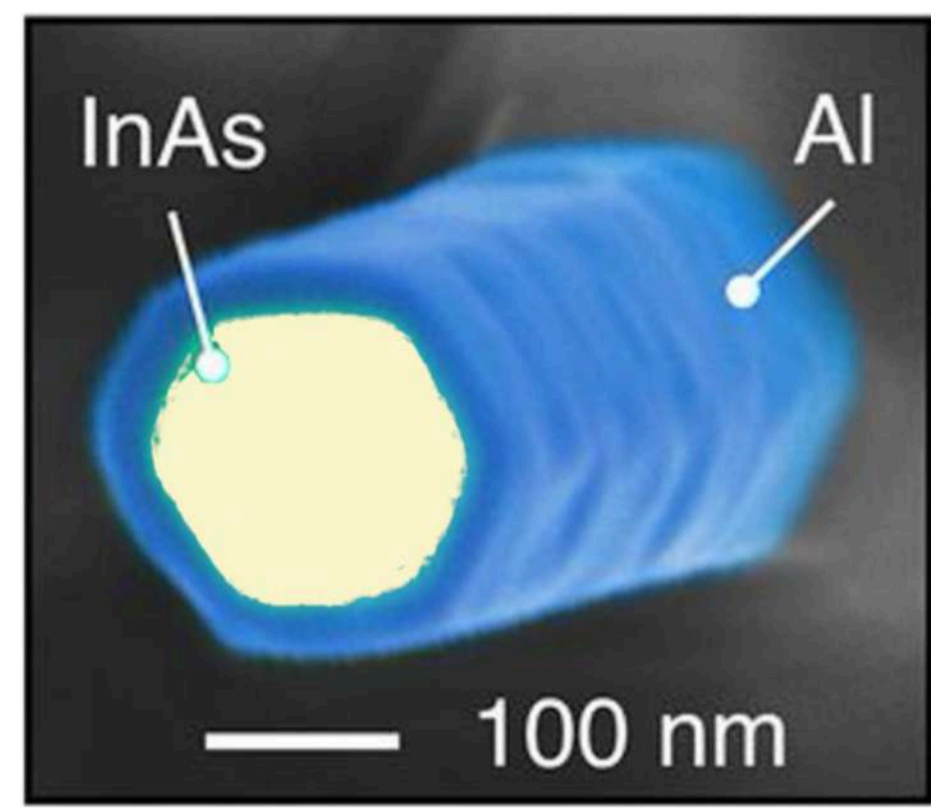
C. Payá<sup>1</sup>, F.J. Matute-Cañadas<sup>2</sup>, A. Levy-Yeyati<sup>2</sup>, R. Aguado<sup>1</sup>, P. San-Jose<sup>1</sup>, E. Prada<sup>1</sup>

<sup>1</sup>Instituto de Ciencia de Materiales de Madrid (ICMM), CSIC, Spain

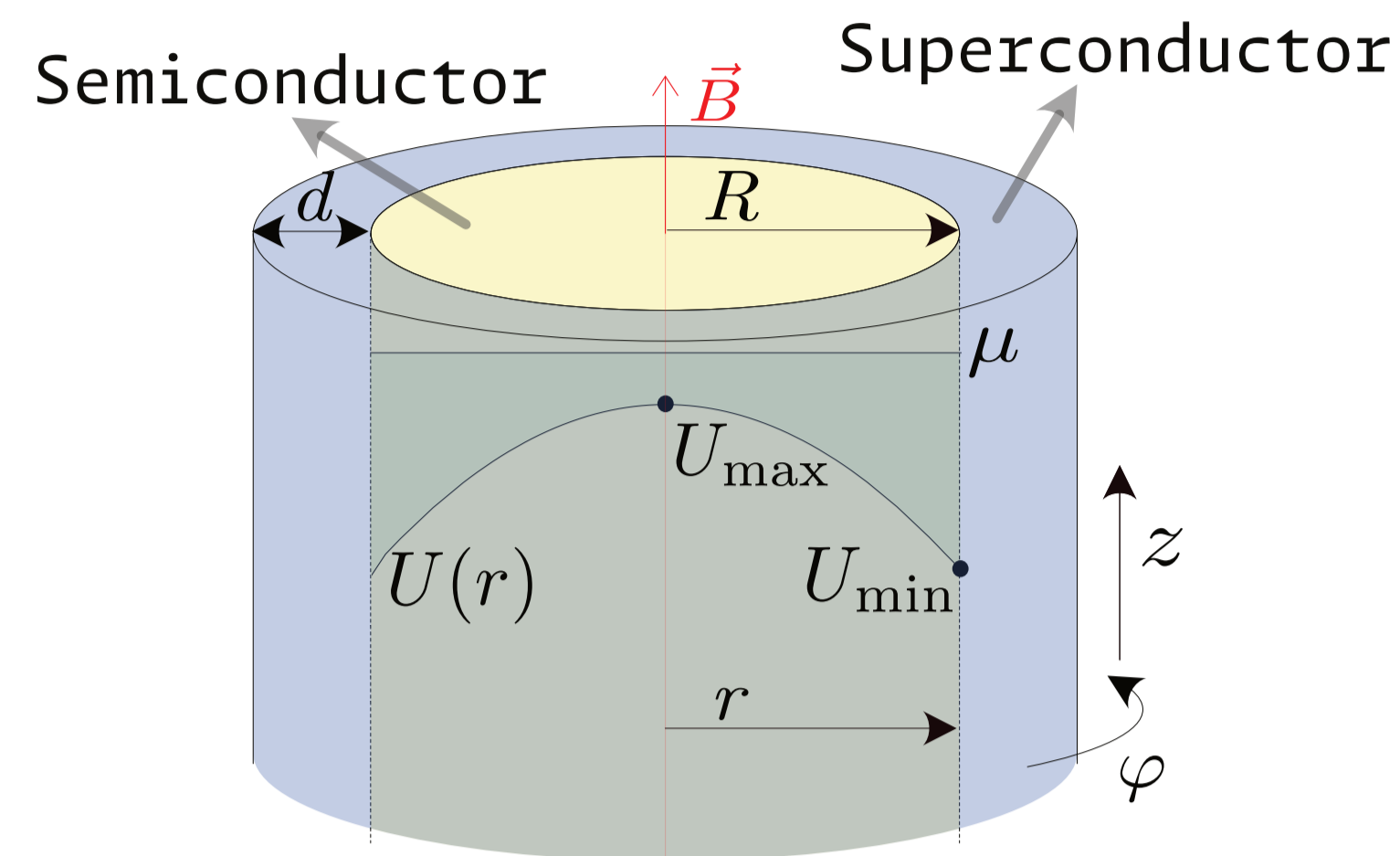
<sup>2</sup>Condensed Matter Physics Center (IFIMAC), Universidad Autónoma de Madrid, Spain



## Why full-shell hybrid nanowires?

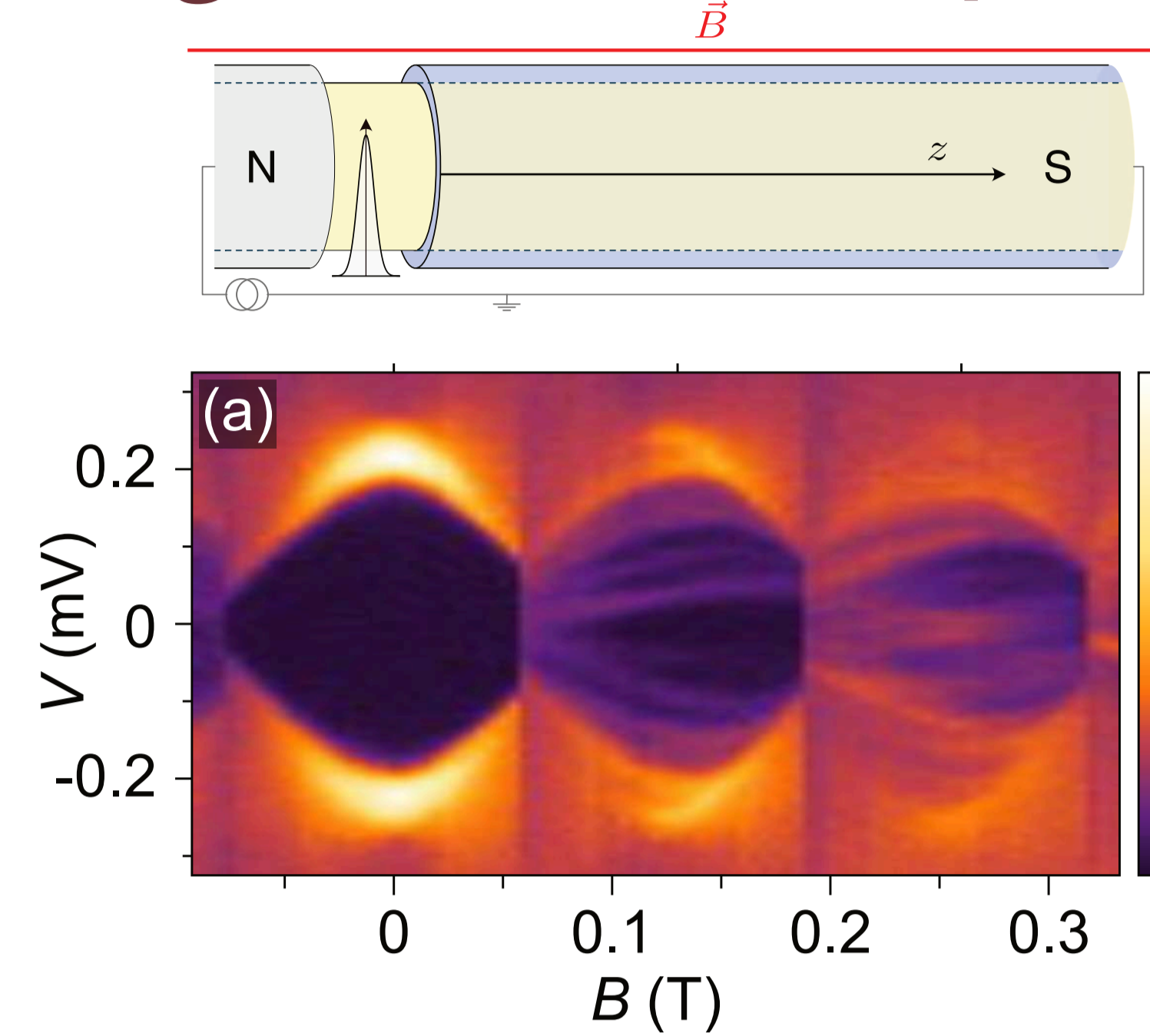


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- Topological at lower magnetic fields
- Core shielded from environment
- Spin-orbit coupling induced by band-bending

## Single-wire transport experiment



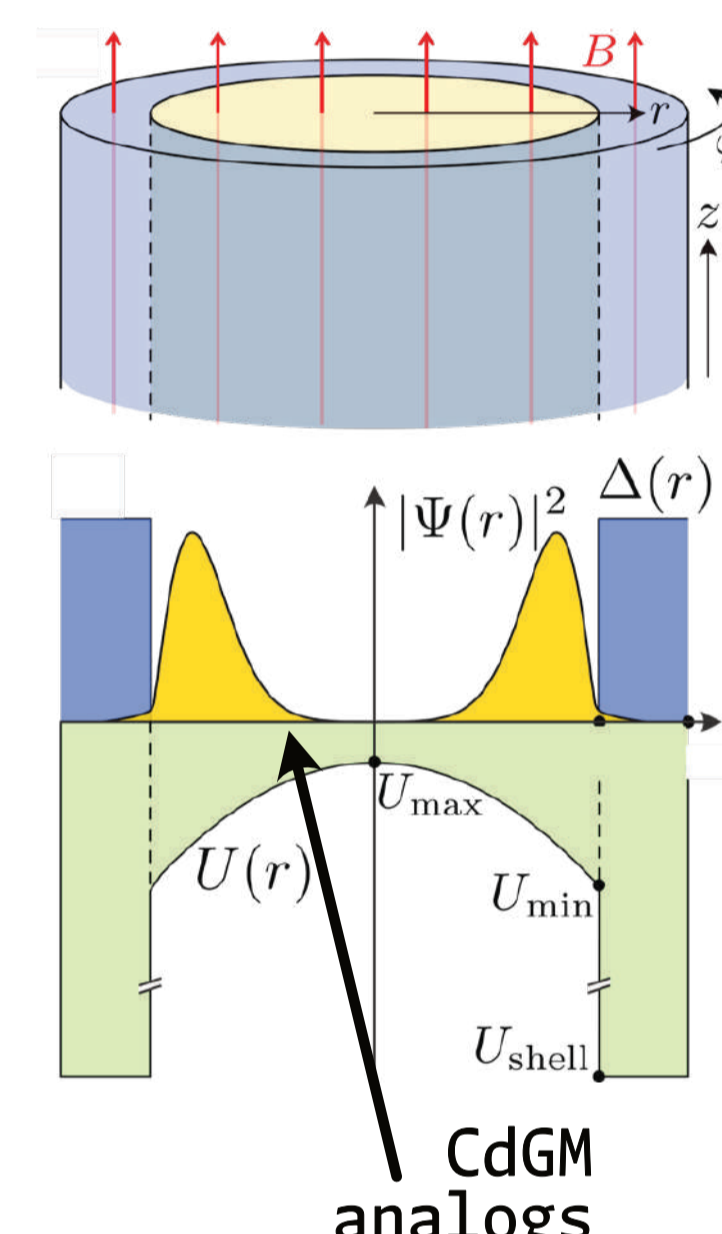
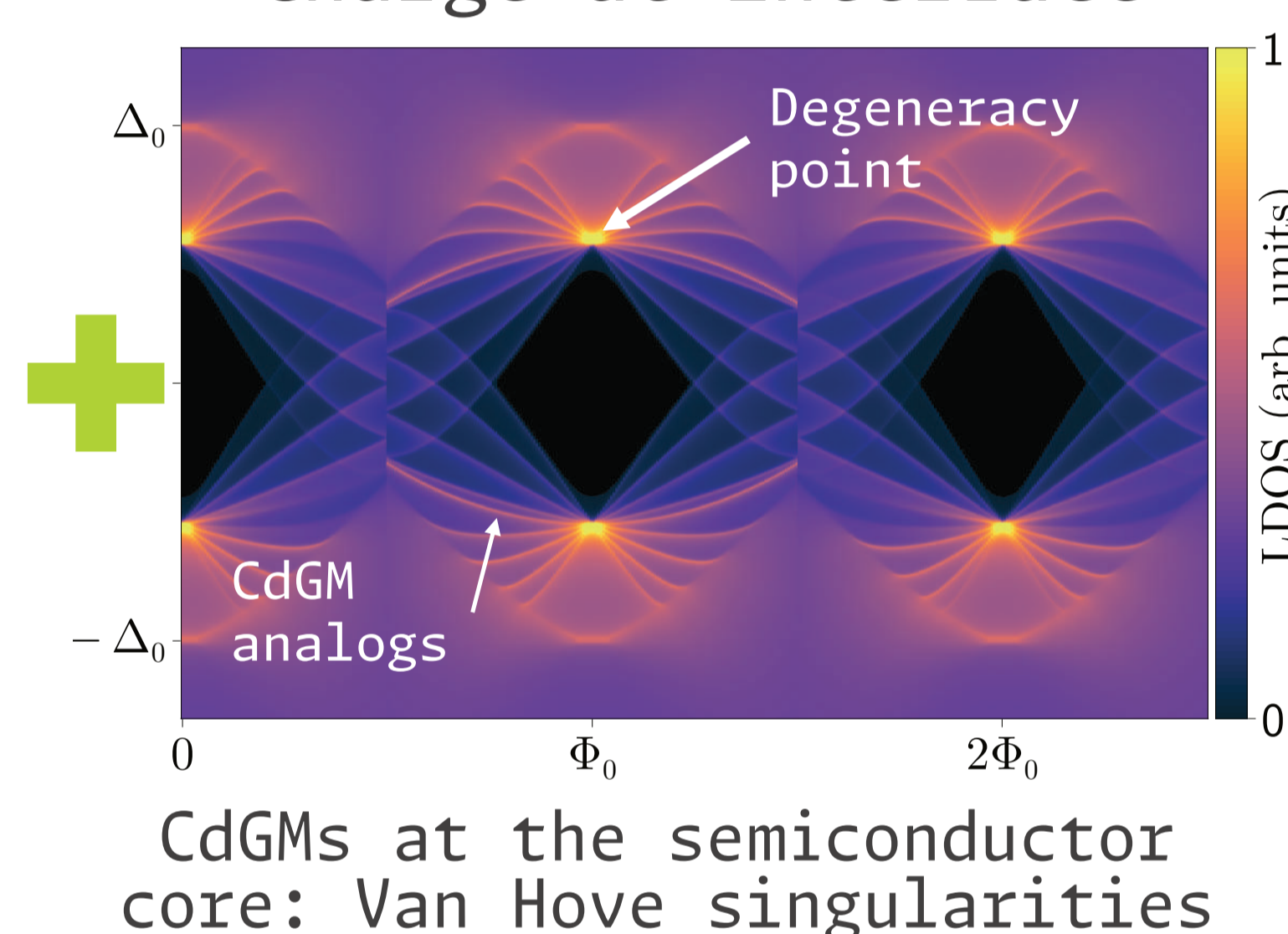
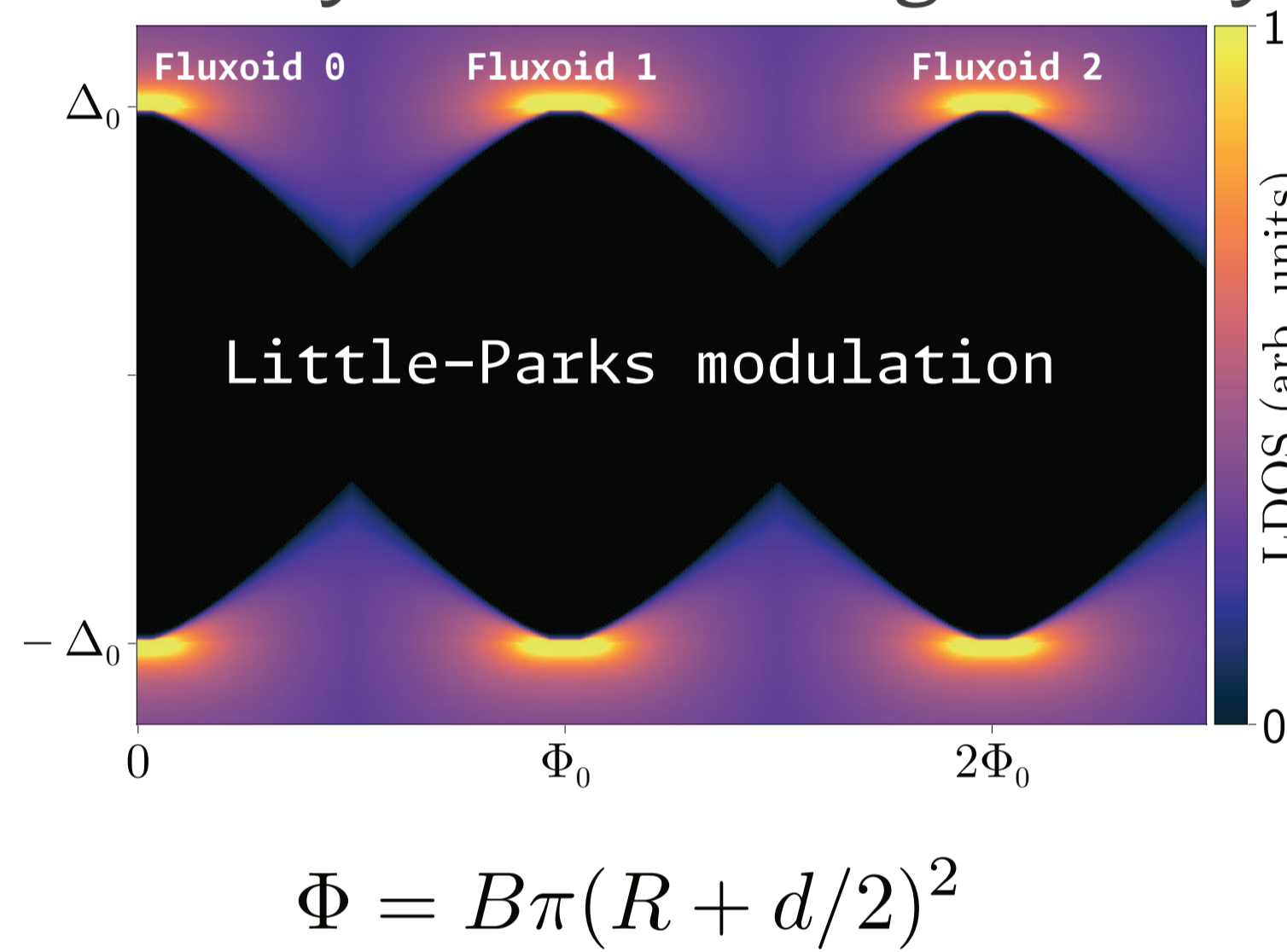
- Main findings:**
- Little-Parks gap modulation
  - Skewed subgap Andreev states

Experiment in collaboration with S. Vaitiekėnas and C. M. Marcus's group (see references)

## Caroli-de Gennes-Matricon analogs

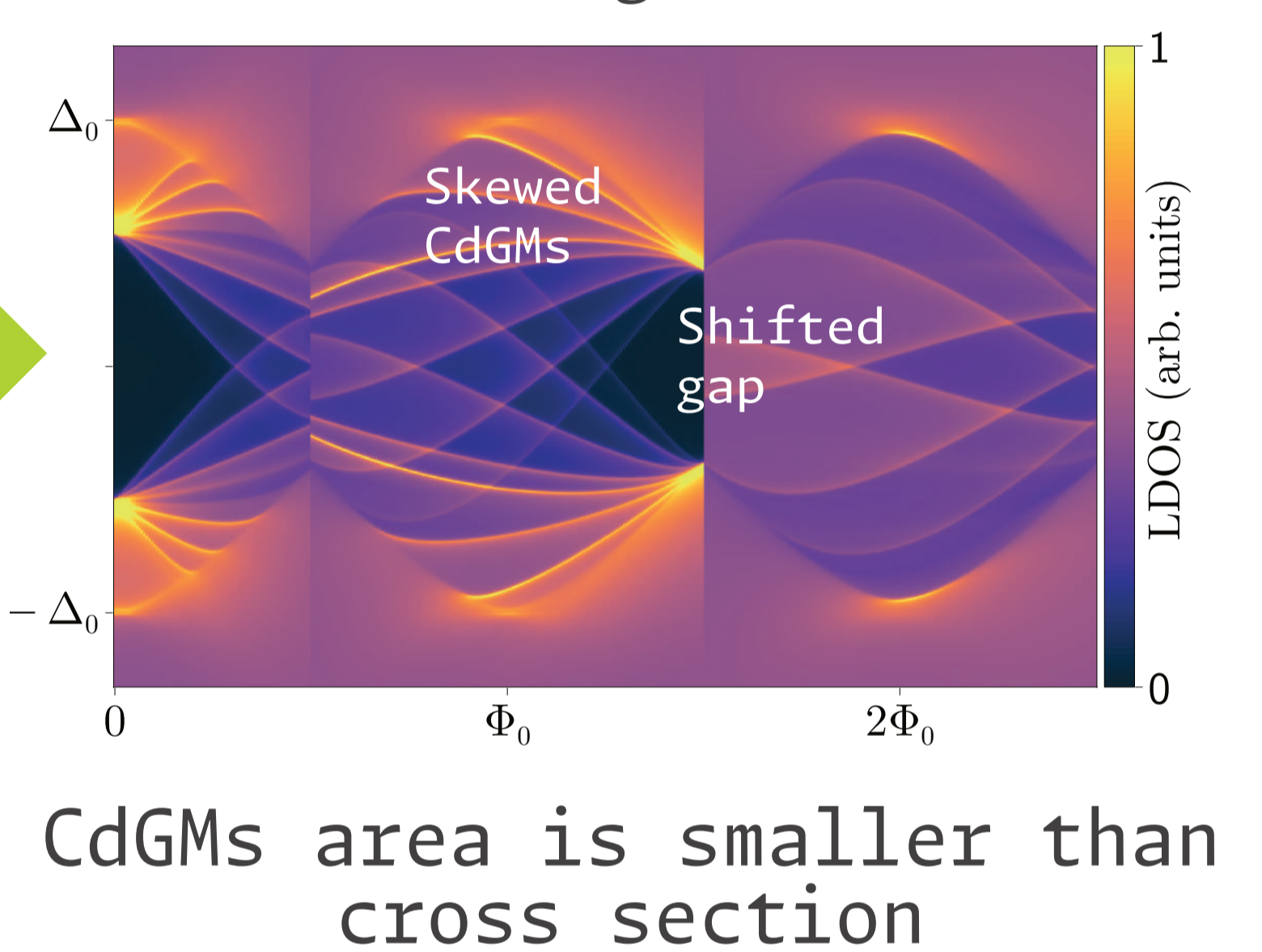
Doubly connected geometry

Charge at interface

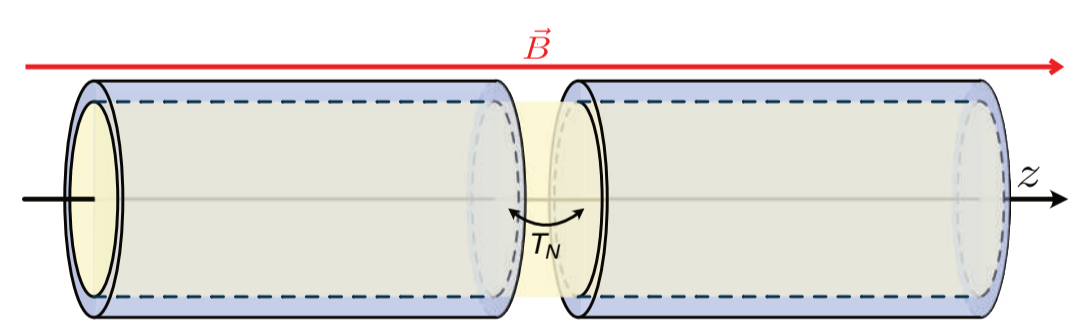


## Skewed subgap states

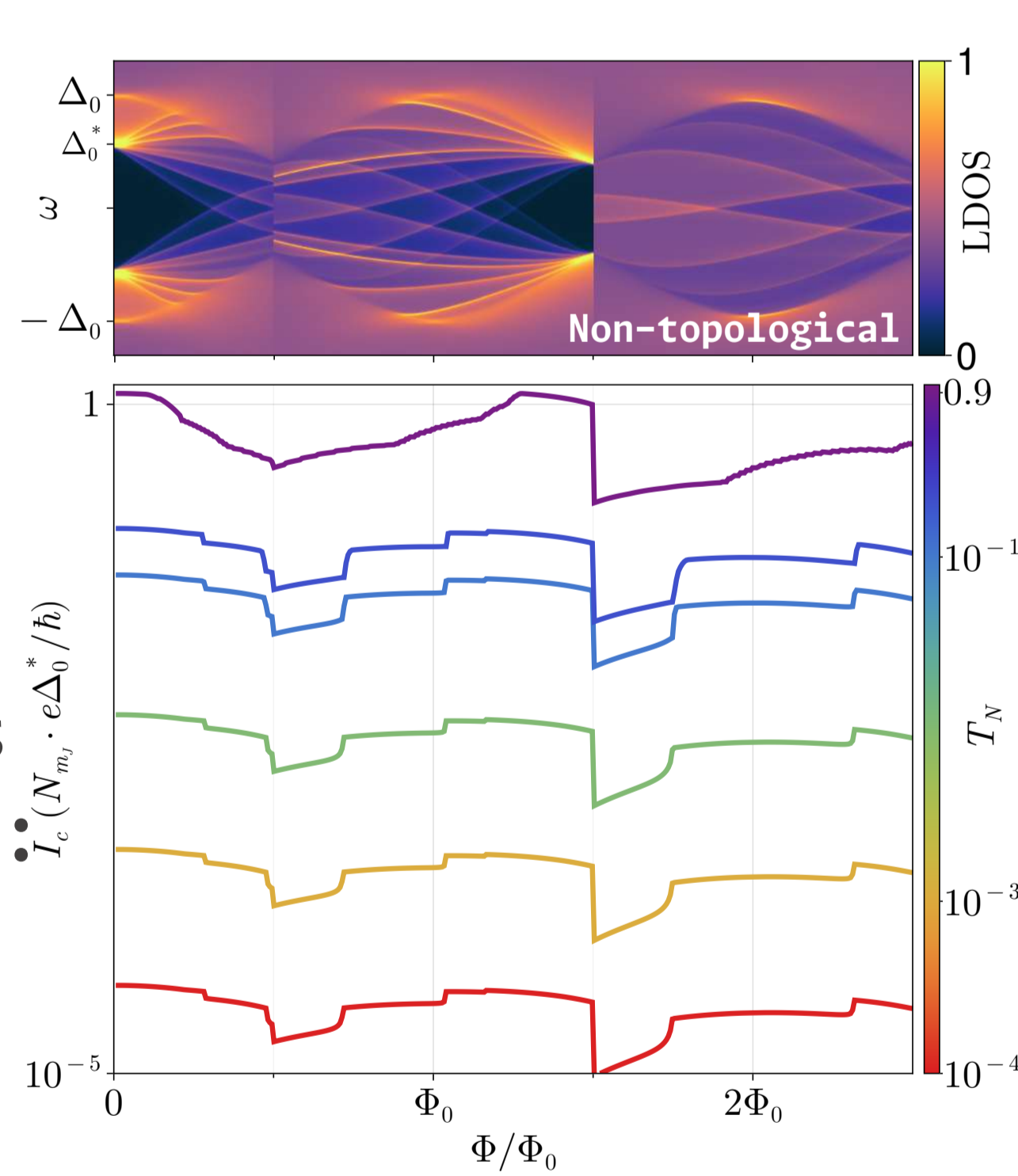
Realistic charge distribution



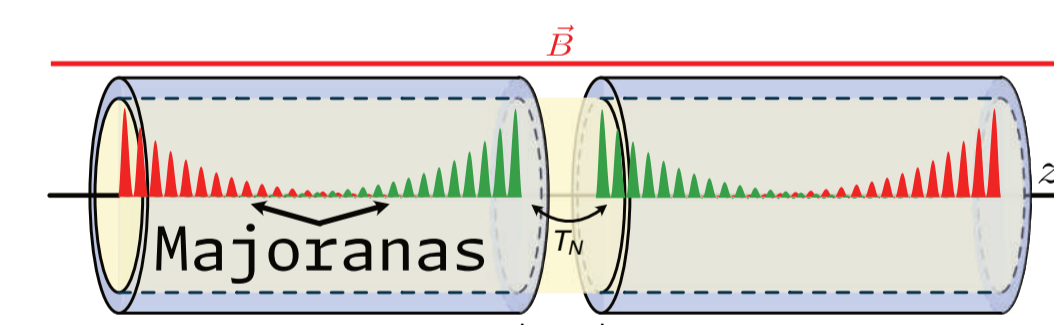
## Skewness in the critical current



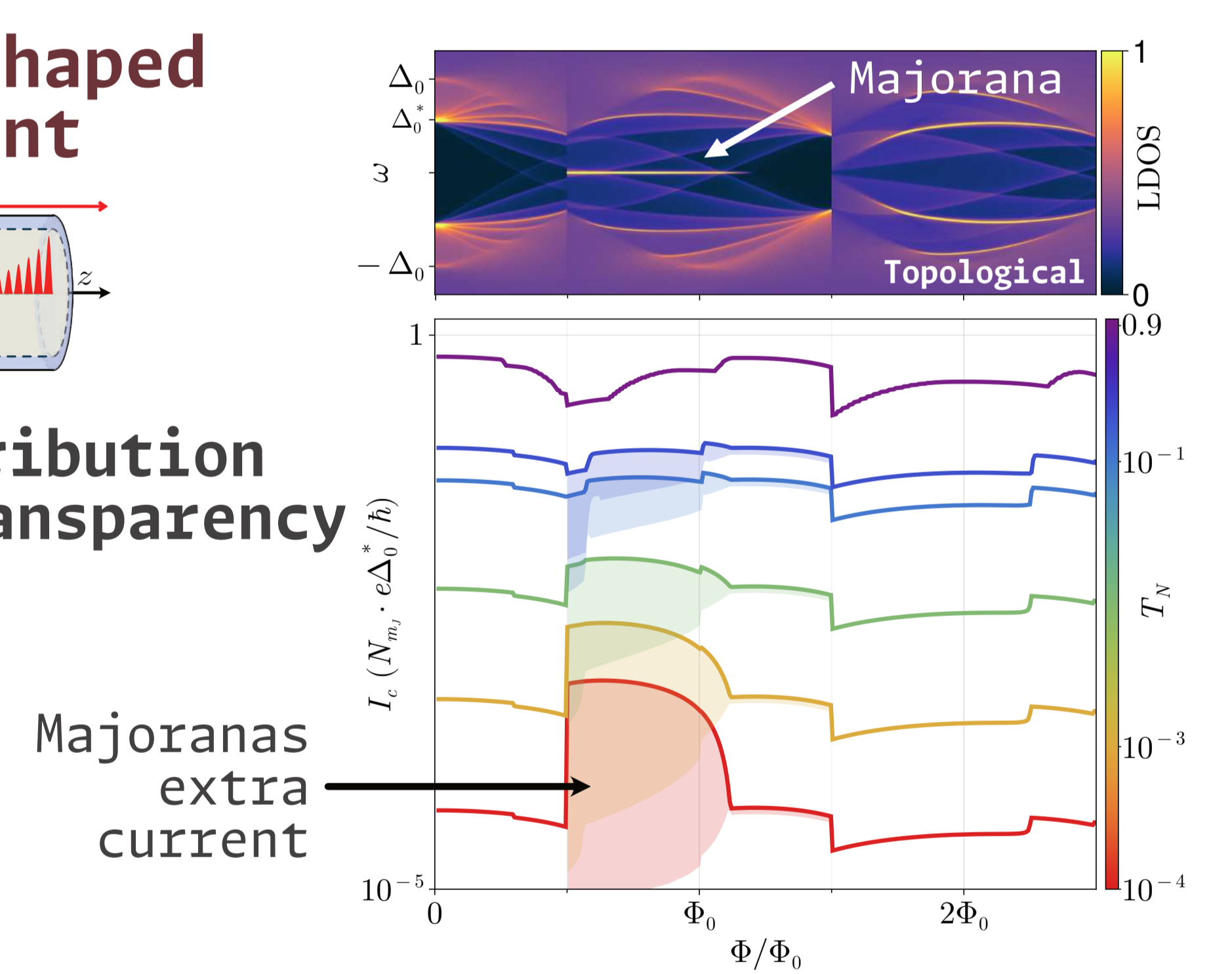
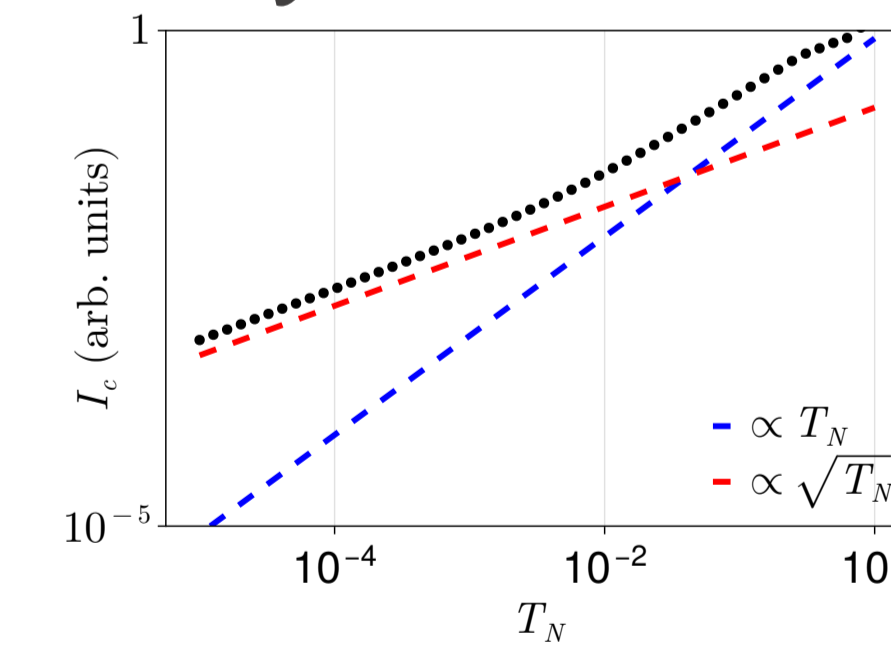
- Little-Parks modulation
- Critical current **skewed to right** within LP lobes
- CdGM 0-energy crossings: current steps
- Shape independent of transparency  $T_N$



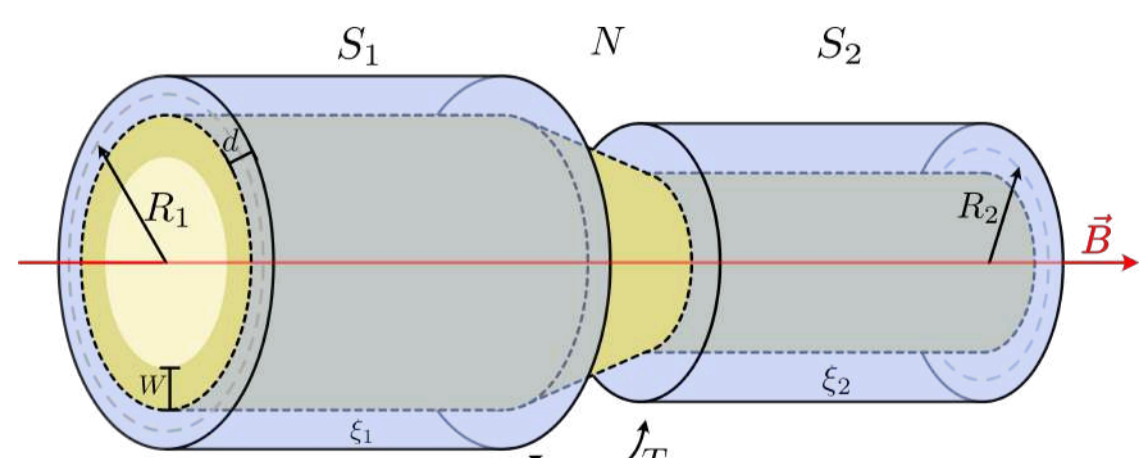
## Majorana *fin* shaped critical current



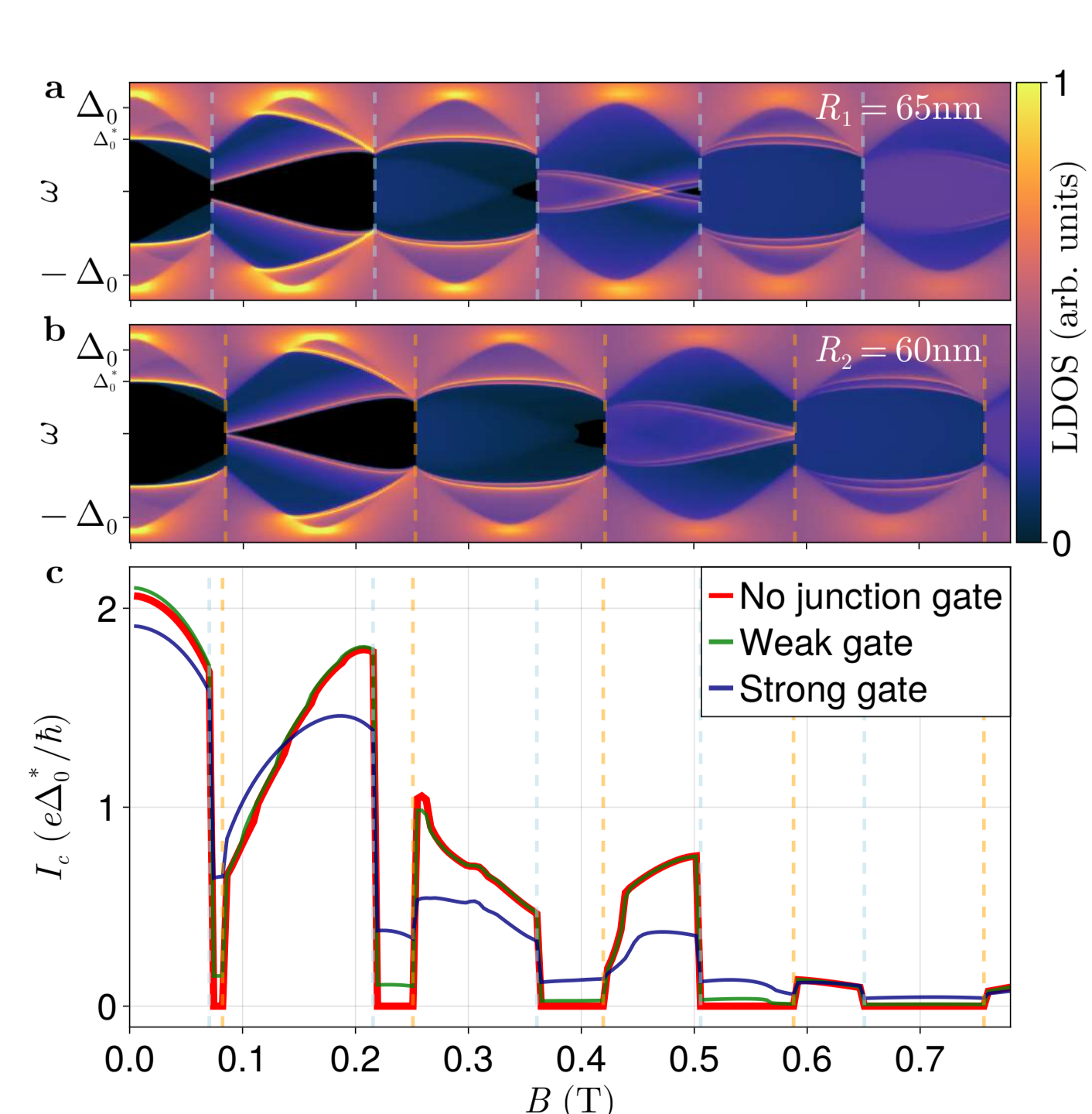
- Majorana contribution only at low transparency



## Asymmetric junction: fluxoid valve effect



- Fluxoids coincide: valve opens
- Fluxoids mismatch: valve closes
- Gated junction: valve worsens



## Conclusions

- CdGMs *skew* the Josephson critical current towards high magnetic fluxes
- Majoranas at both sides of the junction induce a *fin shaped* critical current
- Fluxoid mismatch leads to a *valve effect* in asymmetric junctions

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