

Josephson effect in full-shell hybrid nanowires

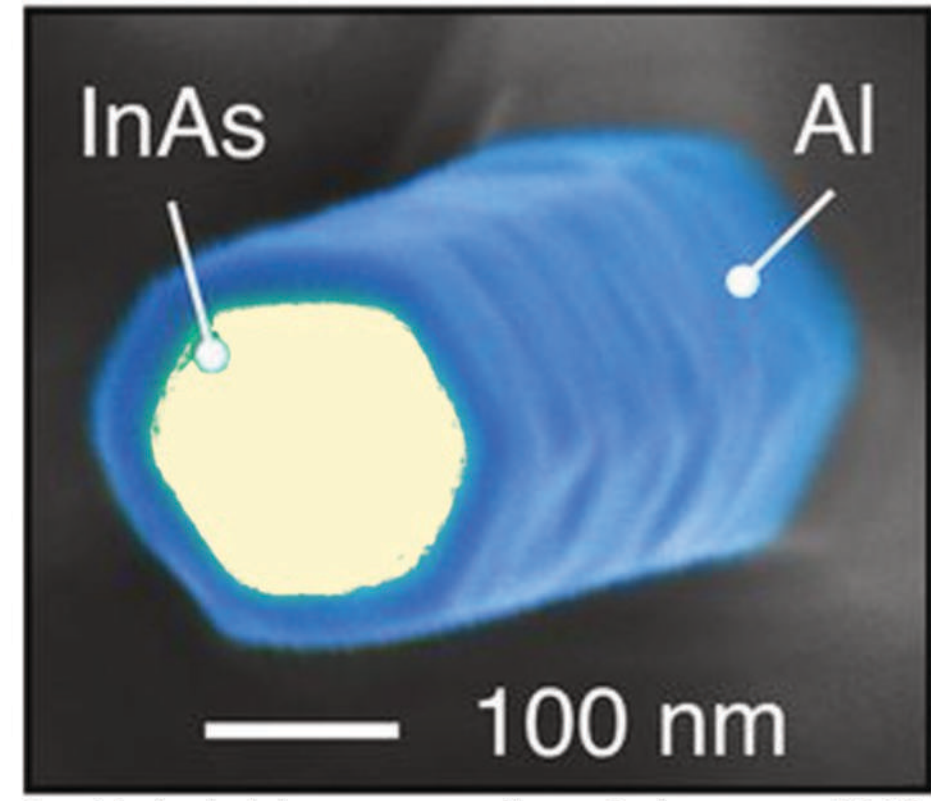
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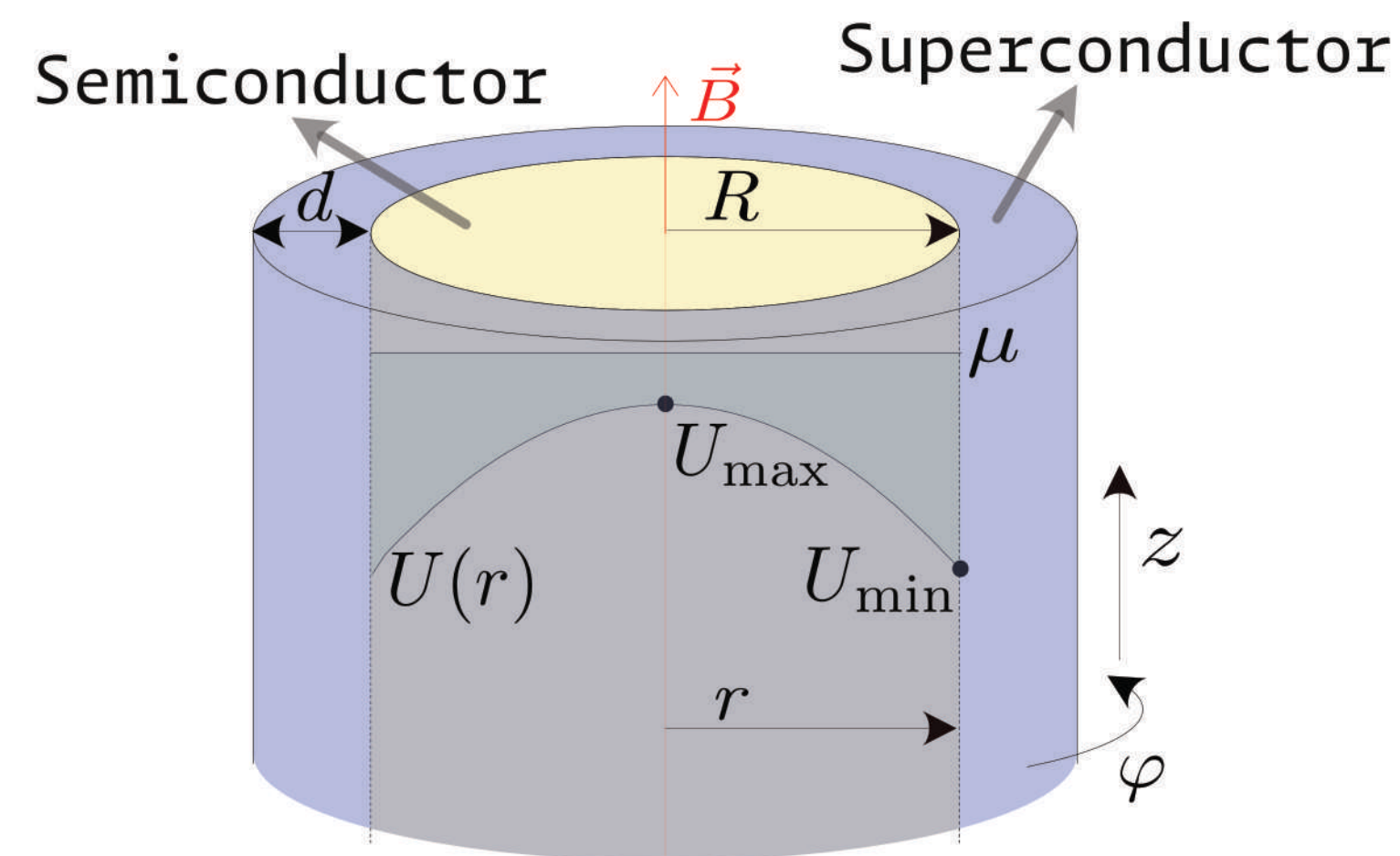
²Condensed Matter Physics Center (IFIMAC), Universidad Autónoma de Madrid, Spain



Why full-shell hybrid nanowires?

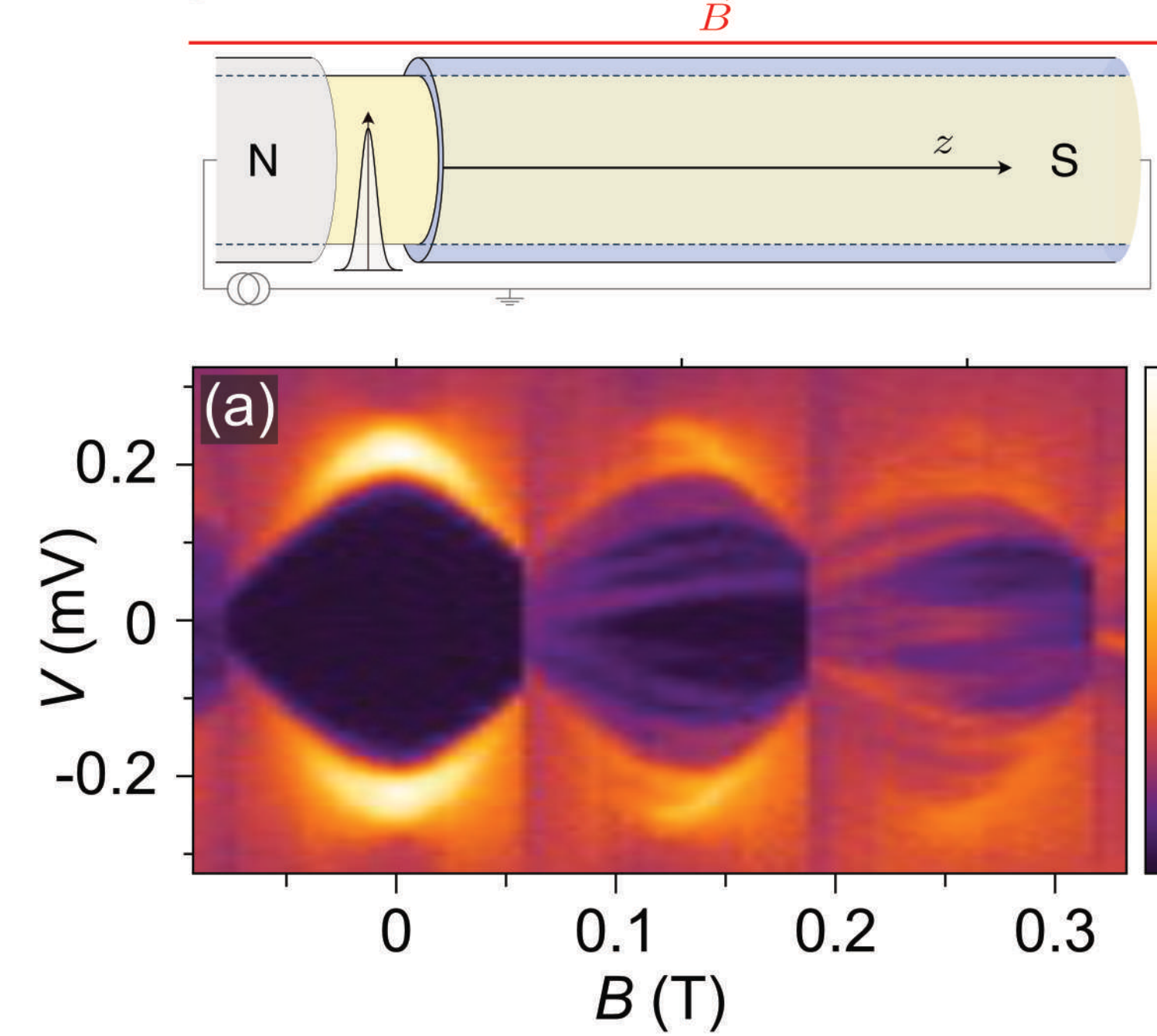


S. Vaitiekėnas et al., Science, 2020



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

Single-wire transport experiment



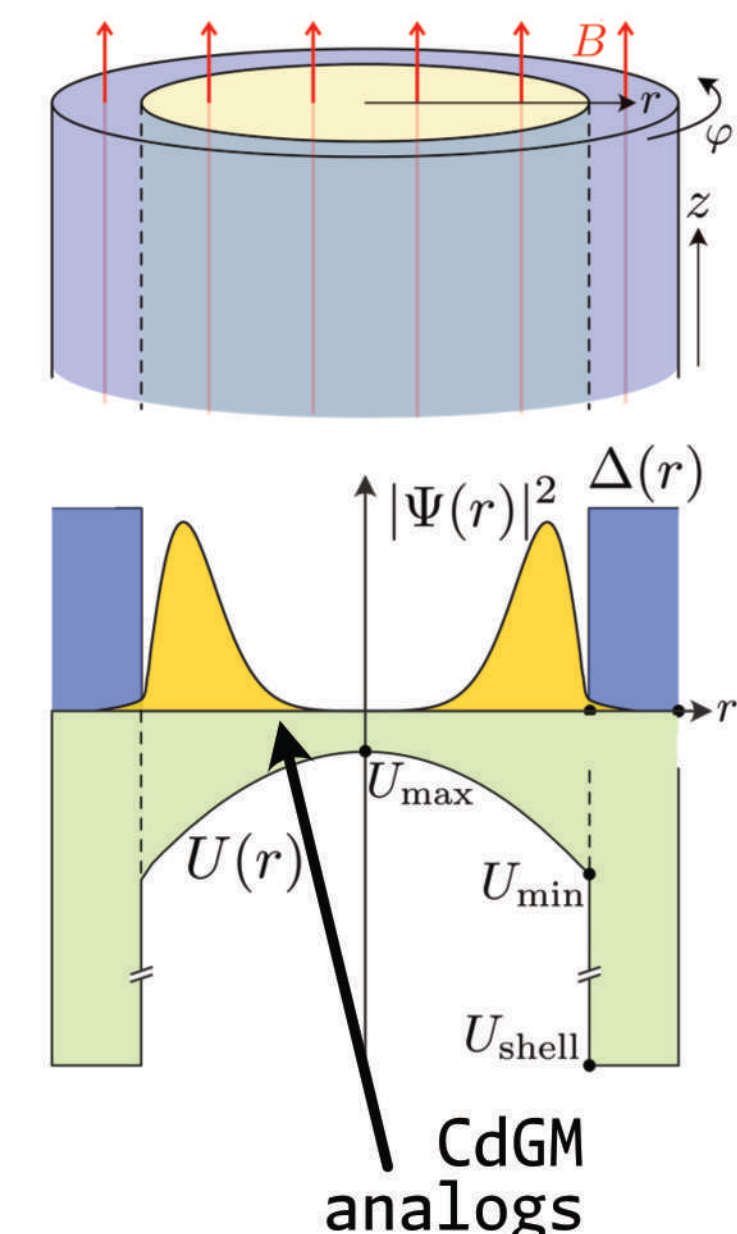
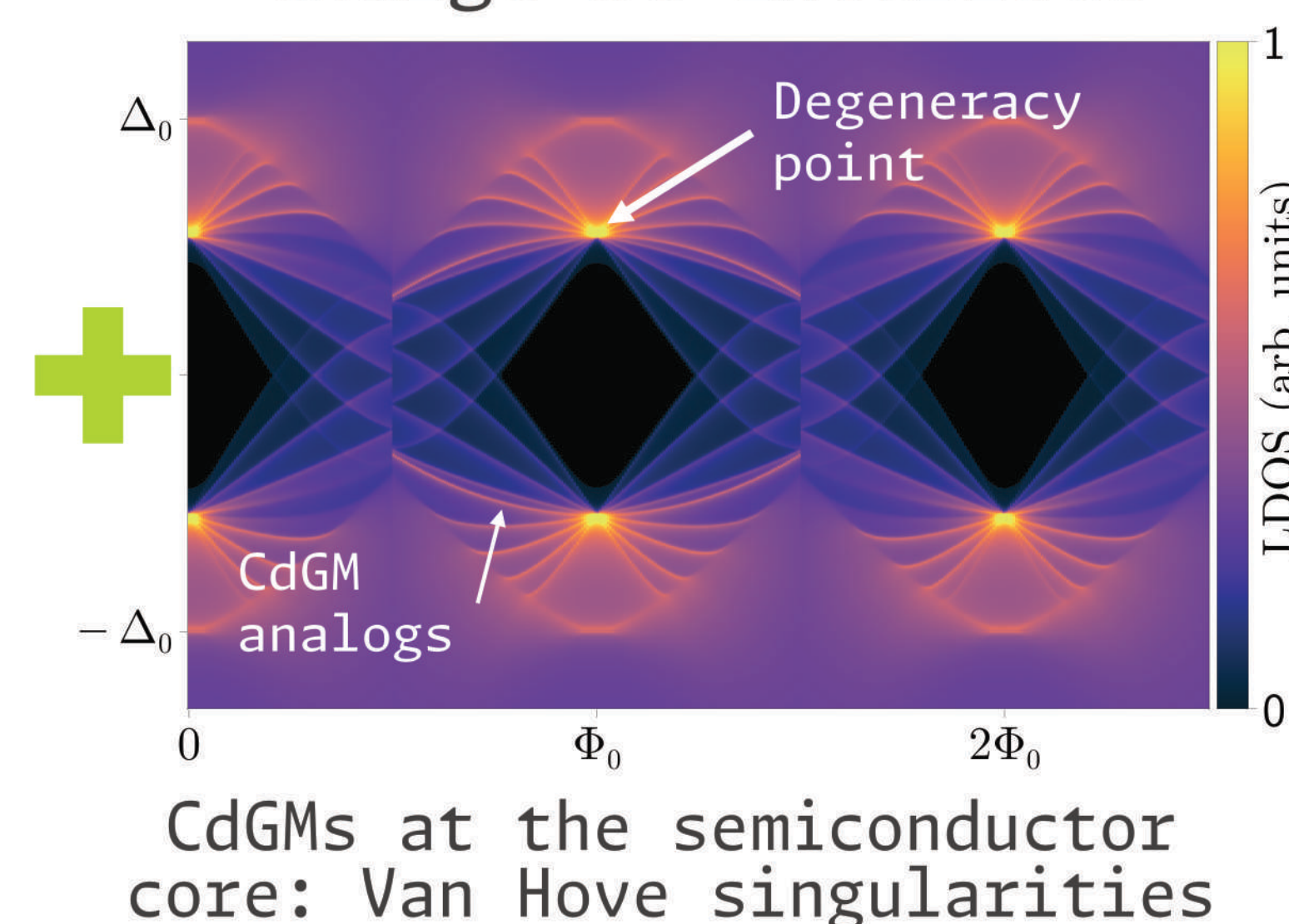
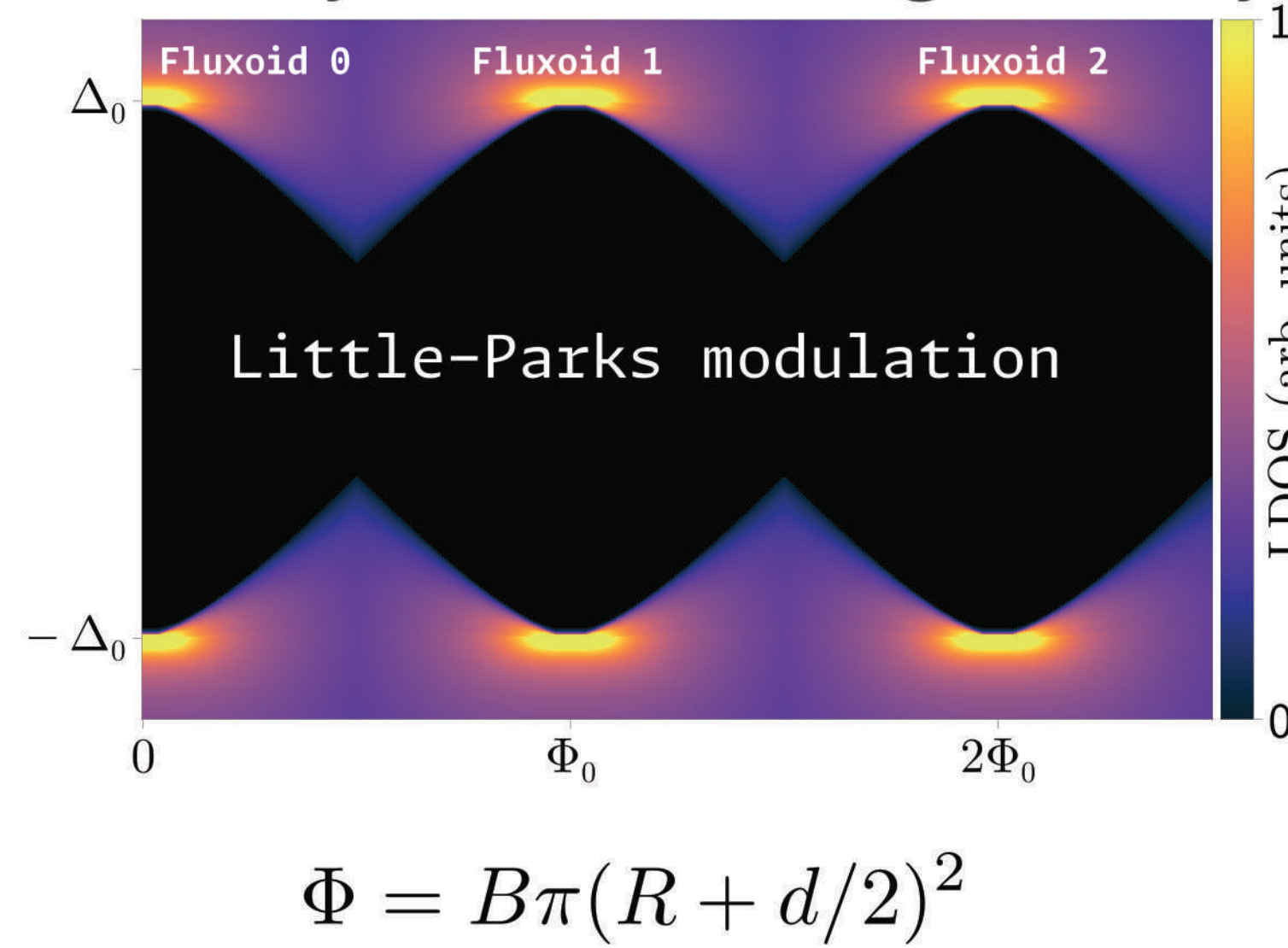
- Main findings:**
- Little-Parks gap modulation
 - Skewed subgap Andreev states

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

Caroli-de Gennes-Matricon analogs

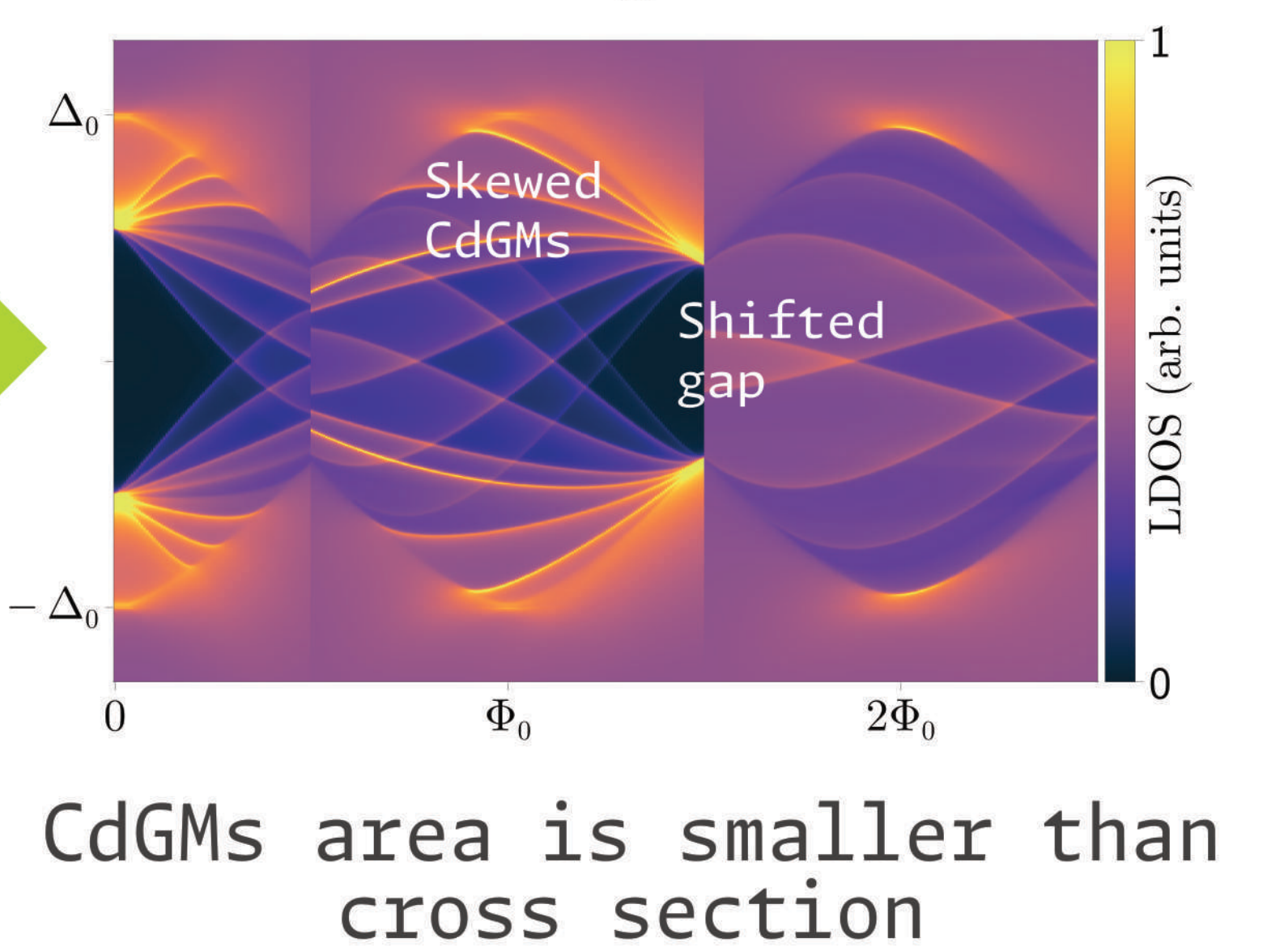
Doubly connected geometry

Charge at interface

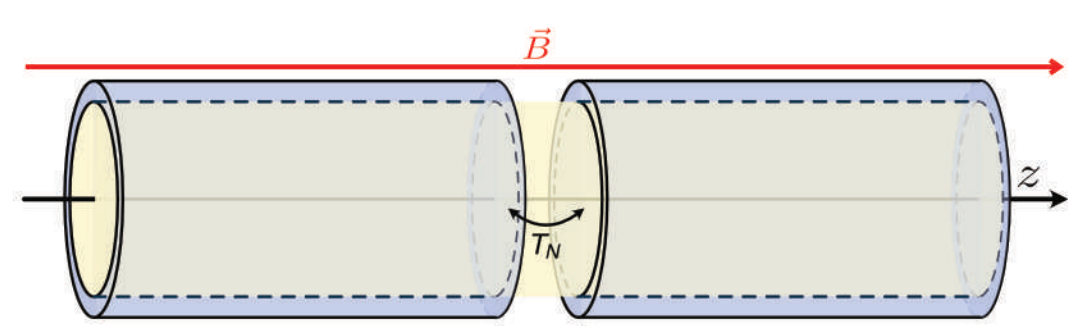


Skewed subgap states

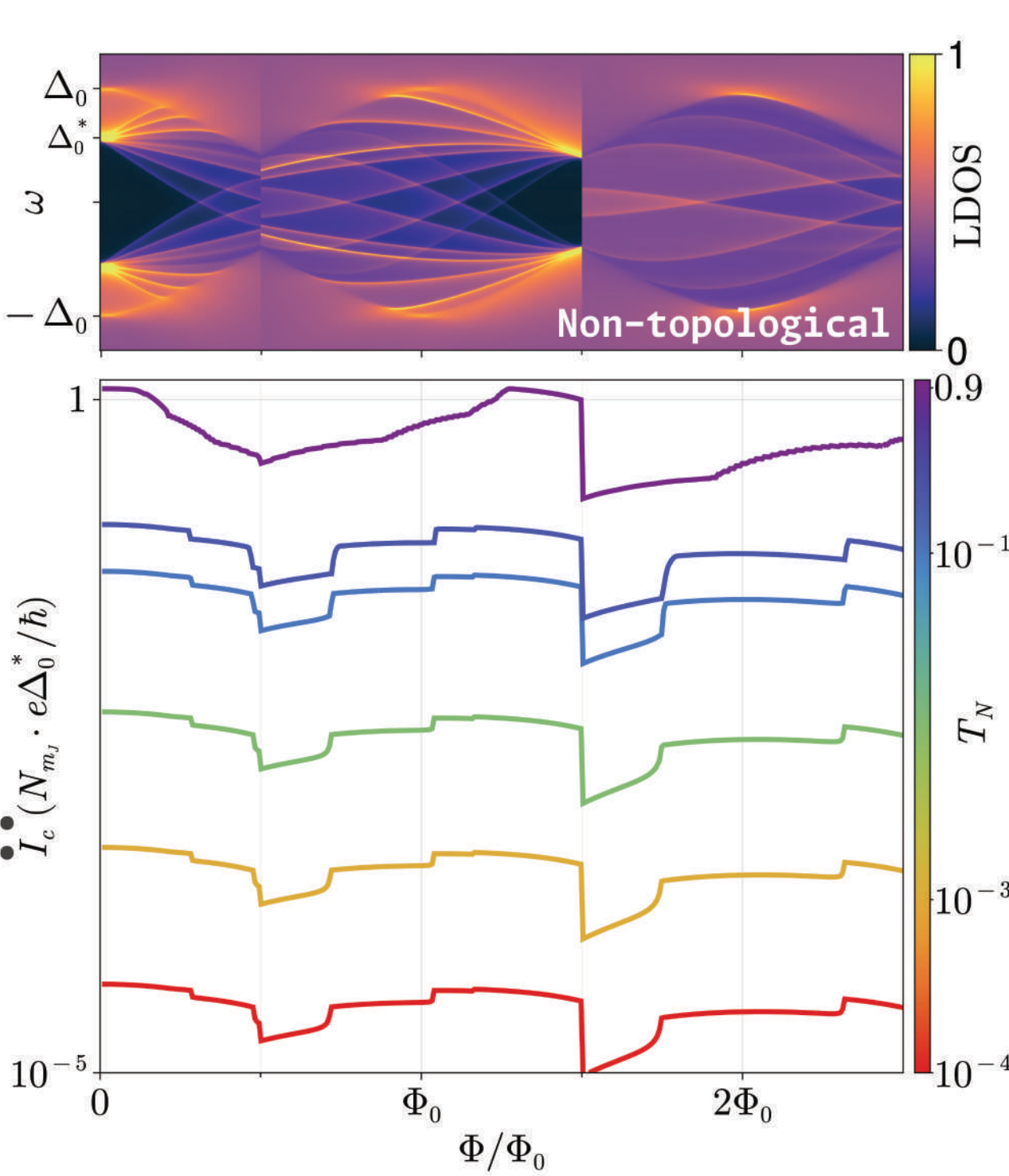
Realistic charge distribution



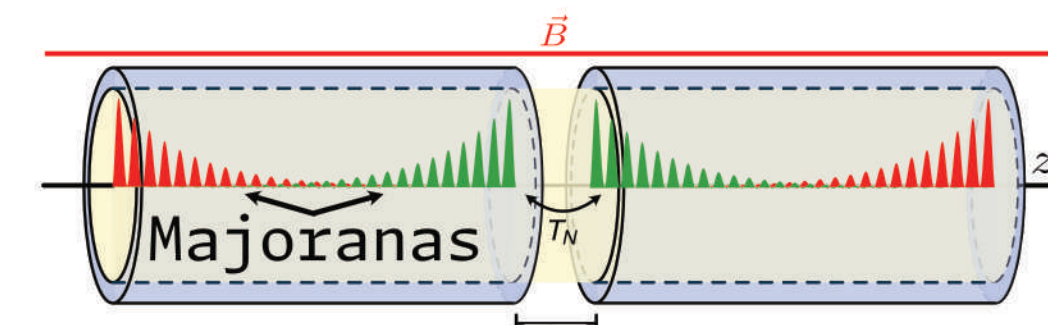
Skewness in the critical current



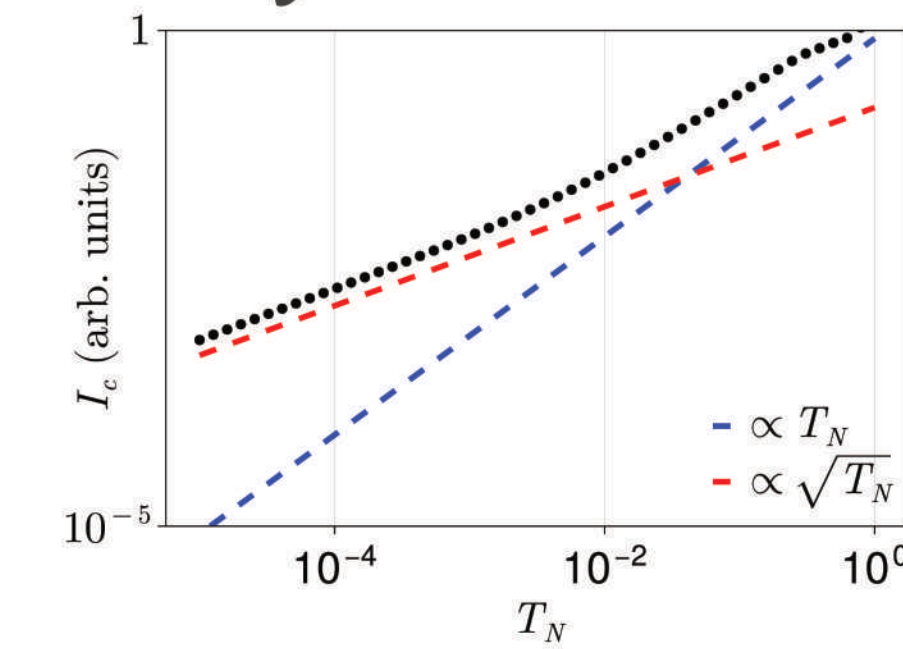
- Little-Parks modulation
- Critical current **skewed to right** within LP lobes
- CdGM 0-energy crossings: current steps
- Shape independent of transparency T_N



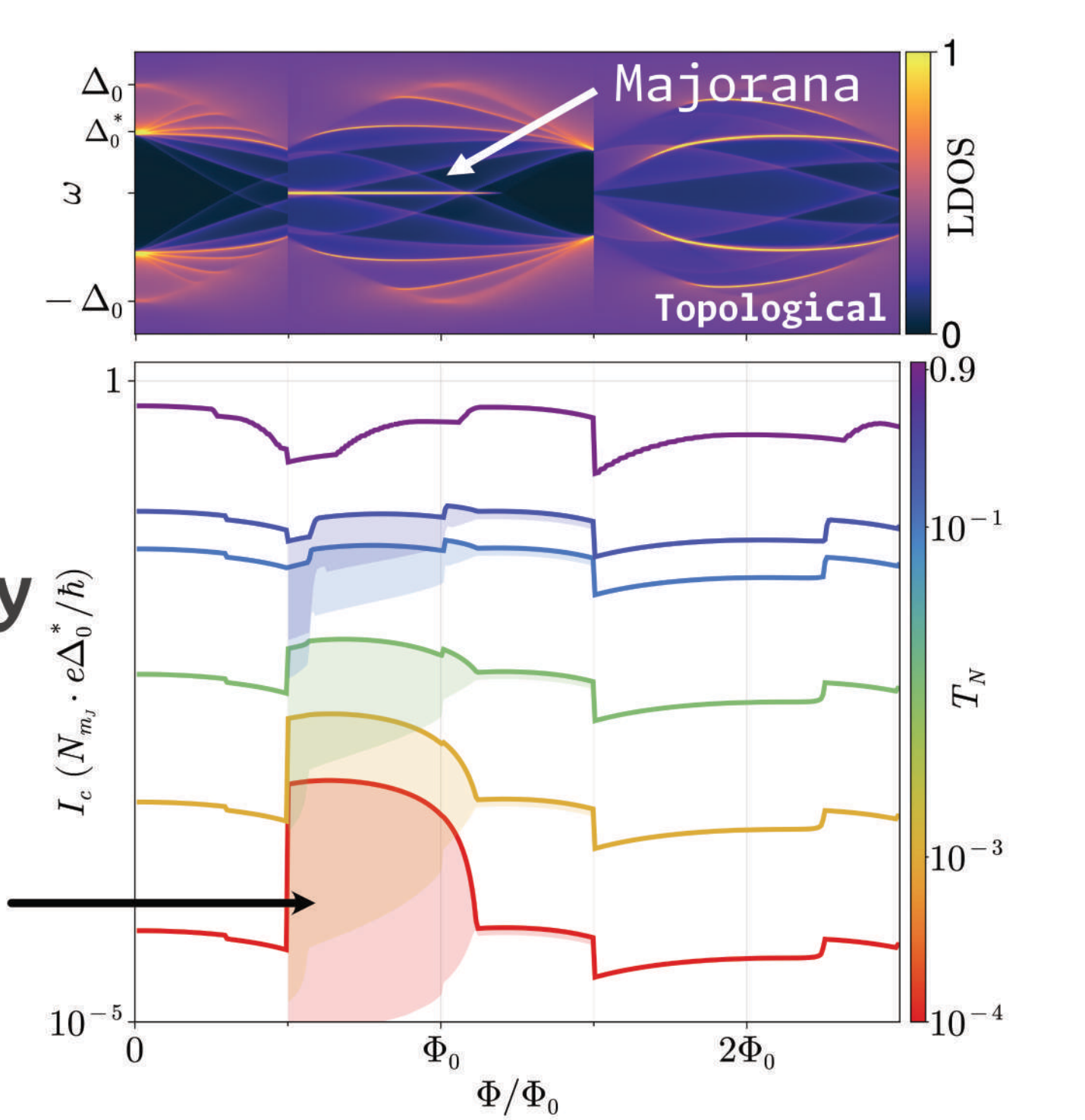
Majorana *fin* shaped critical current



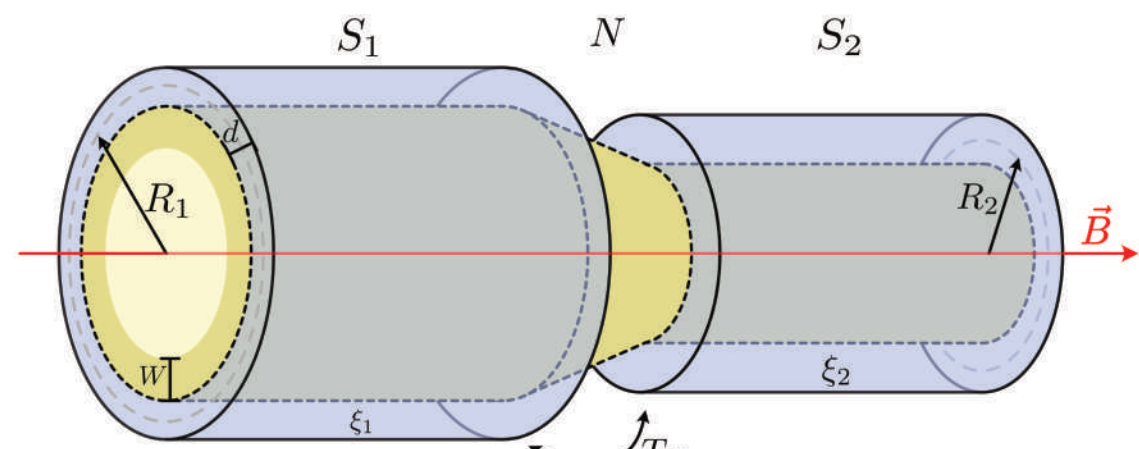
- Majorana contribution only at low transparency



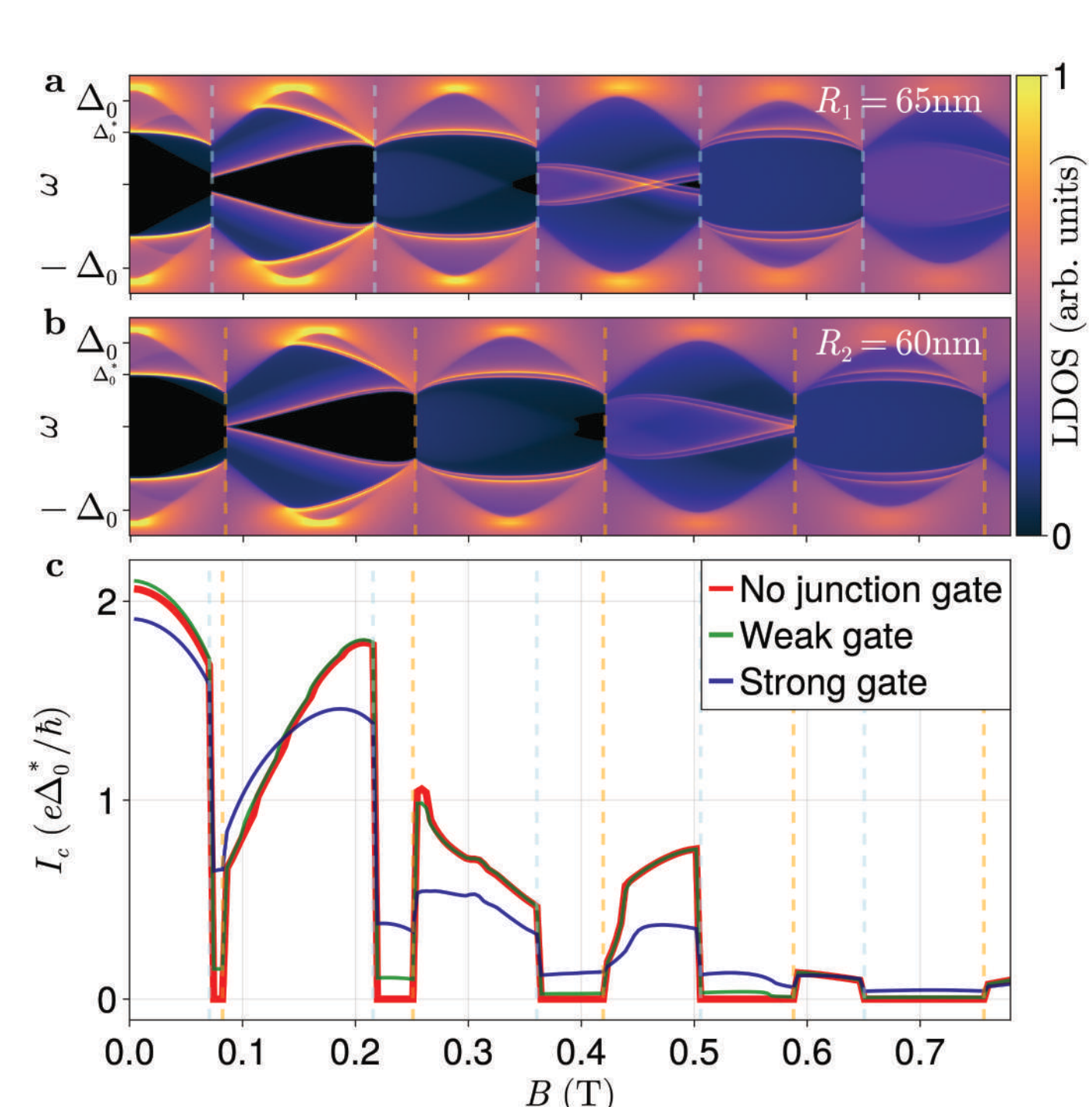
Majoranas extra current



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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Or let's discuss!

