

Josephson effect in full-shell hybrid nanowires

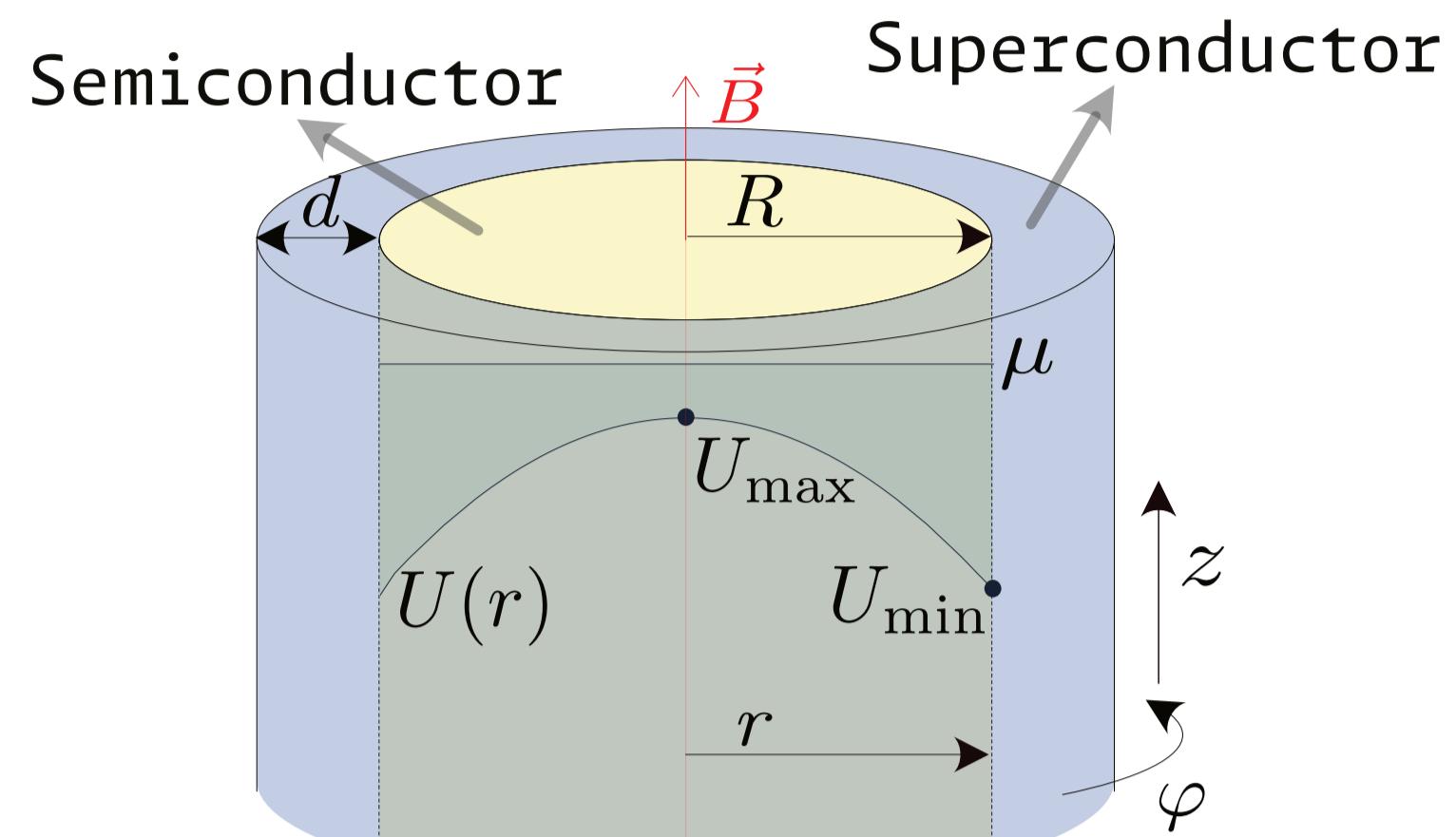
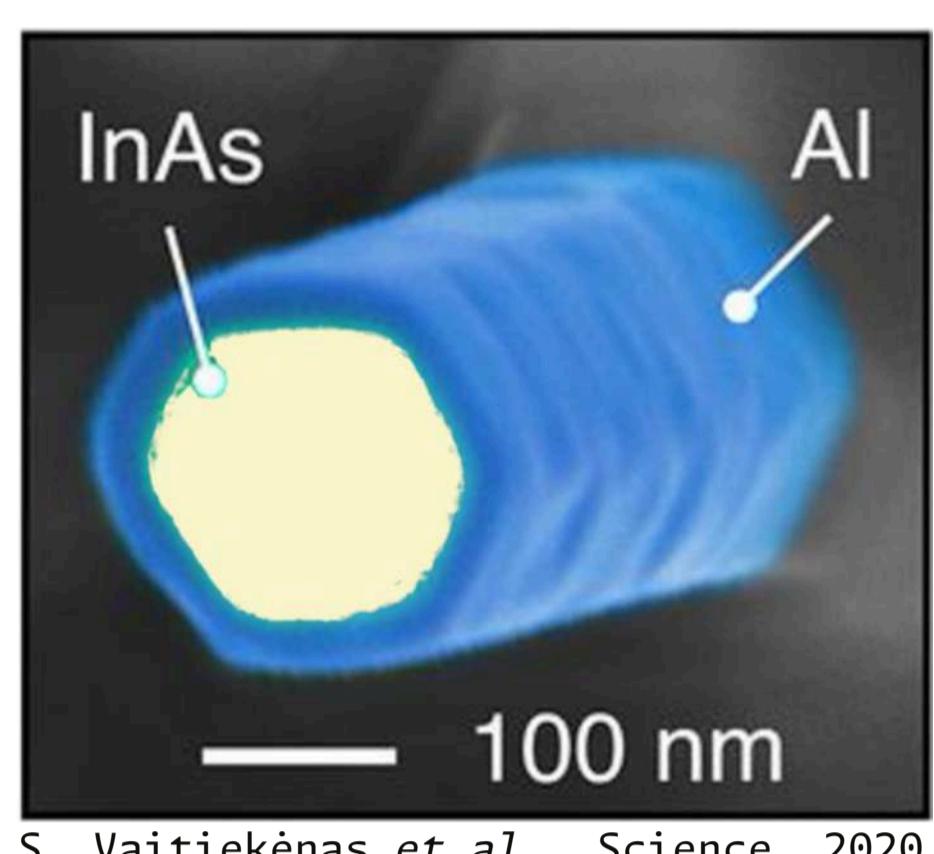


C. Payá¹, F.J. Matute-Cañadas², A. Levy-Yeyati², R. Aguado¹, P. San-Jose¹, E. Prada¹

¹ Instituto de Ciencia de Materiales de Madrid (ICMM), CSIC, Spain

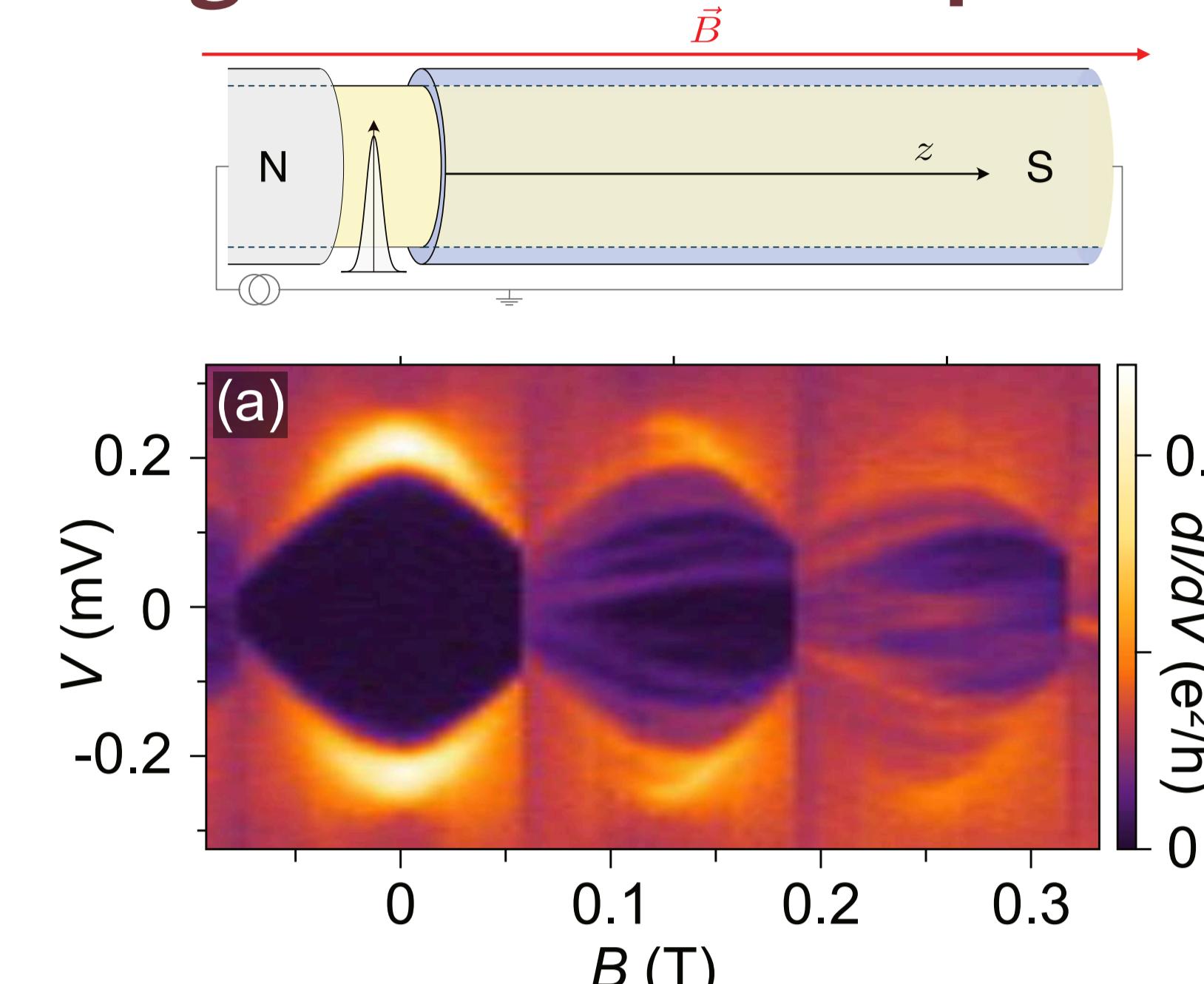
² Condensed Matter Physics Center (IFIMAC), Universidad Autónoma de Madrid, Spain

Why full-shell hybrid nanowires?



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

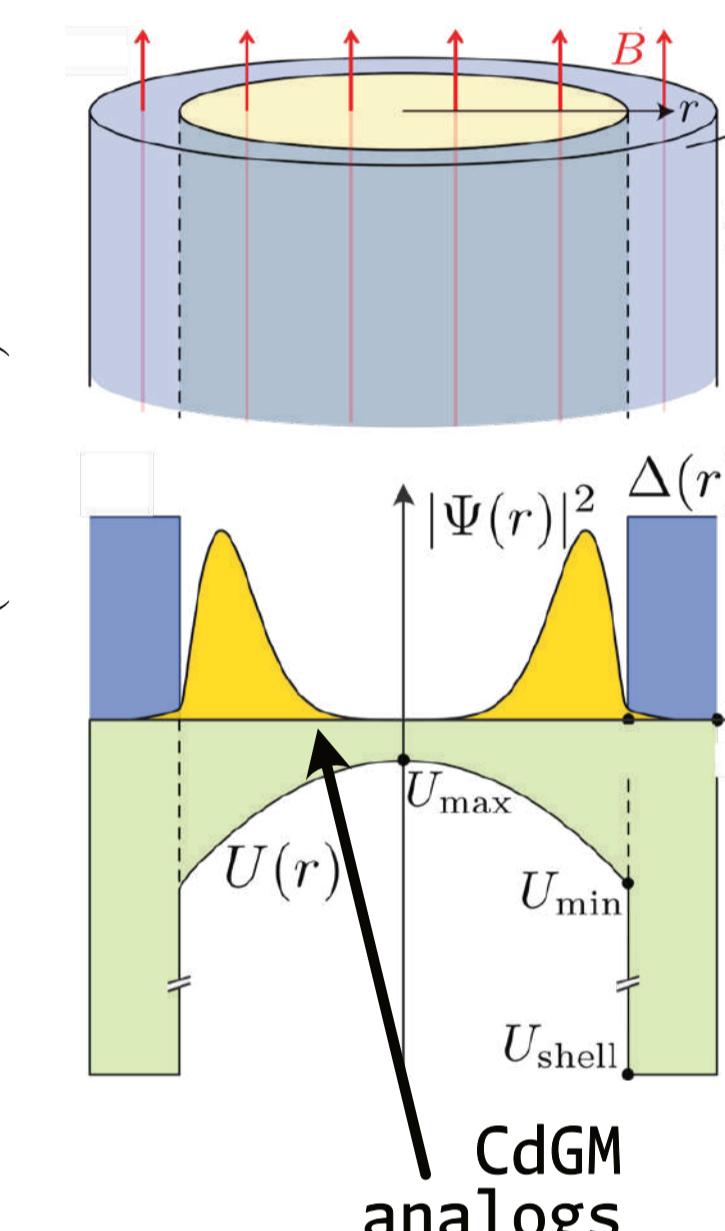
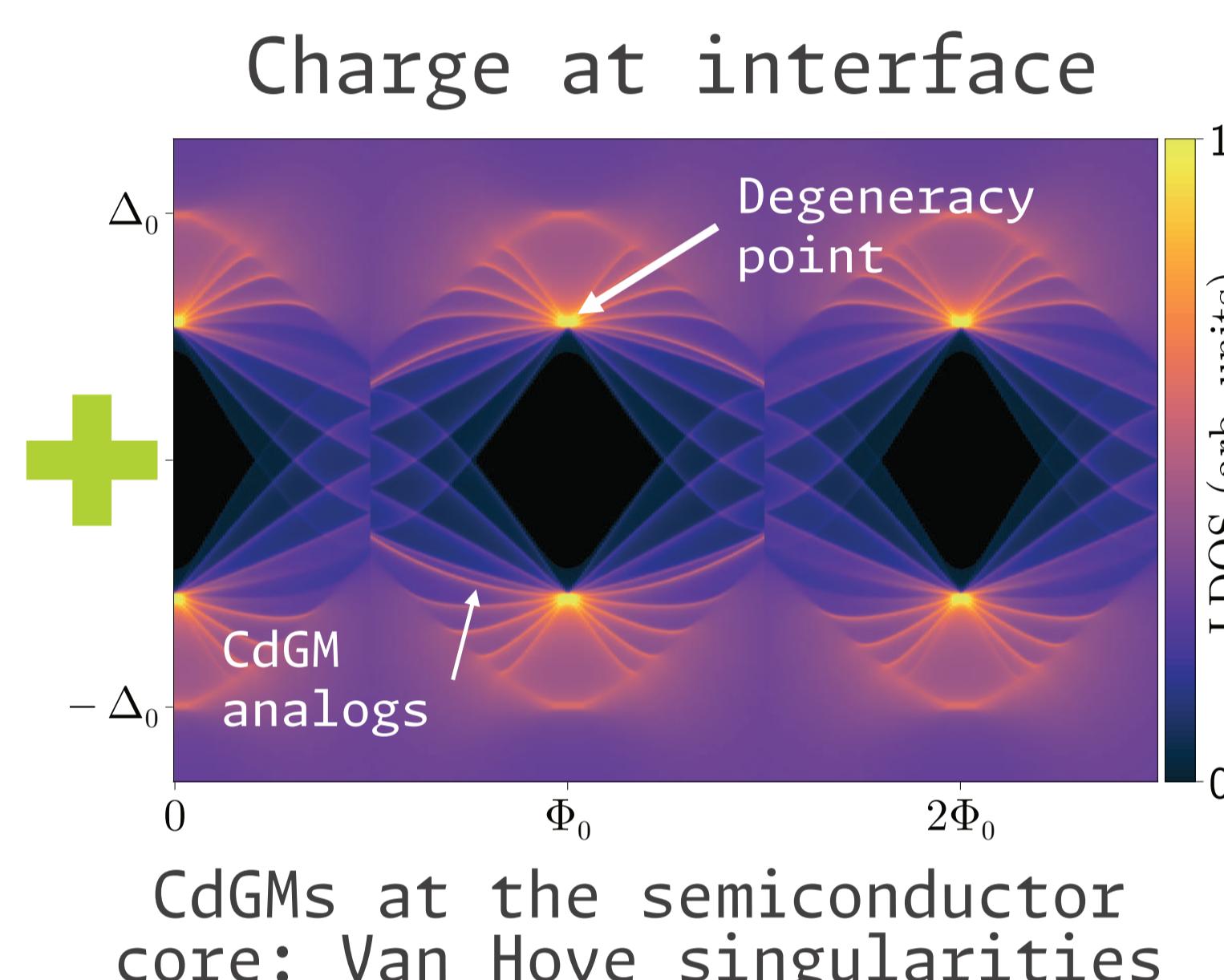
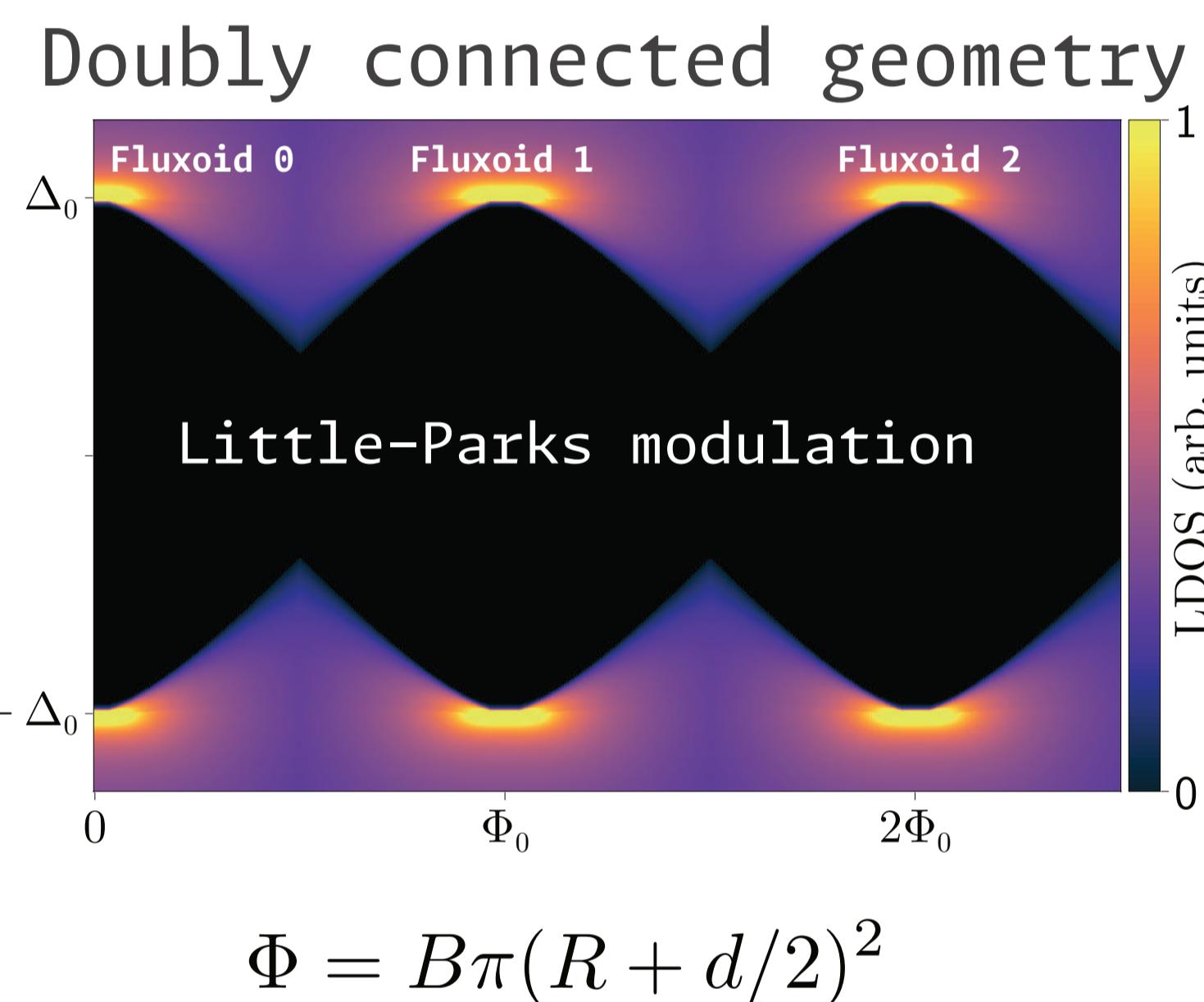
Single-wire transport experiment



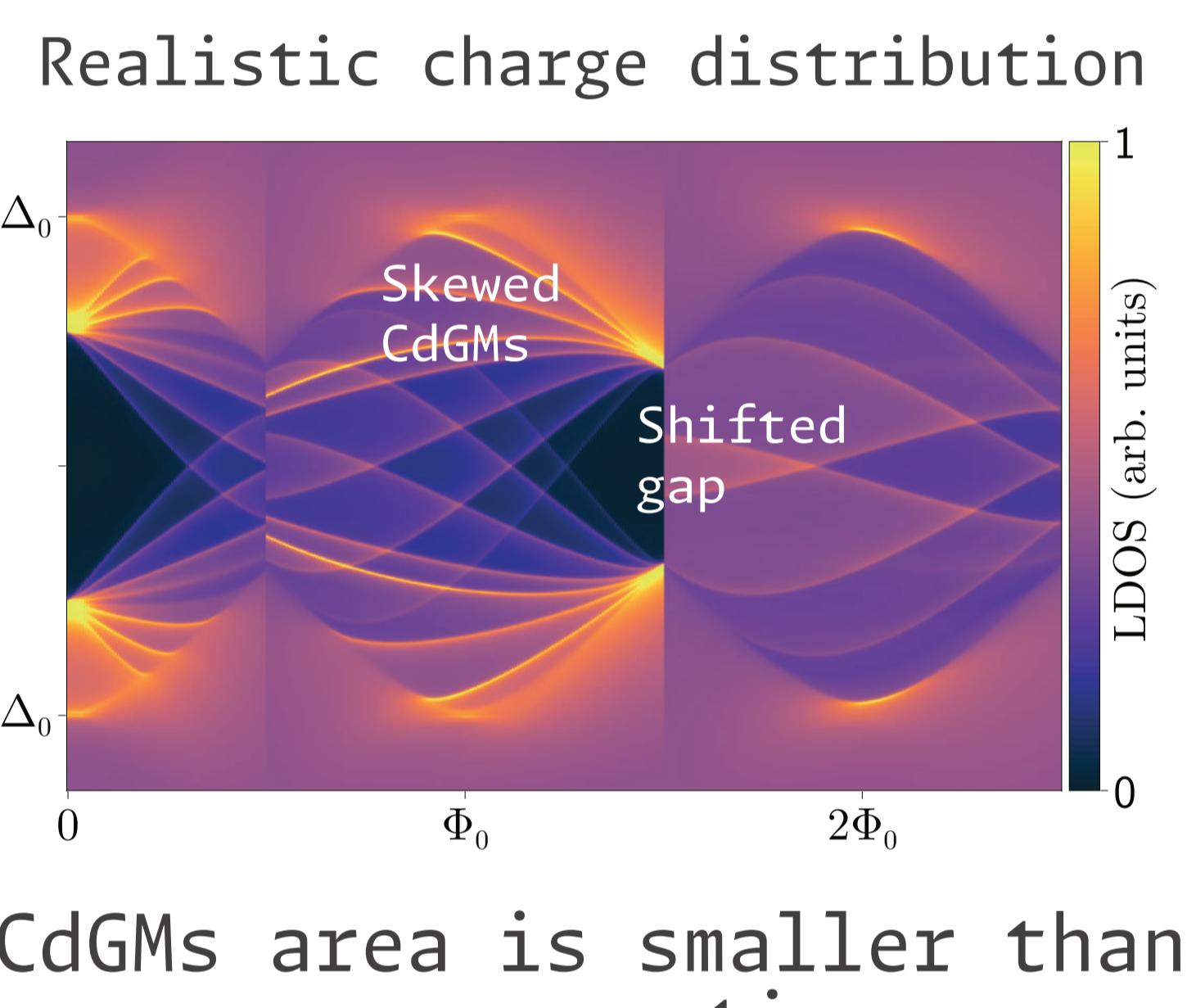
- Main findings:
- Little-Parks gap modulation
 - Skewed subgap Andreev states

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

Caroli-de Gennes-Matricon analogs

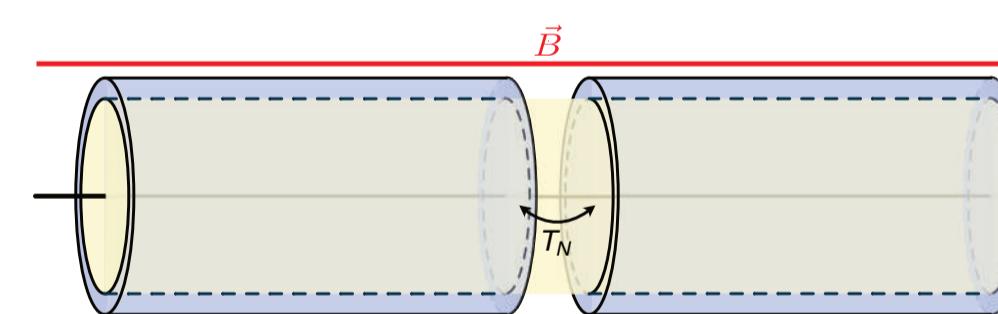


Skewed subgap states

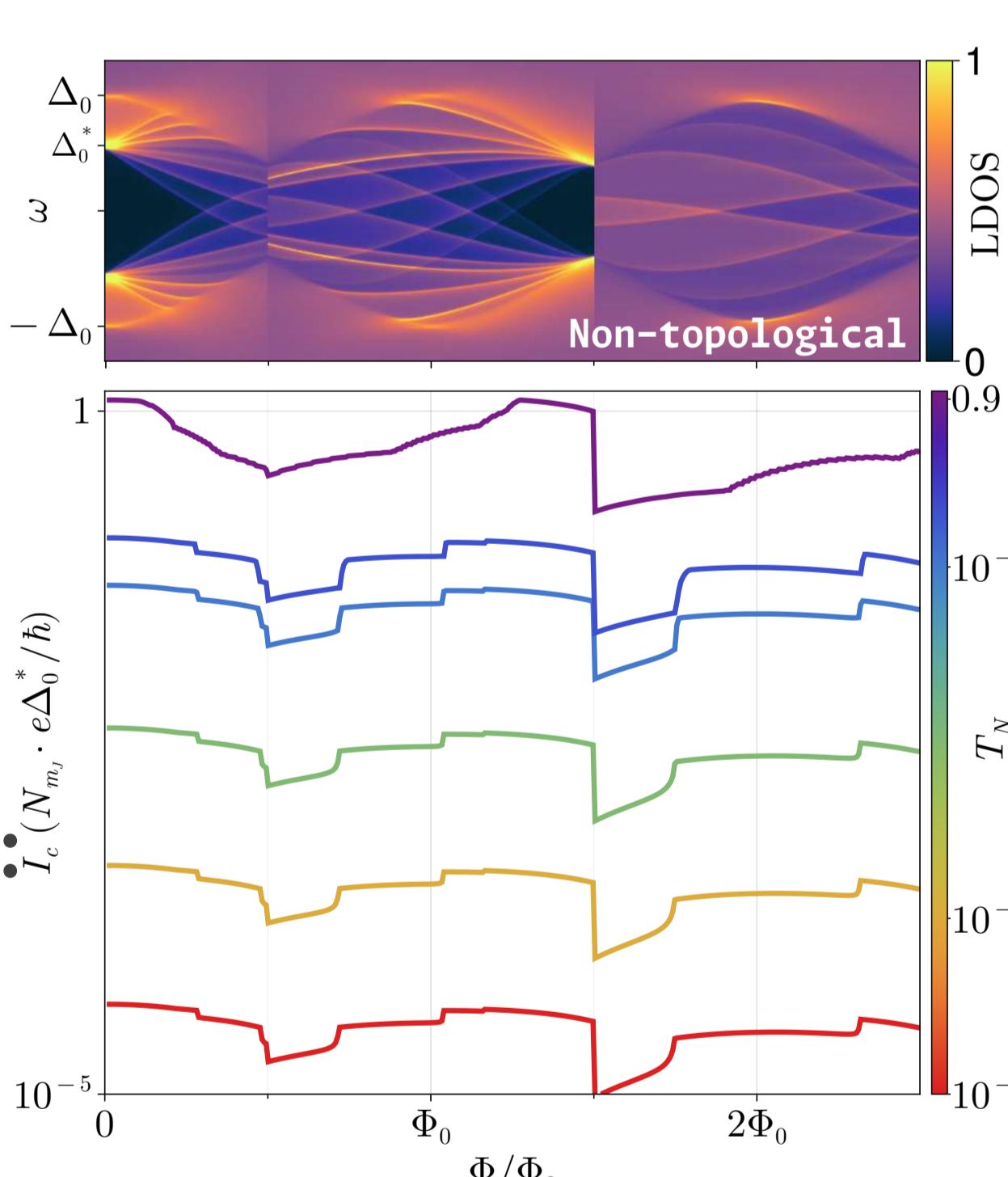


CdGMs area is smaller than cross section

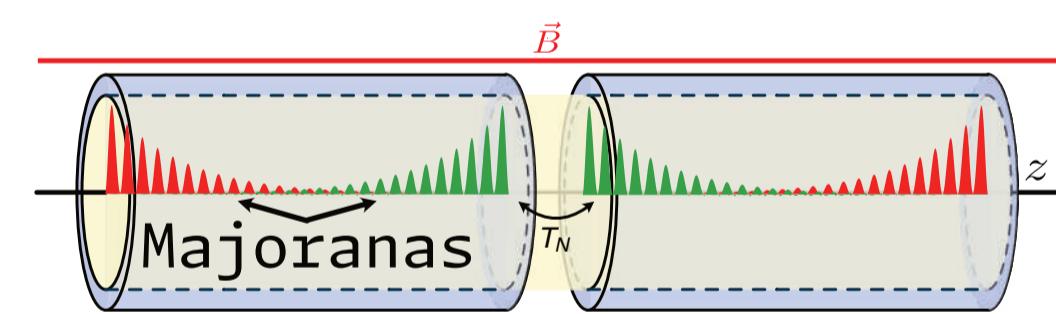
Skewness in the critical current



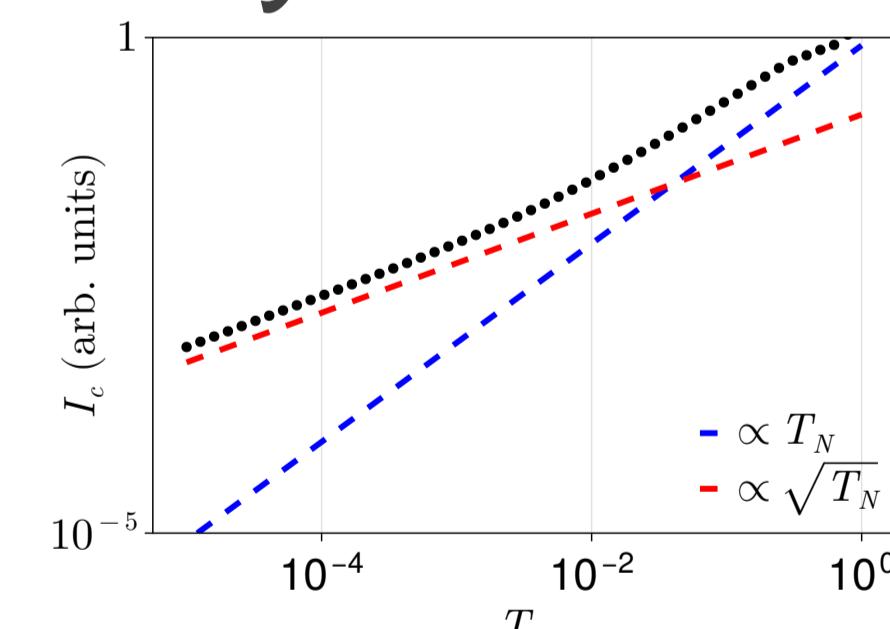
- Little-Parks modulation
- Critical current skewed to right within LP lobes
- CdGM 0-energy crossings: current steps
- Shape independent of transparency T_N



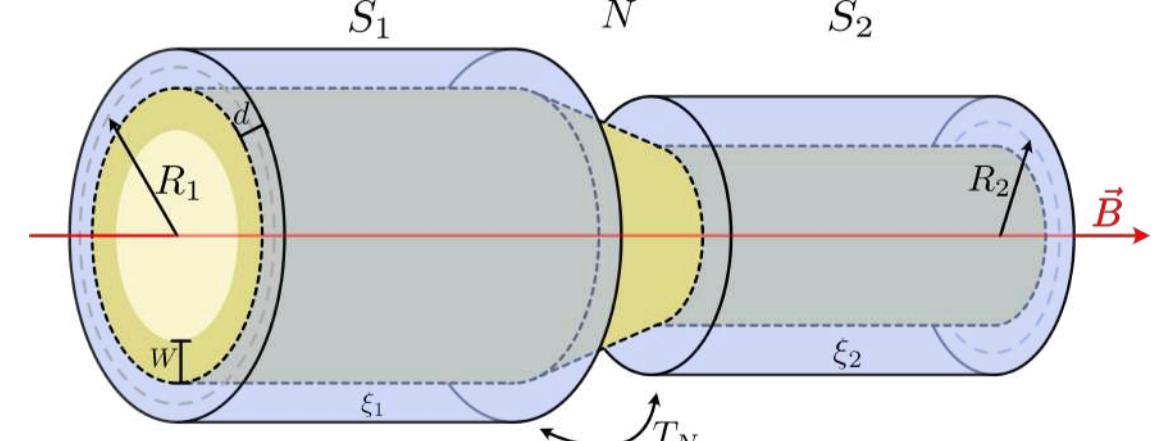
Majorana fin shaped critical current



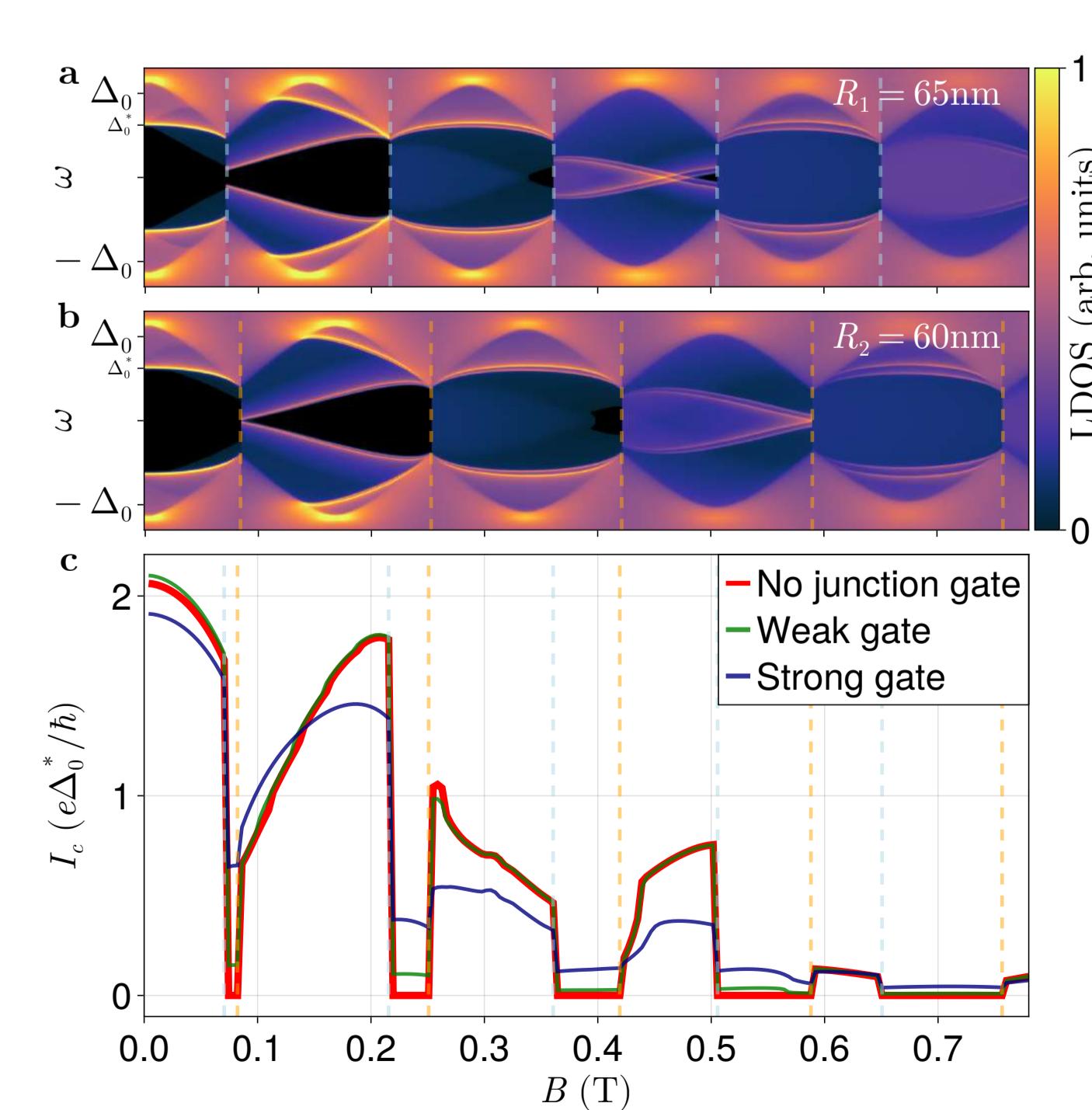
- Majorana contribution only at low transparency



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

Learn more in our papers



Or let's discuss!