Spin filtering in graphene nanoribbons

J. Munárriz, F. Domínguez-Adame, A.V. Malyshev, P. Orellana, C. Gaul, C. Mueller



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The carbon atom

s-orbital



p-orbitals



sp₂-hybridization





The carbon atom

• Planar hybridization scheme





The carbon atom

• Planar hybridization scheme





Dispersion relation







Transport properties

- Exceptional coherence
 - Coherent transport ~ μ m
 - Spin coherent transport ~ μm
- Klein paradox:







Modelization

- Model:
 - Atomic tight binding: nearest-neighbor interaction
 - Ferromagnetic insulator: spin-dependent onsite energy

$$\mathcal{H} = \sum_{i} \epsilon_{i} |i\rangle \langle i| + \sum_{\langle i,j \rangle} V_{ij} |i\rangle \langle j| + \sigma H_{ex} \sum_{i \in \mathcal{L}} |i\rangle \langle i|$$
• Output: transmission, intensity
Incoming
Reflected
System
Transmitted



Modelization

• Effect of the ferromagnetic insulator



Klein doesn't help, but dephasing is still present!



Graphene-based spin filter



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Goal: obtain Negative Differential Resistance



• System scheme (*N* barriers)











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• Preliminary results



• Drawback: only for one type of spin...

Thank you all!

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