Spin transport in GNR


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Graphene nanoribbons

Width of ribbon: 0.01-6 nm.
Ribbons via $\text{H}_2$ plasma etching?
Spin polarized transport in GNR

\[ \hat{H}_C = -\sum_{i,\sigma} t d_{i,\sigma}^{\dagger} d_{i,\sigma} + U \sum_{i,\sigma} \langle \hat{n}_{i,\sigma} \rangle (\hat{n}_{i,\sigma} - \frac{1}{2}) + \sum_{i,\sigma} qE(y_i - y_m) \hat{n}_{i,\sigma} \]

\[ \hat{G}_C(\varepsilon) = [\varepsilon \hat{I} - \hat{H}_C - \hat{\Sigma}_L(\varepsilon) - \hat{\Sigma}_R(\varepsilon)]^{-1} \]

\[ D_{i\sigma}(\varepsilon) = -\frac{1}{\pi} \text{Im} \left( \langle i\sigma | \hat{G}_C(\varepsilon) | i\sigma \rangle \right) \]

\[ m_i = \mu_B \left[ \int_{-\infty}^{E_F} (D_{i\uparrow}(\varepsilon) - D_{i\downarrow}(\varepsilon)) \, d\varepsilon \right] \]

\[ T_\sigma(\varepsilon) = \text{Tr}[\hat{\Gamma}_L \hat{G}_{C,\sigma} \hat{\Gamma}_R \hat{G}_{C,\sigma}^\dagger] \]

\[ P = \frac{\left[ T_\uparrow(\varepsilon) - T_\downarrow(\varepsilon) \right]}{\left[ T_\uparrow(\varepsilon) + T_\downarrow(\varepsilon) \right]} \]
Applying an E- or B-field

B-field

E-field
Magentically excited edges

B-field

E-field

Edge disorder and spin transport?

B-field

E-field

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Conclusion

• Spin polarized currents through graphene nanoribbons were investigated

• All three cases showed spin polarized currents

• The width and length of the ZGNR has a strong influence on the localized states and therefore on the value of the spin polarized current