# Highly tunable spin-dependent electron transport through carbon atomic chains connecting two zigzag graphene nanoribbons

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**JOURNAL OF CHEMICAL PHYSICS**
**Volume:** 137 **Issue:** 10
**Article Number:** 104107
**DOI:** 10.1063/1.4752197
**Published:** SEP 14 2012
View Journal Impact

## Abstract

Motivated by recent experiments of successfully carving out stable carbon atomic chains from graphene, we investigate a device structure of a carbon chain connecting two zigzag graphene nanoribbons with highly tunable spin-dependent transport properties. Our calculation based on the non-equilibrium Green's function approach combined with the density functional theory shows that the transport behavior is sensitive to the spin configuration of the leads and the bridge position in the gap. A bridge in the middle gives an overall good coupling except for around the Fermi energy where the leads with anti-parallel spins create a small transport gap, while the leads with parallel spins give a finite density of states and induce an even-odd oscillation in conductance in terms of the number of atoms in the carbon chain. On the other hand, a bridge at the edge shows a transport behavior associated with the spin-polarized edge states, presenting sharp pure alpha-spin and beta-spin peaks beside the Fermi energy in the transmission function. This makes it possible to realize on-chip interconnects or spintronic devices by tuning the spin state of the leads and the bridge position. (C) 2012 American Institute of Physics. [http://dx.doi.org/10.1063/1.4752197]

## Keywords

**KeyWords Plus:** CONDUCTANCE; STATE

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## Funding

| Funding Agency | Grant Number |
|---|---|
| National Natural Science Foundation of China | 11174220 |
| Shanghai Pujiang Program | 10PJ1410000 |
| King Abdulaziz University (KAU) | 49-3-1432/HiCi |

## Citation Network

| | |
|---|---|
| MOST 973 Project | 2011CB922204 |
| China Postdoctoral Science Foundation | 2012M511127 |

View funding text


## Publisher

AMER INST PHYSICS, 1305 WALT WHITMAN RD, STE 300, MELVILLE, NY 11747-4501 USA

## Categories / Classification

**Research Areas:** Chemistry; Physics

**Web of Science Categories:** Chemistry, Physical; Physics, Atomic, Molecular & Chemical

## Document Information

**Document Type:** Article

**Language:** English

**Accession Number:** WOS:000309100400010

**PubMed ID:** 22979850

**ISSN:** 0021-9606

**eISSN:** 1089-7690

## Journal Information

**Table of Contents:** Current Contents Connect

**Impact Factor:** Journal Citation Reports

## Other Information

**IDS Number:** 010NF

**Cited References in Web of Science Core Collection:** 37

**Times Cited in Web of Science Core Collection:** 9