Biosensors & Bioelectronics-2013

OMICS Group Conferences
Accelerating Scientific Discovery

2nd International Conference and Exhibition on
Biosensors & Bioelectronics

June 17-19, 2013 Hilton Chicago/Northbrook, USA

Graphene quantum point contact transistor for DNA sensing

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Abstract

The single-atom thickness of monolayer graphene makes it an ideal candidate for DNA sequencing as it can scan molecules passing through a nanopore at high resolution. Additionally, unlike most insulating membranes, graphene is electrically active, and this property can be exploited to control and electronically sense biomolecules. We show that the shape of the edge as well as the shape and position of the nanopore can strongly affect the electronic conductance through a lateral constriction in a graphene nanoribbon as well as its sensitivity to external charges. In this context the geometry of the graphene membrane can be tuned to detect the rotational and positional conformation of a charge distribution inside the nanopore. We show that quantum point contact (QPC) geometry is suitable for the electrically-active graphene layer and propose a viable design for a graphene-based DNA sequencing device.

Biography

Dr. Jean-Pierre Leburton is the G. Stillman Professor of Electrical and Computer Engineering and a full time Research Faculty in the Beckman Institute at UIUC. He joined the University of Illinois in 1981 from Siemens A.G. Research Laboratory in Munich, Germany. He is author and co-author of more than 300 technical papers in international journals and books, and served in numerous conferences committees. He is Fellow of IEEE, APS, OSA, the American AAAS, ECS and IOP. In 2004, he was the recipient of the ISCS Quantum Device Award. In 2011, he was elected to Royal Academy of Sciences of Belgium.

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