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NANOELECTRONICS: ANALYTICAL MODELLING OF SINGLE STRAND DNA (SSDNA)- SET AS A NANO SWITCH FOR FUTURE SPACE APPLICATIONS.

Abstract

Power management has emerged as a critical problem especially when we talk of exploring space. The research paper aims to give an idea that as the devices become smaller, lighter and consume less power, it becomes possible to design and fly space probes on missions that are not currently possible. Power consumption is roughly proportional to the number of electron transferred from voltage source to the ground. Therefore, the utilization of DNA-Single Electron Transistor is expected to reduce the power consumption and would help NASA and similar Space Organizations in their future missions which will involves sending spacecraft to destinations that are much more difficult to travel i.e deep-space planetary missions. The question of whether DNA molecule conducts electric charge is intriguing to physicists and biologists alike. Additionally, DNA offers a platform for fundamental physical understanding of systems in the nanoscale. Electronic components using single molecules that depend on quantum transport of single electric charge for their operations have been proposed since 1974. Molecules, such as DNA, possess the quantum charge transport property due to their chemical and electrical behaviour and therefore could become key components for future Molecular electronics. DNA Single Electron Transistor (SET) was proposed and realized by E, Ben-Jacob et.al. in 1998. However, electrical transport through DNA molecules has attracted much interest recently, in view of understanding their energy structure and due to potential applications to nanometre-scale molecular electronic devices [1].

In this research paper we tries to develop a mathematical model of single strand DNA (ssDNA)-Single Electron Transistor (SET) using tunnelling properties of P-bonds, in sugar-Phosphate back bone of single strand DNA (ssDNA) molecule and graphically analyse the coulomb blockade region from the charge states of SET equations using the Fulton and G. Dolen model [2] and propose how a ssDNA-SET can behave as a switch for future applications in Nanotechnology/Molecular Electronics for low power space applications. The equations thus obtained are simulated using 'C' language and results are plotted graphically using Microcal Origin software.

References: [1] Ben-Jacob, E.; Hermon, Z.; Caspi, S. arXiv:physics/9808044.,1998,1,30.

[2] Fulton, T.A.; Dolan, G.J. Physical Review Letters. 1987,109, 59.