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Detection of Nucleic Acids with Graphene Nanopores: Ab Initio Characterization of a Novel Sequencing Device[1] TAMMIE NELSON, BO ZHANG, OLEG PREZHDO, University of Washington — We report an ab initio study of the interaction of two nucleobases, cytosine and adenine, with a novel graphene nanopore device for detecting the base sequence of a single-stranded nucleic acid (ssDNA or RNA). The nucleobases were inserted into a pore in a graphene nanoribbon, and the electrical current and conductance spectra were calculated as functions of voltage applied across the nanoribbon. The conductance spectra and charge densities were analyzed in the presence of each nucleobase in the graphene nanopore. The results indicate that, due to significant differences in the conductance spectra, the proposed device has adequate sensitivity to discriminate between different nucleotides. Moreover, we show that the nucleotide conductance spectra is not affected by its orientation inside the graphene nanopore. The proposed technique may be extremely useful for real applications in developing ultrafast, low cost DNA sequencing methods.

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