# Graphene Nanoribbons FETs for future Logic Applications: Perspectives and Problems

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**Abstract:** In this presentation, the opportunities offered by monoatomic layers of graphene for the fabrication of high-performance nanoribbon (GNR) FETs are examined. Starting from the description of some fundamental material properties, such as the single-particle Hamiltonian in graphene and its analogy with massless Dirac quasi-particles in quantum electrodynamics, we proceed with the examination of the GNR band structure and, most notably, the inverse relationship of the bandgap with the GNR width. The huge graphene carrier mobility, made possible by both the small effective mass and the weak electron-phonon interaction even at room temperature, makes it conceivable to work out high-performance GNR-FETs, virtually not affected by short-channel effects and operating under ballistic conditions at low supply voltages. Experimental results obtained from graphene-based device structures, however, exhibit the limitations of narrow-bandgap semiconductors, as well as serious fabrication and integration problems within a CMOS process. Simulations of narrow GNR-FETs confirm the high potential of these devices, but highlight at the same time leakage problems due to various band-to-band and source-to-drain tunneling mechanisms which occur at low and negative gate voltages. These effects can possibly be contained by a careful device optimization and/or devising novel FET structures. A new project referred to as "Graphene-based Nanoelectronic Devices" (GRAND) has recently been set up in Europe with the financial support of the Commission in order to investigate all technical aspects connected with the feasibility, design, fabrication and CMOS integration of GNR-FETs.