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Graphene-based Field Effect Transistors as Radiation Sensors

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Since its discovery in 2004, Graphene has been proposed in a wide number of applications, including microelectronic devices and photo-detectors, thanks to its unique electronic properties. Here, we propose the implementation of graphene-based field effect transistor (FET) as radiation sensor. Graphene is employed as the gate readout electrode, able to sense any changes in the field distribution induced by ionization in the underneath absorber, because of the strong variation in the graphene conductivity close to the charge neutrality point. This approach could open up the possibility of achieving high-energy resolutions in radiation detection, not through direct absorption of radiation, but rather by sensing energy absorption in an adjacent medium. With the help of T-CAD software, we have simulated a graphene-FET realized on silicon, having one micrometric strip of graphene as a gate electrode on top of silicon dioxide. First results revealed that, by properly choosing the structures parameters, the e-h pairs generated upon visible light illumination are able to drive the electric field on the graphene gate up to values suitable for effective sensing. Once the optimized parameters will be established, we will fabricate and test the first prototypes, by exploiting the graphene synthesis platform recently installed at LNF and the micro-fabrication facilities made available by the two CNR Institutes (IMM and IFN) involved in the project and supporting this research activity.

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