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Spatially Resolved Biosensing with Graphene Nanodisk Arrays
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Graphene nanostructures have emerged as ideal platforms to design optical biosensors thanks to their ability to support strong and narrow resonances in the infrared part of the spectrum. These resonances, known as surface plasmons, arise from the collective oscillations of their conduction electrons and, contrarily to the case of conventional plasmonic materials, can be tuned by changing the doping level of the nanostructure via, for instance, electrostatic gating. Here, we propose to use these extraordinary properties to design an optical biosensor with spatial resolution. The proposed device consists of a set of 1-micron square pixels, each of them composed of an array of graphene nanodisks. By carefully engineering the size and the distribution of the nanodisks we can tune all pixels to support a plasmonic resonance at the same frequency and with equal intensity, but for different values of doping. Then, by modifying the doping level of the whole system we can select which pixel is on resonance, and therefore we can detect the presence and the location of the molecules with a spatial resolution well below the diffraction limit. The concept of spatially resolved biosensing proposed here opens a new avenue for the design of plasmonic biosensors with improved capabilities.

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