" Terahertz Plasma Excitations in Semiconductor Nanostructures "

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In this course we present physical basis of the THz excitation in nanometer semiconductor structures[1]. We show why nanometer size is necessary to reach THz frequency range. We show also that When the mobility is high enough, the dynamics of a short channel FET at THz frequencies is dominated by plasma waves. This may result on the one hand, in a dc current induced spontaneous generation of plasma waves and THZ emission, and on the other hand, in a resonant photoresponse to incoming radiation. In other cases, when plasma oscillations are overdamped, the FET can operate as an efficient broadband THz detector.

We will present also an overview of some important and recent results concerning the physics of nanometre scale field effect transistors showing that they can be used for the detection of terahertz radiation .The subjects are selected in a way to stress some new aspects/developments rather than purely technological/engineering improvements. The basic physics related problems like temperature dependence of the photoresponse [2], interferences of THz signals leading to helicity sensitive detection will be presented [3]. Until now most of works on nanometer FETs detectors were considering only THz imaging applications. We will show the progress in overcoming the main physical and electronic problems and demonstrate first results on the application of nanometre FETs as detectors in wireless communication with carrier frequencies up to 1THz range[4]. Finally we present also results from THz detection by Grapheme transistors[5]. A possible development of future THz detectors using grapheme and Graphene like structures will be also addressed.

References

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