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Interaction of a two-dimensional electromagnetic pulse with an electron inhomogeneity in an array of carbon nanotubes in the presence of field inhomogeneity

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Auteur	Zhukov, Alexander V [1], Bouffanais, Roland [2], Leblond, Hervé [3], Mihalache, Dumitru [4], Fedorov, Eduard G [5], Belonenko, Mikhail B [6]
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Résumé en anglais	In this study, we address the challenging problem of propagation of infrared electromagnetic two-dimensional bipolar pulses of extremely short duration in a heterogeneous array of semiconductor carbon nanotubes. Heterogeneity is defined here as a region of high electron density. The evolutions of the electromagnetic field and charge density in the sample are described by Maxwell's equations and the continuity equation respectively, wherein the inhomogeneity of the field along the nanotube axis is integrated and incorporated into the modeling framework. Our numerical solution to this problem shows the possibility of a stable propagation of two-dimensional electromagnetic pulses through a heterogeneous array of carbon nanotubes. This propagation of electromagnetic pulses is accompanied by a redistribution of the electron density in the sample. For the first time to the best of our knowledge, this latter effect is fully accounted for in our study. Specifically, we demonstrate that depending on the initial speed of the electromagnetic pulse two possible outcomes might ensue: either (i) the pulse overcomes the region of increased electron concentration, or alternatively (ii) it is reflected therefrom. As a result, a near-infrared pulse is transmitted, while the long-wavelength infrared pulse is reflected, on an obstacle that is much smaller than its wavelength.
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[9] http://dx.doi.org/10.1140/epjd/e2015-60256-7
[10] http://link.springer.com/article/10.1140%2Fepjd%2Fe2015-60256-7