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Simulation of 2D Silicon Diodes using GNU/Archimedes

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www.gnu.org/software/archimedes

Summary. GNU/Archimedes is the GNU Free Software for the design and simulation of Semiconductor devices. Here we show, briefly, how it is possible to simulate a 2D Silicon Diode just typing a very simple script describing the diode. All the relevant scattering phenomena are taken into account in order to obtain a realistic simulation of the Electron-Dynamics. You can find the GNU/Archimedes package at the following web site:
www.gnu.org/software/archimedes

1.1 Introduction

Using GNU/Archimedes is very simple. Indeed, in order to describe a semiconductor device, one only needs to type a brief script in which the description of the device is reported in a simple scripting language. We report, in the following, a brief script usefull for the simulation of a 2D Silicon diode.

```
# Silicon DIODE test-1
# created on 30 sep.2004, J.M.Sellier
# modified on 07 oct.2004, J.M.Sellier
# This file simulate a Silicon Diode.
# To run it type:
# archimedes diode.input

MATERIAL SILICON
TRANSPORT ELECTRONS

FINALTIME 5.5e-12
TIMESTEP 0.0015e-12

XLENGTH 1.0e-6
YLENGTH 0.1e-6
```

```
XSPATIALSTEP 100
YSPATIALSTEP 25

# Definition of the doping concentration
# ======================================
DONORDENSITY    0.        0.    1.0e-6    0.1e-6    2.e21
DONORDENSITY    0.        0.    0.3e-6    0.1e-6    5.e23
DONORDENSITY    0.7e-6  0.    1.0e-6    0.1e-6    5.e23
ACCEPTORDENSITY 0.        0.    1.0e-6    0.1e-6    1.e20

# Definition of the various contacts
# ==================================
CONTACT LEFT  0.0    0.1e-6 OHMIC     0.0    5.e23
CONTACT RIGHT 0.0    0.1e-6 OHMIC     1.0    5.e23
CONTACT UP    0.0    1.0e-6 INSULATOR 0.0
CONTACT DOWN  0.0    1.0e-6 INSULATOR 0.0

NOQUANTUMEFFECTS
MAXIMINI
# SAVEEACHSTEP

LATTICETEMPERATURE 300.

STATISTICALWEIGHT 1500

MEDIA 500

OUTPUTFORMAT GNUPLOT

# end of MESFET test-1
```

1.2 GNU/Archimedes Simulation Results

We report, in the following, some pictures which show the results obtainable with GNU/Archimedes.
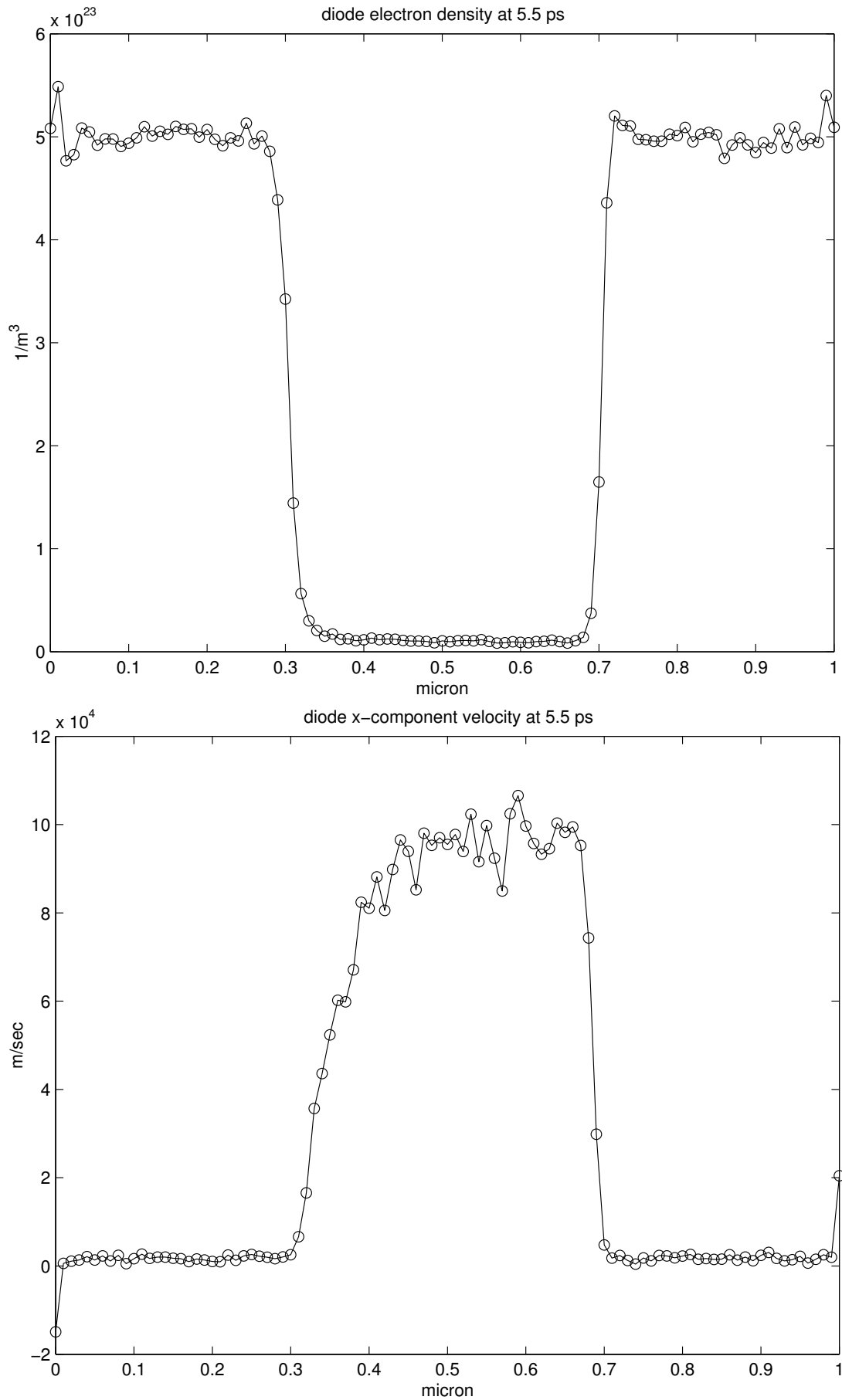
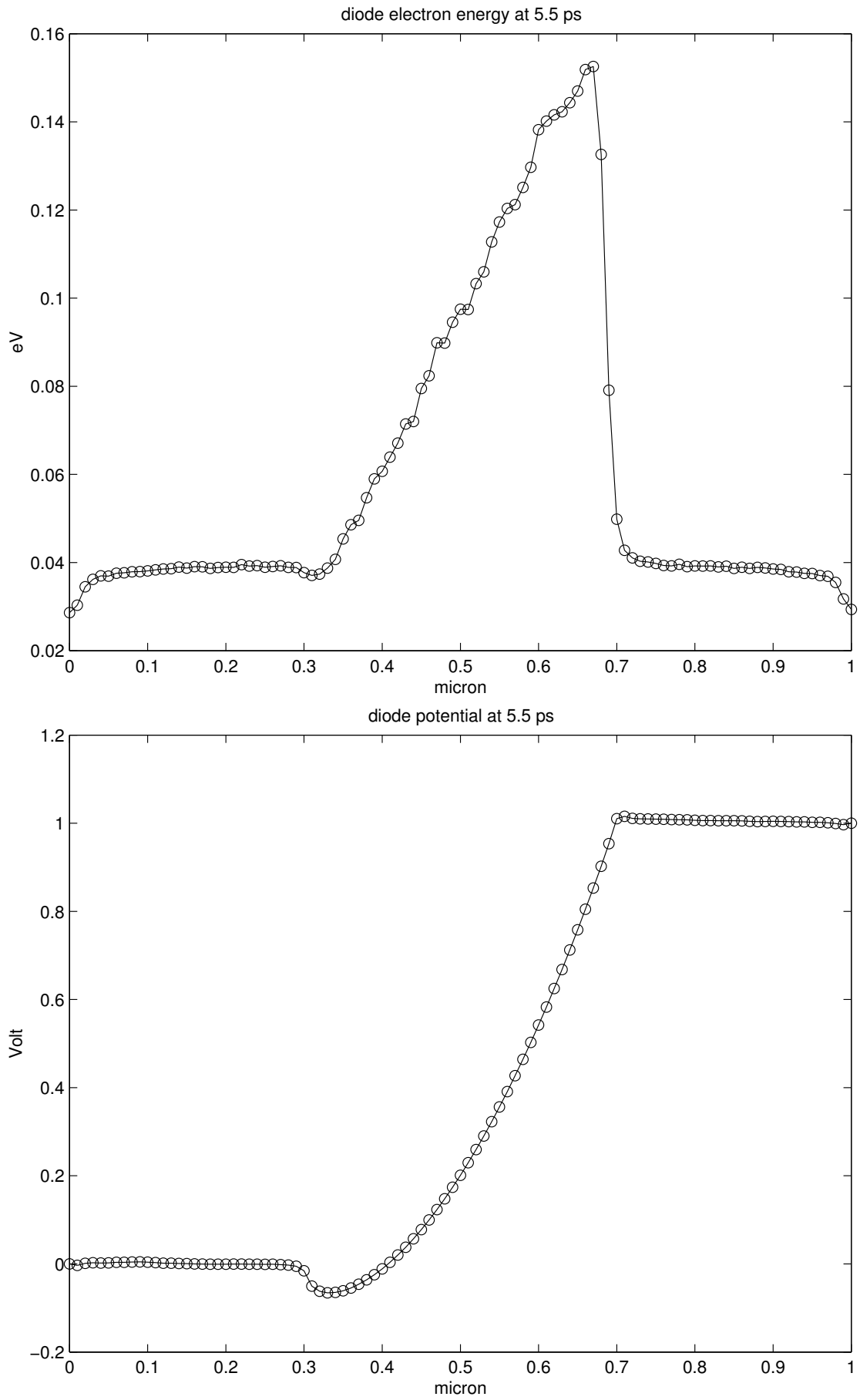Fig. 1.1. Plot of the density and velocity obtained by GNU/Archimedes.

Fig. 1.2. Plot of the energy and potential obtained by GNU/Archimedes.
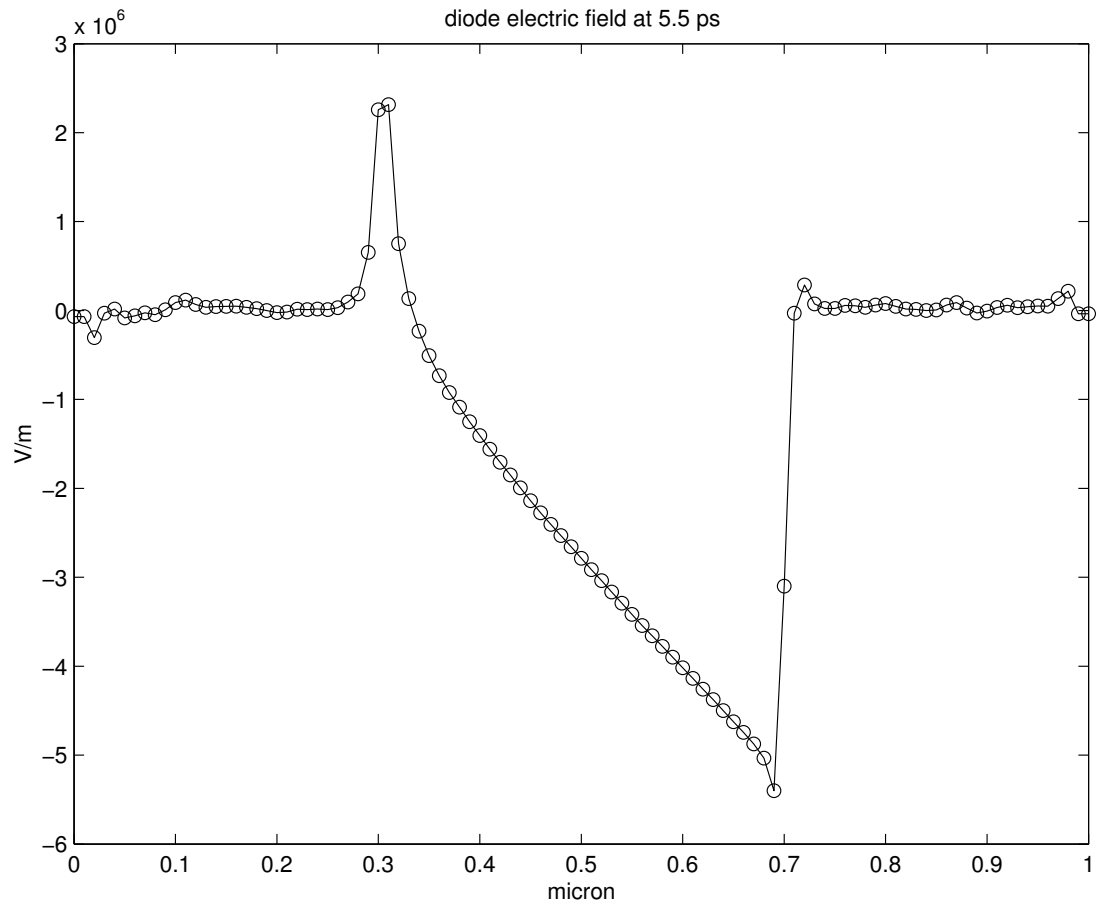
Fig. 1.3. Plot of the electric field obtained by GNU/Archimedes.