Electron Trajectory

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Generating trajectories

After reading through the Thomas Siegel thesis a couple of times, I came to grips first with the intuitive side of the three step model, and later the mathematics. Afterwards, my task was to program the trajectory of the electron after it leaves the atomic potential, initially I tried to do this with seaborne, in order to learn a new skill and make some pretty graphs, but eventually realized it wasn't as well suited to the types of plots I wanted to make as good old matplotlib, so I settled for that instead. After a couple of attempts at inserting the formula found in the thesis:

$$x(t) = \frac{-e}{m\omega_0^2}\left[E_0(t)cos(\omega_0 t+\phi) - E_0(t_i)cos(w_0 t_i+\phi)\right] - \frac{-eE_0(t_i}{m\omega_0^2}(t-t_i)sin(\omega_0 t+\phi) \quad (1)$$

After some attempting and tinkering, I did not manage to implement the formula, and still have a couple of doubts as to the terms, so instead I used the traditional equations of motion, which yielded much better results:

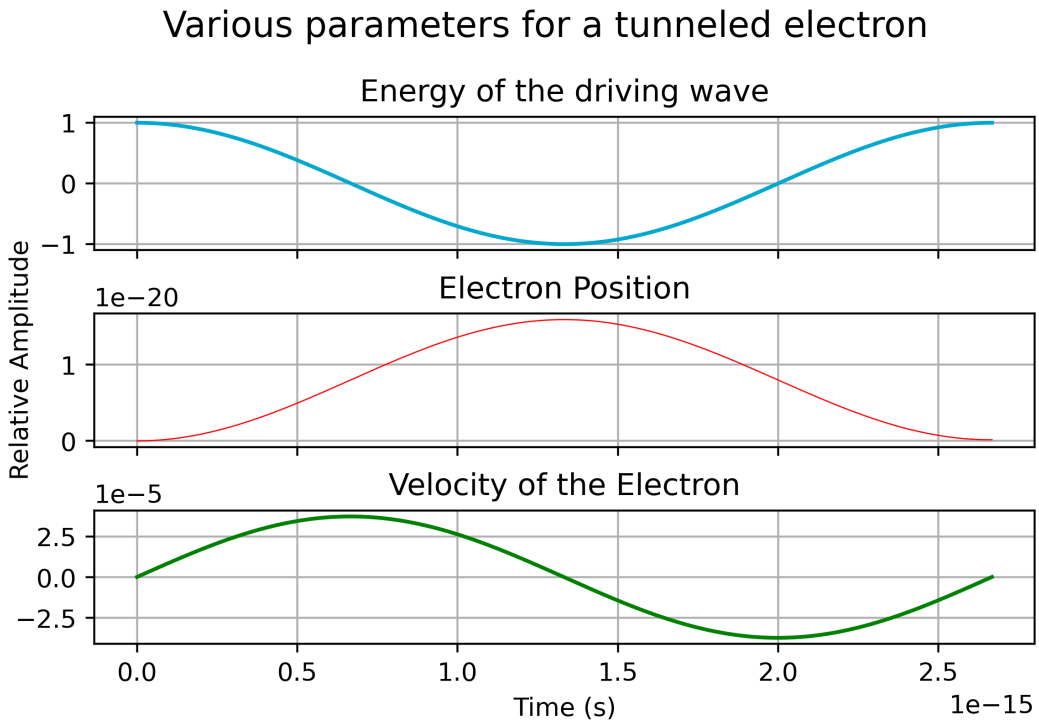

Figure 1: Pretty (and) self explanatory graph

Satisfied with this graph, which accurately (I think) describes the motion of the electron and the velocity. I also created a github repository to keep track of the code (and for postgrad/employers of course) which is linked here: https://github.com/alex-benitez/Atto

Additionally you can add phase to the trajectory, and get a slightly different graph:

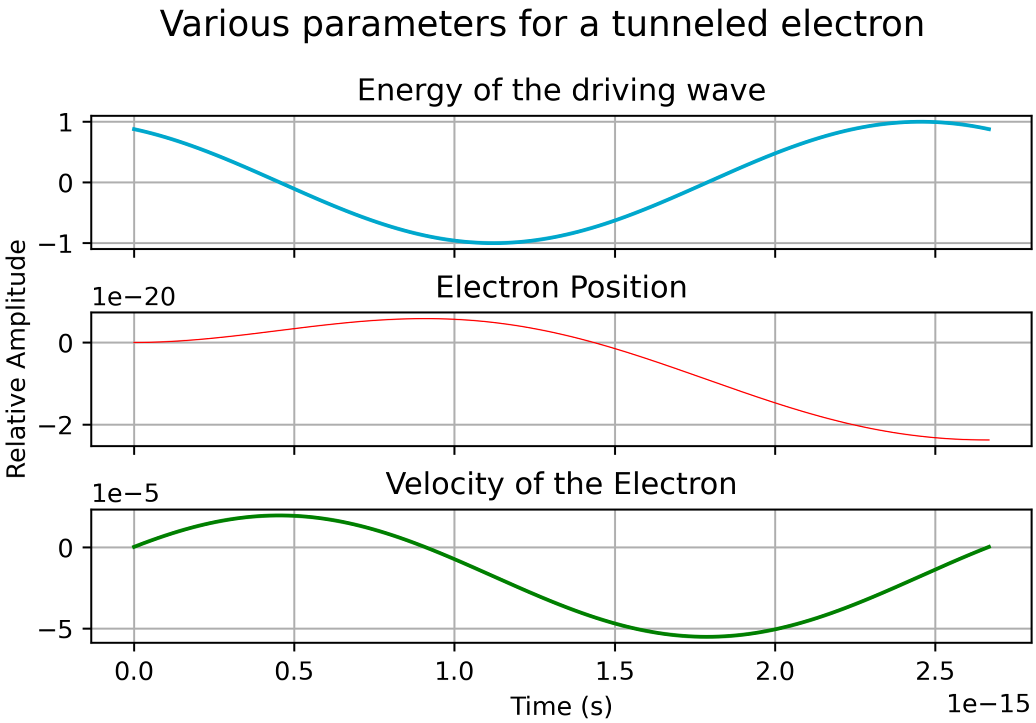

Figure 2: Added phase of 0.5 radians

The next logical step is to create a distribution of electrons exiting the nucleus at a given phase, and use that to plot the graph of possible positions.