# Report for fallingSoliton

Simulated with: /home/mparcerisa/Desktop/code/TFG/BEC-Simulations/lib/managers/crankNicolson/default.py

Simulation constants:

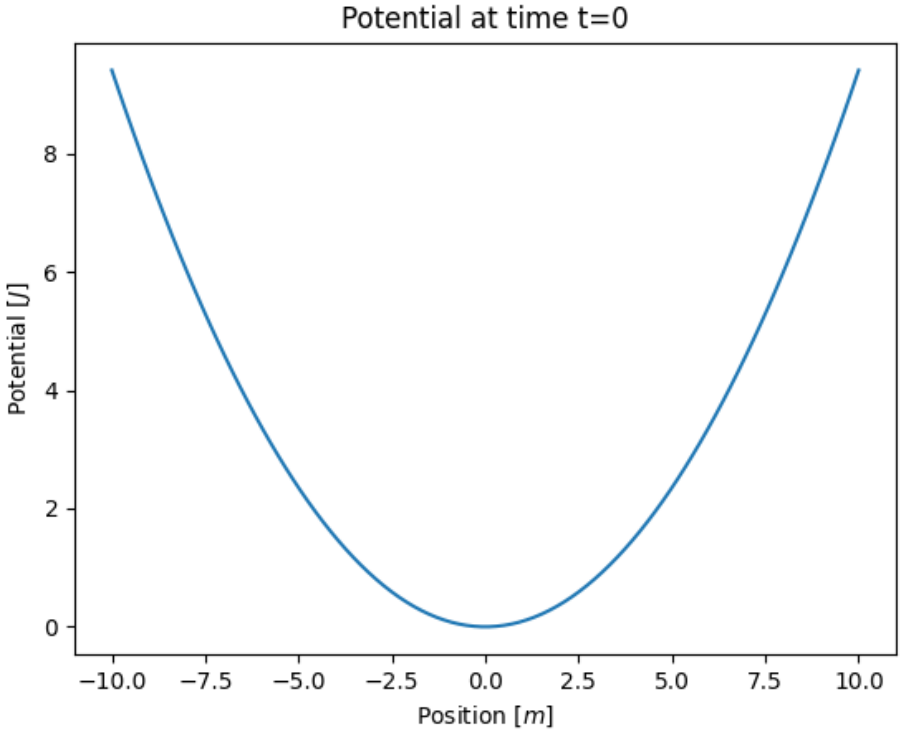
```
N: 1400                         U0: -0.000                      a0: 1.518

a0_over_healingLength: 1.000    baseDensity: 10000.000          bohrRadius: 0.000

dispersionLength: -0.000        dispersionLength_over_bohr: -23.300     dt: 0.100

dx: 0.200                       g: -0.000                       hbar: 1.000

healingLength: 1.518            mass: 1.000                     plotFPS: 1000.000

plotPause: 0.001                plotStep: 10                    plotYMax: 2

plotYMin: -2                    potentialW: 0.434               psi0: 100.000

r: 2.500                        tCount: 200                     tMax: 20

tMin: 0                         velocity: 0.000                 x0: 7.000

xCount: 100                     xMax: 10                        xMin: -10
```

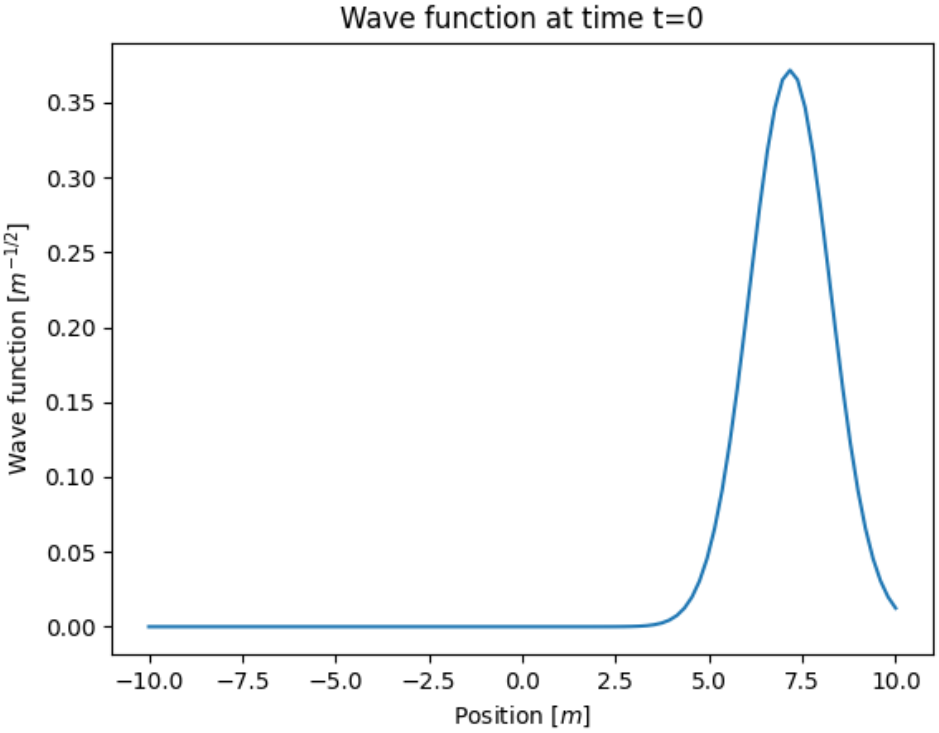
Wave function:

```
def waveFunction(x, t, constants):     w = constants["potentialW"]     m =

constants["mass"]     hbar = constants["hbar"]     x0 = constants["x0"]

const = (m * w / (hbar * jnp.pi)) ** (1 / 4)     exponential = jnp.exp(-m * w *

(x - x0) ** 2 / (2 * hbar))     return const * exponential
```

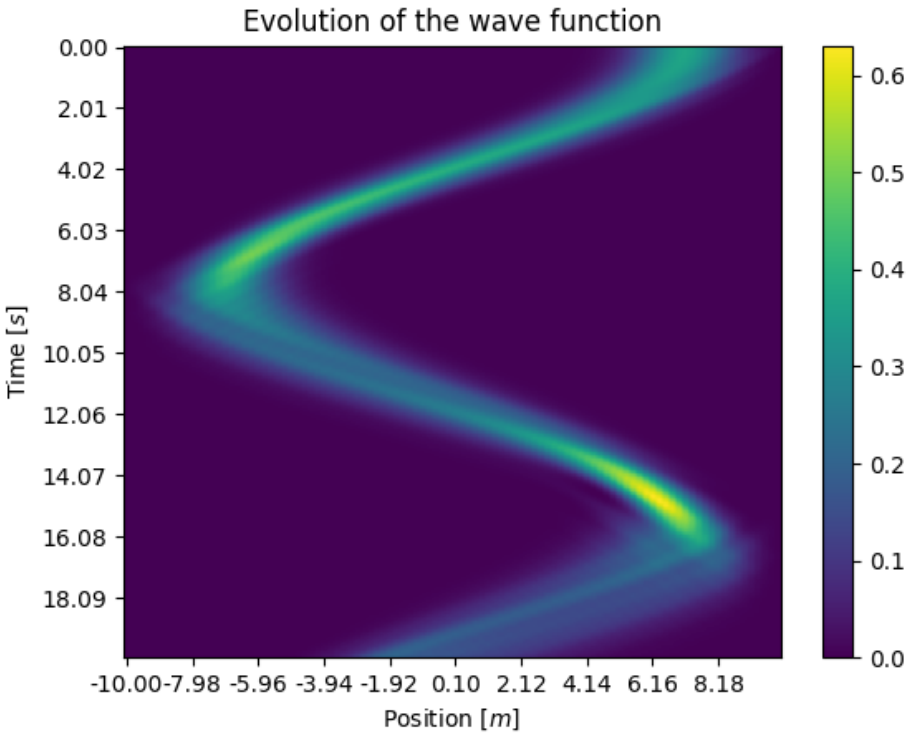
Potential function:

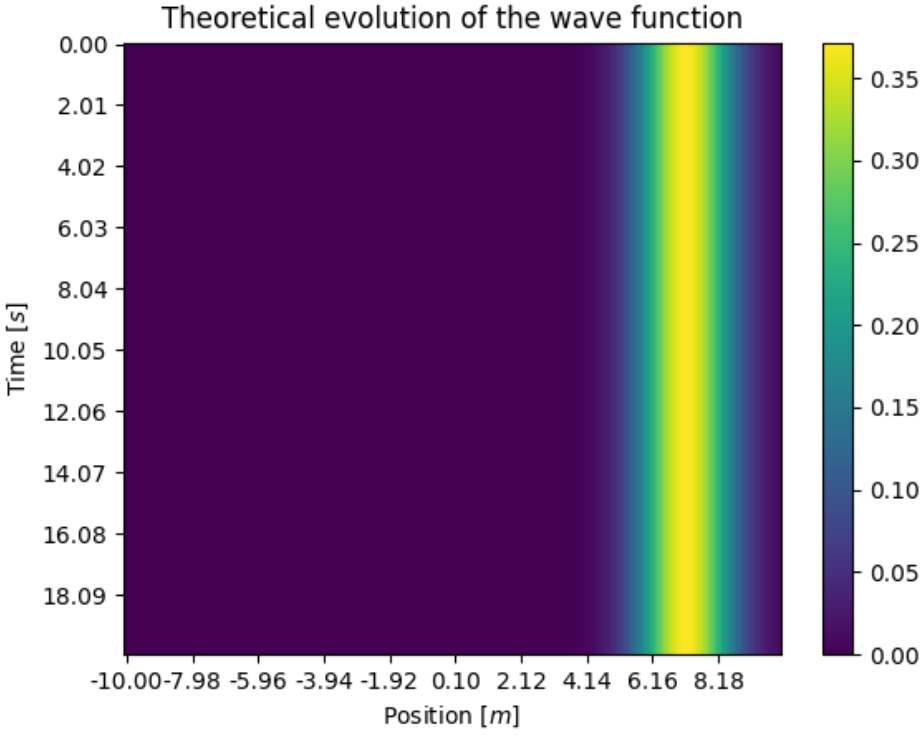
```
def V(x, t, constants):     """     The potential energy function.     """     #

The width of the harmonic oscillator potential.     w = constants["potentialW"]

# The mass of the particle.     m = constants["mass"]     # The potential energy

at the given position and time.     return m * w**2 * x**2 / 2
```

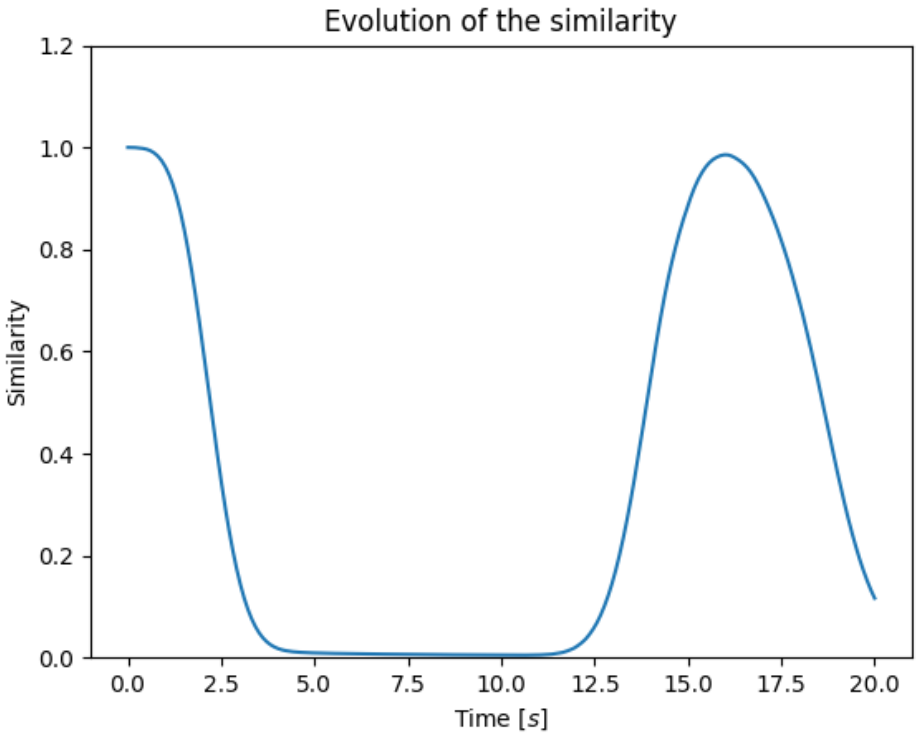

Potential at time t=0
Potential [J]
0
2
4
6
8
−10.0
−7.5
−5.0
−2.5
0.0
2.5
5.0
7.5
10.0
Position [m]

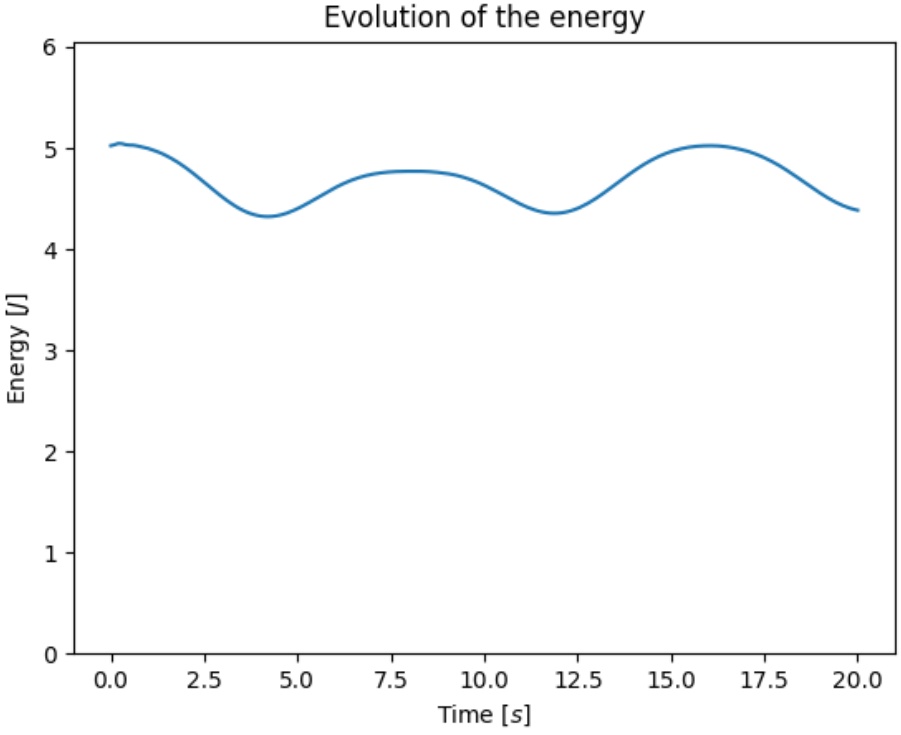

Wave function at time t=0
Wave function [m^-1/2]
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
−10.0
−7.5
−5.0
−2.5
0.0
2.5
5.0
7.5
10.0
Position [m]

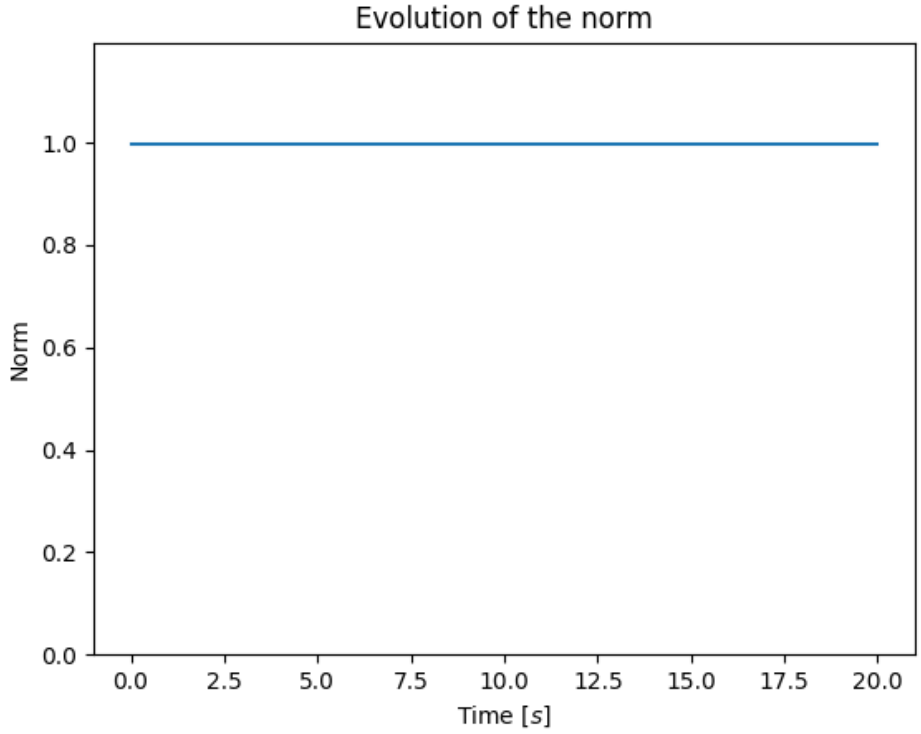
# Results


Evolution of the wave function
Time [s]
0.00
2.01
4.02
6.03
8.04
10.05
12.06
14.07
16.08
18.09
-10.00 -7.98 -5.96 -3.94 -1.92 0.10 2.12 4.14 6.16 8.18
Position [m]
0.6
0.5
0.4
0.3
0.2
0.1
0.0


Theoretical evolution of the wave function
Time [s]
0.00
2.01
4.02
6.03
8.04
10.05
12.06
14.07
16.08
18.09
-10.00 -7.98 -5.96 -3.94 -1.92 0.10 2.12 4.14 6.16 8.18
Position [m]
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00


Evolution of the similarity
Similarity
Time [s]
0.0
0.2
0.4
0.6
0.8
1.0
1.2
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0


Evolution of the energy
Energy [J]
Time [s]
0
1
2
3
4
5
6
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0


Evolution of the norm
Norm
1.0
0.8
0.6
0.4
0.2
0.0
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
Time [$s$]