Computer Homework 19 Magnetic trap (physics behind aurora)

In the demo, you have a proton in a magnetic field BB = (0, 1T, 0). With the initial velocity in #1, the proton will have a helical trajectory within the magnetic field. Watch this demo carefully.

Homework: Now replace the magnetic field to be the one generated by a magnetic dipole (rewrite #2), use #3 for a different initial velocity, and observe the trajectory of the proton. What is the time between two adjacent return points closest to the south pole?

```
from visual import *
q = 1.6 * 10 ** -19
dt = 1*10**-12
BNP = vector(0, -1*10**-8, 0)
BSP = vector(0, 1*10**-8, 0)
Bcharge = 10**-16
mass = 1.67 * 10 ** -27

def B(r):
    BB = (0,1,0)    #2 replace this by the magnetic field generated by magnetic dipole
    return BB

scene = display(title='Lorentz force', width=600, height=600, background=(0.5,0.5,0))

atom = sphere(pos=(0,0,1*10**-8),radius=10**-10,color=color.green)      #4 initial position
N = sphere(pos=BNP,radius=10**-9,color=color.blue)
S = sphere(pos=BSP,radius=10**-9,color=color.red)

atom.velocity = vector(2*10**-2, 10**-3, 0)                  #1
#atom.velocity = vector(1*10**-2, 90*10**-3, 0)              #3 different initial velocity
atomtrail = curve(color=atom.color)

while true:
    rate(30000)
    atomtrail.append(pos=atom.pos)
    a =    q * cross(atom.velocity , B(atom.pos)) / mass
    atom.pos = atom.pos + atom.velocity * dt
    atom.velocity = atom.velocity + a * dt
```