auroras

April 5, 2018

This code models and shows a single particle moving in a constant magnetic field. The plan is to change the way it's coding a single particle from how it's currently actually making many particles to having a single particle leave a trail. Also we plan to combine this code with the code for a dipole magnetic field to show a particle moving in something like Earth's magnetic field.

In [1]:
```
from vpython import *

        particles=[]
        dt=0.01
        B = vector(0,-1,0)  #B field going straight down
        t = 0
        tf = 100000
```

```
<IPython.core.display.Javascript object>


<IPython.core.display.Javascript object>


<IPython.core.display.Javascript object>


<IPython.core.display.Javascript object>


<IPython.core.display.Javascript object>


<IPython.core.display.Javascript object>


<IPython.core.display.HTML object>


<IPython.core.display.Javascript object>
```

In [3]:
```
#make arrows that show B field
B0 = vector(0,-1,0)

xmax = 50
dx = 5
y = 5

bscale = 30

for x in arange(-xmax, xmax+dx, 2*dx):
    for z in arange(-xmax, xmax+dx, 2*dx):
        arrow(pos=vector(x,y,z), axis=B0*bscale, shaftwidth= 0.25, color=color.white)
```

In [4]:
```
#particle=sphere(pos=vector(0, 0, 0),radius=1.5,color=color.cyan)# make_trail = True)
#particle.make_trail = True

def makeparticle(position,velocity):
    newparticle=sphere(pos=position,radius=1.5,color=color.cyan)
    newparticle.velocity=vector(velocity)
    particles.append(newparticle)
```

In [5]:
```
scene.autoscale = False
```

In [6]:
```
position = vector(0,0,0)
velocity = vector(1,-1,0,)
q = 1.0

while t < tf:
    ''' attempt at making a trail on a single particle instead of make a ton of parti
    #lorentz force
    acc+=cross((q*velocity), B)
    #acc += vector(5,0,0)
    velocity += acc*dt
    particle.pos += velocity*dt
    t += dt
    #print(particle.pos)
    '''
    #still trying to figure out how to add a trail to a particle
    #right now this makes a new particle over and over again
    makeparticle(position, velocity)
    for thisparticle in particles:
        acc=vector(0,0,0)
        #lorentz force
        acc+=cross((q*thisparticle.velocity), B)
        #updating velocity and position of particle
        thisparticle.velocity+=acc*dt
        thisparticle.pos+=thisparticle.velocity*dt
        t += dt
```

```
        scene = canvas(title='Particle moving in B field')
```

```
<IPython.core.display.HTML object>
```

```
<IPython.core.display.Javascript object>
```