Précession du périhélie de Mercure

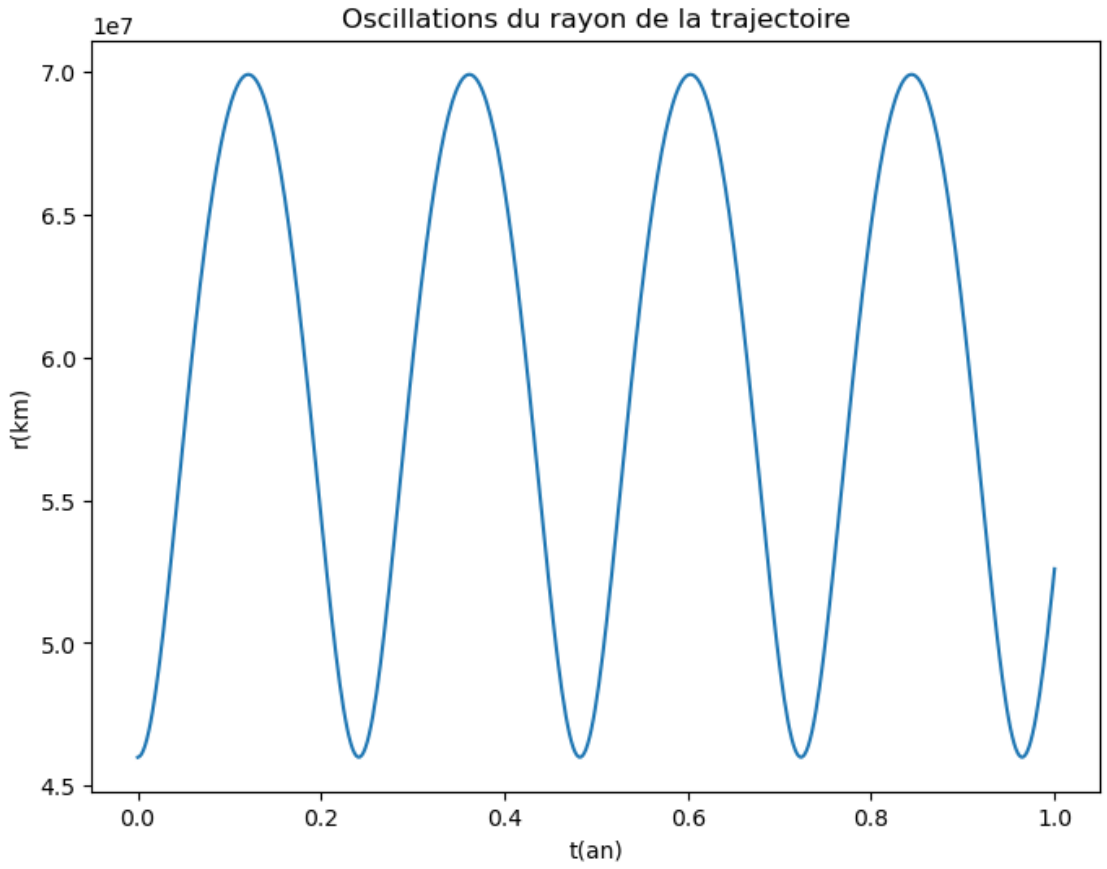
[1]:
```
import numpy as np
import matplotlib.pyplot as plt
from scipy.integrate import odeint
```

[2]:
```
rP=46e9
vP=59e3
thPp=vP/rP
C=rP**2*thPp
print(C)
```

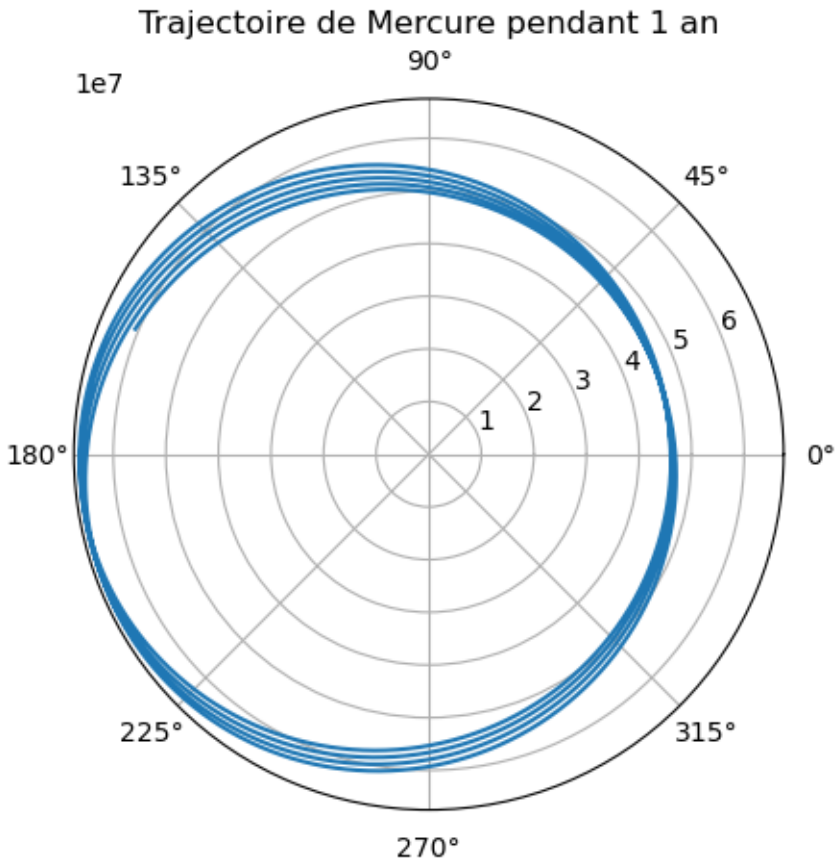
```
2714000000000000.0
```

[3]:
```
G=6.67e-11
MS=1.99e30
m=3.3e23
alpha=8.7e10
an=365.25*24*60*60
```

[4]:
```
def derivee(inc,t):
    r,rp=inc
    rpp=C**2/r**3-G*MS*(1/r**2+3*alpha/r**4)
    return [rp,rpp]
ci=[rP,0]
tab_t=np.linspace(0,1*an,500)
sol=odeint(derivee,ci,tab_t)
tab_r=sol[:,0]
plt.figure(figsize=(8,6))
plt.plot(tab_t/an,tab_r/1000)
plt.xlabel("t(an)")
plt.ylabel("r(km)")
plt.title("Oscillations du rayon de la trajectoire")
plt.show()
```



[5]:
```
alpha=2e19
def derivee(inc,t):
    r,rp,th=inc
    rpp=C**2/r**3-G*MS*(1/r**2+3*alpha/r**4)
    thp=C/r**2
    return [rp,rpp,thp]
ci=[rP,0,0]
tab_t=np.linspace(0,1*an,10000)
sol=odeint(derivee,ci,tab_t)
tab_r=sol[:,0]
tab_theta=sol[:,2]
plt.figure()
plt.polar(tab_theta,tab_r/1000)
plt.title("Trajectoire de Mercure pendant 1 an")
plt.show()
```


Trajectoire de Mercure pendant 1 an
90°
1e7
135°
45°
6
5
4
3
2
1
180°
0°
225°
315°
270°

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