NumPy

Python for Physics
Lab -7

Electricity and Magnetism

Coulomb Force between Charges

Coulomb law for two point charges:

$$F = \frac{kq_1q_2}{r^2}$$

In [593]:
```
ep = 8.854* 10**-12
k = 1/(4*np.pi*ep)
q1 = -1* 10**-13
q2 = +2* 10**-10
r = np.arange(-15,15, 0.5)

F = (k*q1*q2)/(r**2)
```

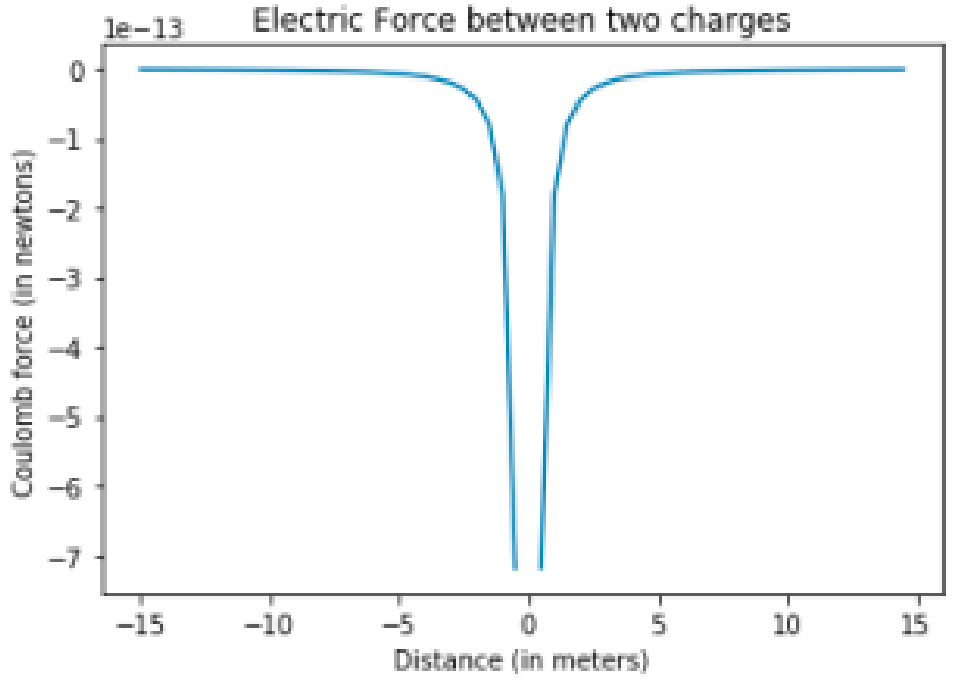
```
plt.plot(r,F)
plt.xlabel('Distance (in meters)')
plt.ylabel('Coulomb force (in newtons)')
plt.title('Electric Force between two charges')
```

```
D:\anaconda\lib\site-packages\ipykernel_launcher.py:7: RuntimeWarning:
divide by zero encountered in true_divide
  import sys
```

```
Text(0.5,1,'Electric Force between two charges')
```

```
import sys
```

Out[593]: Text(0.5,1,'Electric Force between two charges')



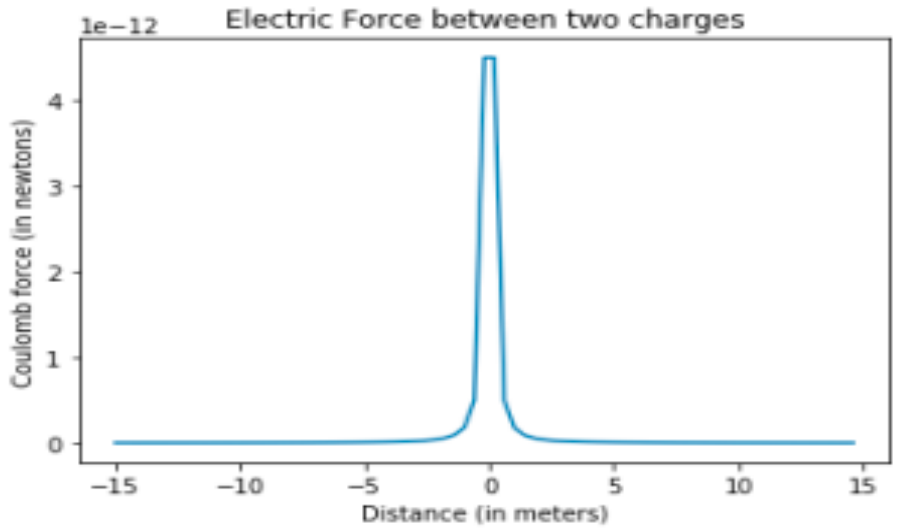
```
4]: ep = 8.854* 10**-12
    k = 1/(4*np.pi*ep)
    q1 = +1* 10**-13
    q2 = +2* 10**-10
    r = np.arange(-15,15, 0.4)

    F = (k*q1*q2)/(r**2)

    plt.plot(r,F)
    plt.xlabel('Distance (in meters)')
```

```
plt.ylabel('Coulomb force (in newtons)')
plt.title('Electric Force between two charges')
```

```
Out[594]: Text(0.5,1,'Electric Force between two charges')
```



Gravitational Force

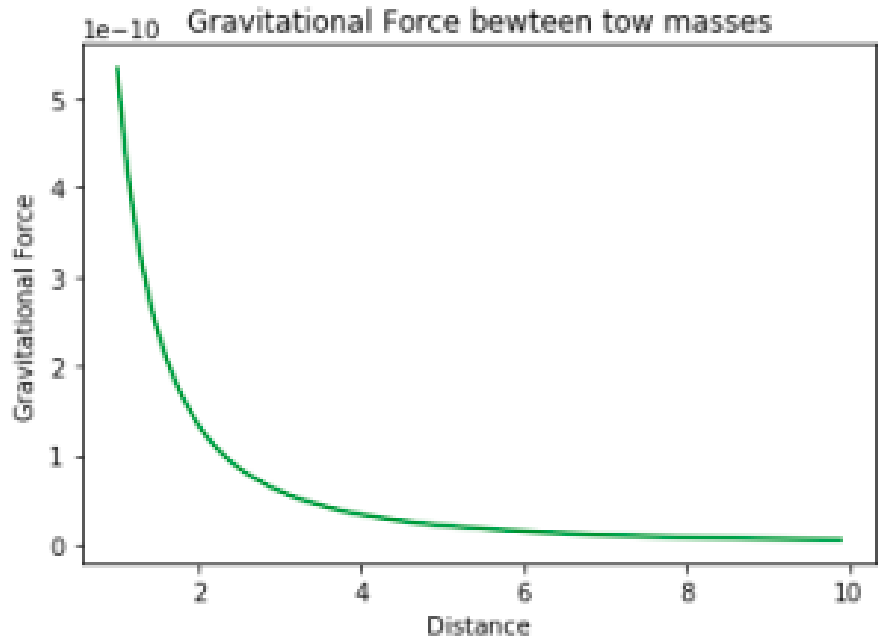
This program calculates and displays the Gravitational Force between two masses:

$$F = \frac{Gm^1m^2}{r^2}$$

In [596]:
```
import matplotlib.pyplot as plt
import numpy as np

# define function of gravitational force
def grv_force(r):
    G = 6.67*10**-11
    gf = (G*2*4)/(r**2)
    return gf
r = np.arange(1, 10, 0.1)
```

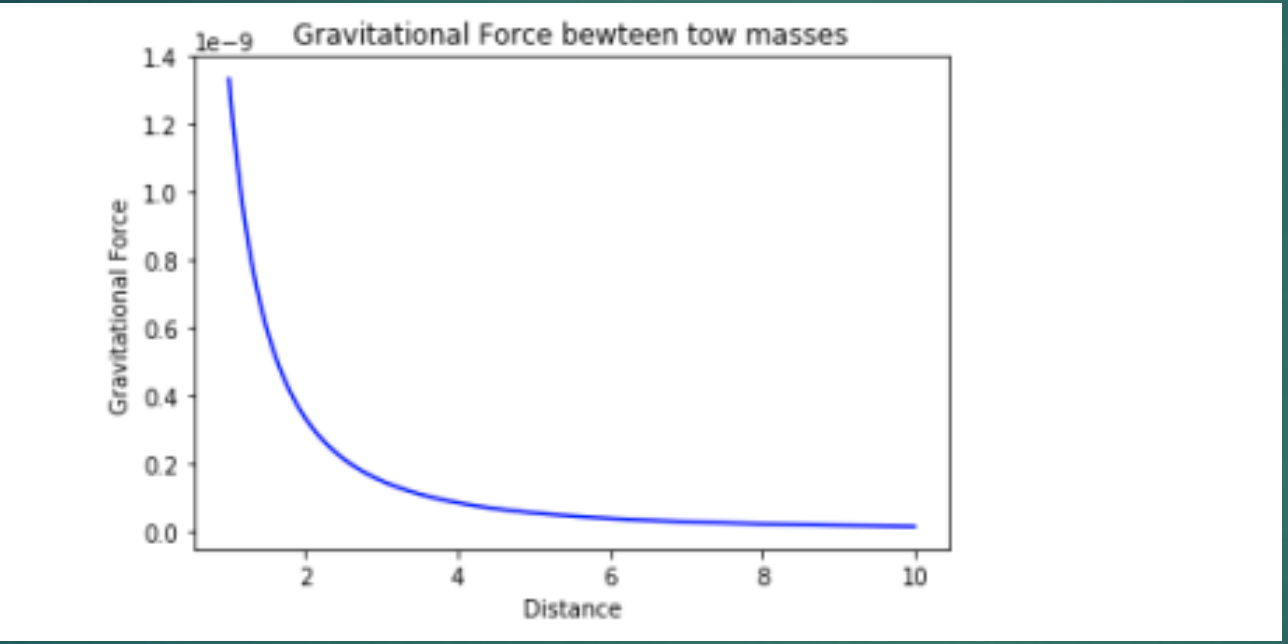
```
plt.plot(r, grv_force(r), 'g')
plt.xlabel('Distance')
plt.ylabel('Gravitational Force')
plt.title('Gravitational Force bewteen tow masses')
plt.show()
print (r,grv_force(r))
```



In [597]:

```
import matplotlib.pyplot as plt
import numpy as np

# define function of gravitational force
def grv_force(r,m1,m2):
    G = 6.67*10**-11
    gf = (G*m1*m2)/(r**2)
    return gf
r = np.arange(1, 10, 0.01)
plt.plot(r, grv_force(r,4,5), 'b')
plt.xlabel('Distance')
plt.ylabel('Gravitational Force')
plt.title('Gravitational Force bewteen tow masses')
plt.show()
#print (r,grv_force(r))
```


Gravitational Force bewteen tow masses
1e−9
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Gravitational Force
2
4
6
8
10
Distance