Coulomb's Law and Exercise 2.4

April 26, 2023

[8]:
```
#Coulombs Law Problem
#Given two charges, q_1 and q_2, calculate the force on each charge if they are␣
 ↪r away from each other.
#Write a python code to find the value of the force for q_1 = +1.3×10-8 C, q_2␣
 ↪= +4.3×10-8 C, and r = 2×10-2 m.

#Coulomb's law F=k(q1*q2)/r^2

#Constants
k=8.99e9

#Input values
q1=float(input("What is the value of the first charge? "))
q2=float(input("What is the value of the second charge? "))
r=float(input("What is the value of distance between the charges (r)? "))

#Used to check for correct value input
print(q1)
print(q2)
print(r)

#Calculates force
charge_force= (k*q1*q2)/(r**2)

#Prints calculated force to 4 decimals
print("The force is", f'{charge_force:.4f}', "newtons.")
```

```
What is the value of the first charge? 1.3e-8
What is the value of the second charge? 4.3e-8
What is the value of distance between the charges (r)? 2e-2
1.3e-08
4.3e-08
0.02
The force is 0.0126 newtons.
```

[14]:
```
#Exercise 2.4
#Write a program to calculate the time in years that it takes a spaceship to␣
 ↪reach it's destination
```

```
# a) in the frame of reference of the of an observer on earth and b) in the␣
 ↪frame of reference as
# percieved by a passenger on board the ship
import math as math
#Ask for inputs
fast_speed=float(input("How fast is your spaceship traveling (eg. .99c, .8c,␣
 ↪etc...)? "))
light_dist=float(input("How far in light-years are you traveling? "))

#print(fast_speed, light_dist)

#Calculate time in the reference frame of an observer on Earth

time_earth= light_dist/fast_speed
print("Time for the earthbound observer is", f'{time_earth:.2f}', 'years.')

#Calculate time in the reference frame of an observer on the spaceship

#Calculate gamma
gamma=(1)/math.sqrt(1-(fast_speed/1)**2)

#Calculate time in the reference frame of the ship using the Lorentz␣
 ↪transformation
#t'=gamma(t- ux/c)
time_ship=gamma*(time_earth -((fast_speed*light_dist)/1**2))

#Print time as observed on the ship, it should be lower than time observed on␣
 ↪earth because 'moving clocks run slow'
print("The time for the spaceship bound observer is" ,f'{time_ship:.2f}',␣
 ↪"years." )
```

```
How fast is your spaceship traveling (eg. .99c, .8c, etc…)? .99
How far in light-years are you traveling? 10
Time for the earthbound observer is 10.10 years.
7.09
The time for the spaceship bound observer is 1.42 years.
```

[ ]: