Project 3 - FYS3150*

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An abstract

I. INTRODUCTION

An introduction.

II. THEORY AND METHODS

A. Newton's law of gravitation

Newton's law of gravitation states for two objects of mass m_1 and m_2, the force on object 1 from object 2 is given by [1],

$$\boldsymbol{F_{1,2}} = \frac{Gm_1m_2}{r^2}\boldsymbol{u_r} = \frac{Gm_1m_2}{r^3}\boldsymbol{r} \tag{1}$$

where G is the gravitational constant and $\boldsymbol{u_r} = \boldsymbol{r}/r$ is a radial unit vector. $\boldsymbol{r}$ is a radial vector pointing at object 2 and $r = |\boldsymbol{r}|$ is the distance. Newton's third law gives us that the force on object 2 from object 1 is $\boldsymbol{F_{2,1}} = -\boldsymbol{F_{1,2}}$. Newton's third law gives us the differential equation governing the motion of object 1

$$\ddot{\boldsymbol{r(t)}} = \boldsymbol{a(t)} = \boldsymbol{F_{1,2}}(t, \boldsymbol{r(t)})/m_1, \tag{2}$$

where $\boldsymbol{a}$ is the acceleration, and we can solve this equation to find the motion $\boldsymbol{r(t)}$. For a two-body system this equation will produce closed elliptical orbits around a common center of mass.
If we assume that the orbit of object 2 around object 1 is circular we know that the force obeys the following equation

$$F_{2,1} = \frac{Gm_1m_2}{r^2} = \frac{m_1v_1^2}{r}, \tag{3}$$

which implies that

$$v_1^2 r = Gm_2. \tag{4}$$

Introducing 1 AU $= 1.5 \cdot 10^{11}$m

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B. The second part

$$1 = 1 \tag{5}$$

C. The third part

A reference

III. RESULTS AND DISCUSSION

A. First subpart

An equation reference

B. Second subpart

More text.

IV. CONCLUSION

Do stuff.

V. APPENDIX

All code used is available at: The programs used in this project are listed in this section:

main.cpp: Program1

plot.py: Program2

[1] All theory in this project adapted from FYS3150 Project 3 (Fall 2016) *linkname*.