Physics 235, Extra Credit Homework Set 02

Write the following text on the front cover of your homework assignment and sign it. If the text is missing, 20 points will be subtracted from your homework grade.

Honor Pledge for Graded Assignments
"I affirm that I have not given or received any unauthorized help on this assignment, and that this work is my own."

_____

_____

_____

Signature _____

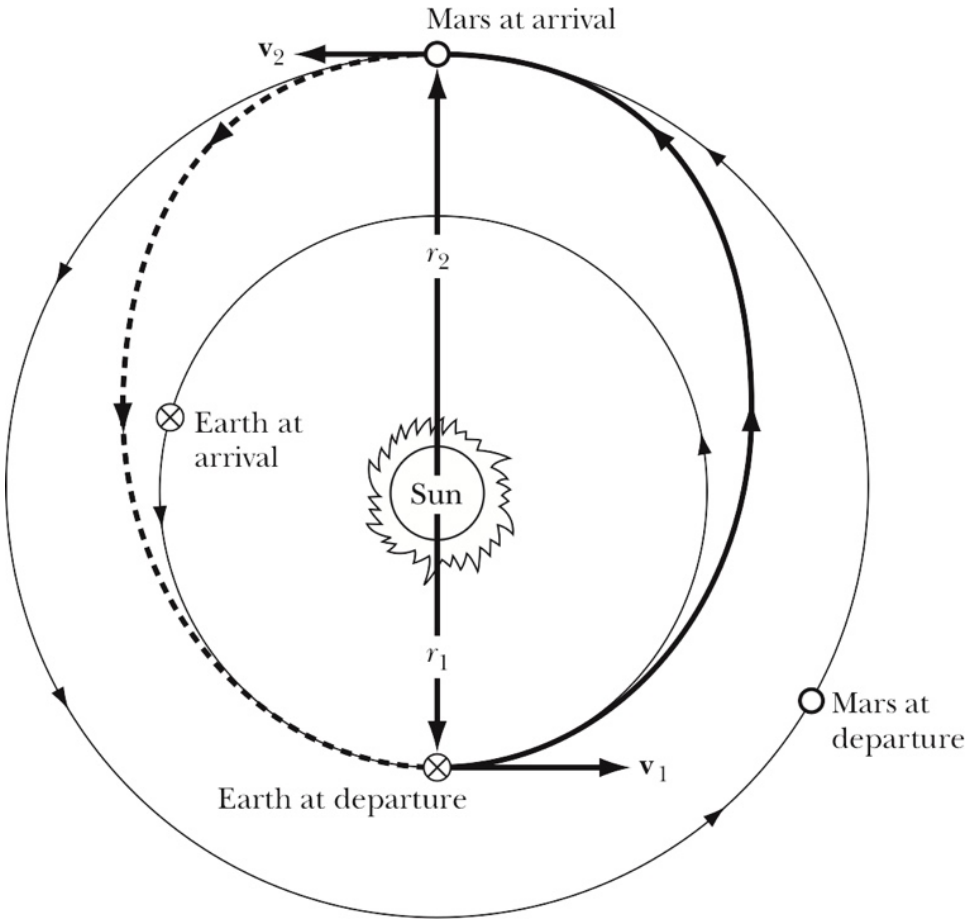
In this assignment, we simulate the orbital motion of the Earth and Mars and determine the time required to travel from Earth to Mars.
The script of orbital motion of the Earth around the Sun can be found at the following URL:

https://www.glowscript.org/#/user/wolfs/folder/Public/program/OrbitalMotion/edit

a) Add the orbital motion of Mars to this script and use realistic values of the distance and velocity of Mars. Include only the influence of the sun on Mars to determine its orbit. Make sure that you check the step size you use for these simulations.

b) Now include the force between the Earth and Mars in your simulations. Compare the details of the orbit of Mars obtained in this manner with the orbit you obtained in part a).

c) Now consider the launch of a rocket from Earth with the goal of reaching Mars. We will consider the Hohman transfer for this trip (see Figure on the following page). The launch of the rocket gives it an extra velocity in the direction of motion of the Earth. Simulate the launch of this rocket and follow it trajectory after launch. Determine the extra velocity you need to give the rocket in order to reach the orbit of Mars. Note your target is that when the rocket reaches the orbit of Mars, the direction of its velocity is the same as the direction of the velocity of Mars (see Figure on the following page).



d) Determine the time required to travel from Earth to Mars.

e) We can use the same technique to travel back to Earth. Determine the required velocity of the rocket when it leaves Mars in order to return to Earth. Note your target is that when the rocket reaches the orbit of Earth, the direction of its velocity is the same as the direction of the velocity of the Earth (see Figure above). How long does it take to return to Earth? How does this compare to the time required to reach Mars?

Submit the actual program used in parts c) and d) and the graphs and your conclusions for parts a) – c) via email to Professor Wolfs (wolfs@pas.rochester.edu). If you develop the program in ghostscript, you can also submit the URL as long as your programs are in a public folder. The name of the file with the program should be should be ExtraHW02Phy235XXYYYYYYYY.py where XX is your last name and YYYYYYYY is your student id number and the subject of your email should start with ExtraHW02Phy235XXYYYYYYYY where XX is your last name and YYYYYYYY is your student id number.