Physics 235, Extra Credit Homework Set 03

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."

_____

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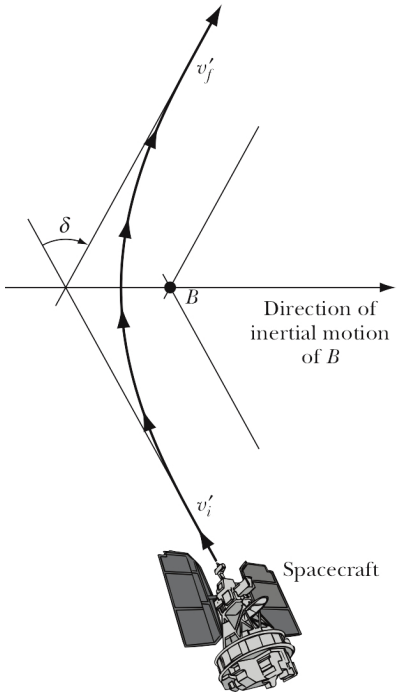
Signature _____

In this assignment, we simulate the gravitational assist when a spacecraft flies by the Earth. The Earth has a mass of 5.97 x 10^{24} kg and its orbital speed is 108,000 km/h.



Physics 235 Due: noon, December 10, 2021
Extra Credit Homework Set 03

Consider a spacecraft that uses the gravitational assist of the Earth to change its direction and its speed, as shown in the Figure (assume the Earth is located at *B* and the orbital velocity is pointing in the direction shown in the Figure). Ignore the rotation of the sun around the center of the Milky-Way galaxy.

Use numerical simulations (e.g. using glowscript.org) to explore the gravitational assist of the spacecraft and show how its speed and direction changes as function of time as the spacecraft passes the Earth. Explore how the final velocity (magnitude and direction) changes as function of the initial velocity of the spacecraft.

Modify the simulation developed above to explore how the gravitational assist changes when the spacecraft passes the Earth on the right-hand side in the Figure above instead of on the left-hand side. Explore how the final velocity (magnitude and direction) changes as function of the initial velocity of the spacecraft.

Note: for each simulation, make sure you use the proper time step (verify that your results are not sensitive to the time step you used).

Submit the actual programs used 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 ExtraHW03Phy235XXYYYYYYYY.py where XX is your last name and YYYYYYYY is your student id number and the subject of your email should start with ExtraHW03Phy235XXYYYYYYYY where XX is your last name and YYYYYYYY is your student id number.