SP3176 The Universe Assignment 1
JUPITER'S MOON AND THE SPEED OF LIGHT

In this assignment, we will use Stellarium to observe Jupiter and its moon Io, and use the data to calculate the speed of light.

For an introduction to the pioneering work by Ole Christensen Rømer, read

https://en.wikipedia.org/wiki/R%C3%B8mer%27s_determination_of_the_speed_of_light.

In Stellarium, in the "Sky and viewing options window", check "Simulate light speed".

Set the location to Singapore. Date and Time to 16 Jan 2018, 5:0:0.

Search for Jupiter (you can find it in the "List" of " Solar System" objects).

Control the time (by clicking the up and down hour/minute arrow).

Zoom in, center and lock Jupiter in view by clicking on it and press spacebar. (This is a useful step which you'll probaby do often in this assignment.)

Increase the time by the minute. You will see the emergence of Io from behind Jupiter. Play around with the time, zoom, (click on Jupiter and press spacebar if it runs away), and observe the phenomenon.

We are now ready to collect the data for the speed of light calculation!

Find **two** events of the emergence (or immersion) of Io that are a few months apart. In each event, record the **distance of Jupiter**, and the **time of emergence** (or immersion).

Given that the (synodic) period of Io is 1.769861 days. Predict the time of the later event emergence based on the time and date of the earlier event. [You may find it convenient to convert the date and time into Julian Days using https://www.aavso.org/jd-calculator]

If the Earth-Jupiter distance for the later event is shorter than the earlier event, the actual event should occur earlier than the above predicted time. The converse is true as well.

Let

$$\Delta D = \text{Difference in Earth-Jupiter distance for the two events}$$

and

$$\Delta t = \text{Difference in predicted time and actual time of the later event}$$

The speed of light is then simply calculated by

$$c = \frac{\Delta D}{\Delta t}.$$

[Note: It is OK if your calculated speed of light differs from the currently known value! I (zhihan) did the assignment myself and my value sucks..]

Do more? Yes please do a few more pairs of observations if you are kiasu!

Discuss.

Administrative details

This assignment is to be done individually, and holds 5% weightage of the total assessment for The Universe.

A report not exceeding 500 words and 2 pages (figures and references inclusive), providing **brief** accounts of the background, theory, method, results and discussion, will be submitted. There is no need for an elaborate and extended report.

File name for the assignment submission: A1_A#######X.pdf where A#######X is your matric number.

Submission: Week 4 Saturday