The study of the moon's orbit by Kepler's second law

Sidarat Khamphakdee ; sidarat.6944@gmail.com
Princess Chulabhorn Science High School Mukdahan
281 Moo 6, Bang Sai Yai, Muang, Mukdahan, Thailand. 49000
Adviser : Niwat Worasan ; watpoojan@hotmail.com

Abstract

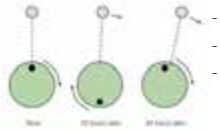
This research is about the moon's orbit and Kepler's Second Law. The purposes of this study are 1) to study about the relation between the moon's orbit and Kepler's Second Law. 2) to study about the relation between angular velocity of the moon and Kepler's Second Law. The result of this study reveals the moon's orbit be in line with Kepler's Second Law.

Introduction

Kepler's Second Law (the law of equal areas) is the law describing the motion of planets around the Sun that says "The radius vector sweeps equal areas in equal times".

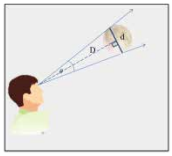
Materials and Method

1. Measure the angle of the moon as the Moon shifts on orbit in equal time

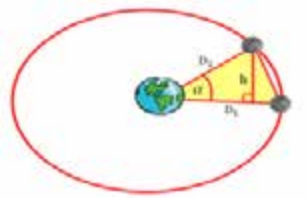


- Observe time when the Moon is on meridian in each day.
- Calculate the angle of the Moon as it shifts orbit.
- Calculate the angle that the Moon's shift in equal time by comparing angular velocity, in following with Kepler's Second Law.

2. Measure the distance of the Moon by using angular distance



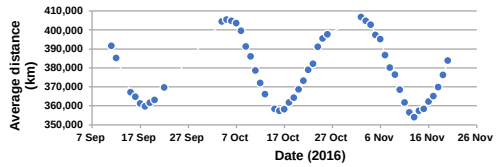
- Take 5 pictures of the Moon when it is on meridian in each day. Then take a picture of Pleiades (M45) to evaluate the angular diameter of view from camera.
- Use Adobe Illustrator CS6 program to find the diameter of the Moon from pictures taken to calculate the angular diameter of the Moon.
- Calculate the distance of the Moon by using angular distan



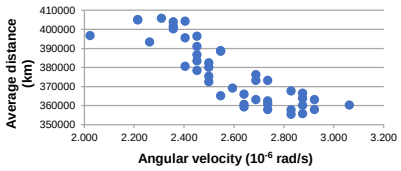
3. Calculate triangle areas of the Moon as it sweeps on orbit
4. Calculate the angular velocity of the Moon and analyze the significance of the data with Kepler's Second Law.

Results and Discussion

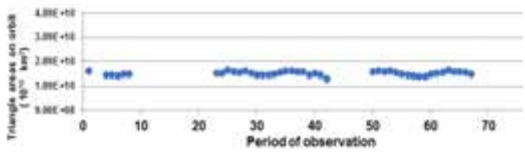
Graph 1: Show the average distance of the Moon in each day



Graph 2: Show the relation between the average distance and the angular velocity of the Moon



Graph 3: Show triangle areas of the moon's orbit in each equal time



Conclusions

For triangle areas on the Moon's orbit in each equal time, average triangle area is 1.619×10^{10} km^2. It has a standard deviation 7.400×10^{8} km^2 which is 4.55 % of the average triangle area. The angular velocity of the moon has an average of 2.525×10^{-6} rad/s. In conclusion, the angular velocity of the moon inversely impact the distances of the moon which is in accordance with Kepler's Second Law.

Acknowledgment

I would like to thank Mr. Niwat Worasan, Ms. Ladda Deesuan, Mr. Matipon Tangmatitham and the National Astronomical Research Institute of Thailand (Public Organization).

Reference

Matipon Tangmatitam. (2013). The Handbook of Astronomic Workshop, Chiang Mai: Educational Astronomic Information Service Center.