Measuring the orbital period and eccentricity of the moon by Its apparent size

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Abstract

In this research, the moon's orbital period and orbital eccentricity were studied. By observing the moon each day using a digital DSLR camera connected to the Dobsonian telescope 10 inches width. Calculate angular apparent size relative to the fixed two stars and find the distance from earth relative with the size. Plot a graph between distance and each day, a graph is periodic function as wave. After analyzing the graph, it was found that the average angular moon's size is 0.52°, the average distance from the earth is equal 384,151.7 kilometers, the moon's orbital period (T) is equal 28.95 days, and the moon's orbital eccentricity is equal 0.0582

Introduction

According to the moon's orbit is not a circle, due to Kepler's 1st law of planetary motion. So the distance from the earth is not constant, when the moon orbits close to the earth it is larger and farther away from earth the size is smaller. If we observe and calculate the moon's size every day for a month and find the distance relative with the size, so we can determine such as the moon's orbital period, which is at the origin of this project.

Materials and Method

1. Taking photo of the moon.
2. Calculate the angular size $\emptyset$.
3. Find the distance S ; $tan\emptyset = \frac{D}{S}$ when D is moon's diameter.
4. Plot graph between distance and sequence of days.

Results and Discussion
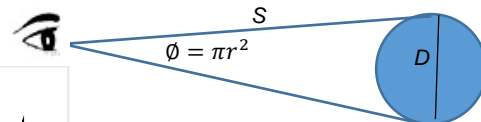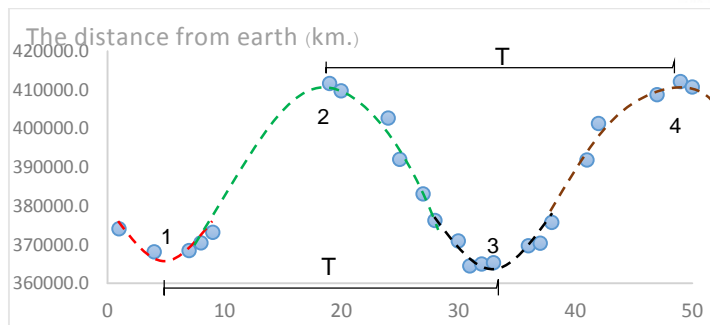
Add trendline with polynomial equation.

1. y = 387.13x² - 4000.8x + 377703
2. y = -406.91x² + 15197x + 269367
3. y = 450.82x² - 29846x + 858664
4. y = -294.42x² + 28649x - 285656

Calculate the max. and min. values by differentiate the equations and the orbital period(T) can be found.

Conclusions

-The average angular size of the moon is 0.52 degrees.
-The average distance from the earth is equal 384,151.7 kilometers. The error about 0.07 %
-The moon's orbital period (T) is equal 28.95 days which the error about 2.98 %.
-Analyze the moon's orbital eccentricity from the perigee 366025.35 kilometers and apogee 411268.4 kilometers is equal 0.0582. The error about 6.01%.

Acknowledgment

Reference

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