The Study of Jupiter's Density

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Abstract

The purpose of this research is to study the density of Jupiter by dividing the mass by the volume of Jupiter. The mass of Jupiter is derived from the moon's orbit. The mass is calculate a according to the Kepler equation . The volume of Jupiter is derived from photograph taken to scale . From the photographs we can measure the diameter on the X-axis and Y-axis to ditermin the fatness of the Jupiter and the represent the Jupiter's volume in the oval volume formular.

Introduction

Jupiter is the fifth planet from the sun. And the largest. The total mass of planets is doubled. This planet looks like a gas group with no solid surface. Internal components are high density gas.

Materials and Method

1. Finding Jupiter Mass by Creating a Harmonic Simulation Io's Moon
   - Observe the Io's Moon movement around Jupiter.
   - Then create SHM equation.
   - Calculate the period of the Io's Moon as it shifts orbit.
   - Calculate the mass of Jupiter from the period with Kepler's Third Law.
2. Finding the volume of Jupiter.
   - Take 5 pictures of the Jupiter with Io Moon from camera.
   - Use Adobe Illustrator CS6 program to find the diameter of the X axis and Y axis of Jupiter from pictures taken to calculate the angular diameter of the Io Moon to Jupiter.
   - Calculate the volume of Jupiter using the oval volume formula.
3. Calculate the density of Jupiter using Mass divided by volume.

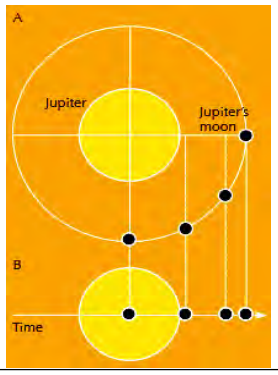
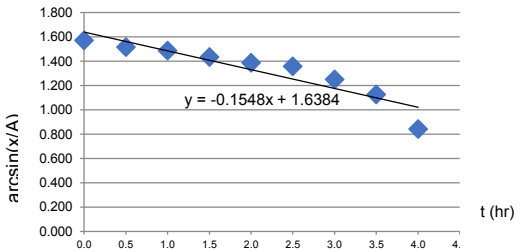


Fig 1 : The movement one of the Galilean moons around Jupiter: (A) as seen from above the orbit plane and (B) as seen from Earth (viewed parallel to the orbit plane). The black dots represent the Galilean moon's positions at equal intervals of time.

Results and Discussion

Graph 1 : The graph shows the relationship between time and t the change in position of the Moon Io. During orbit period.



Graphs show that the slope of the graph is 0.15 When compared to the SHM equation, the period of orbit of the Moon around Jupiter is 146,880 s.

Apply this value instead of the value in Kepler's formula. To find the mass as shown that.

$$T^2 = \frac{4\pi^2 a^3}{G(M+m)}$$

when T = 146,880 s , a = 422,000 Km , m = 8.93×10^{22} Kg, G = 6.67×10^{-11} $m^3/kg\ .s^2$ By substituting in the equation, the mass of Jupiter is equal to 1.215×10^{27} Kg.

Table 1 : Show the volume of Jupiter.

Picture	a (Km)	**b** (Km)	Flatness	Volume $(Km)^3$
1	9.59×10^4	5.75×10^4	0.37	1.32×10^{15}
2	7.67×10^4	5.75×10^4	0.21	1.06×10^{15}
3	9.59×10^4	5.75×10^4	0.37	1.32×10^{15}
4	1.15×10^4	7.67×10^4	0.21	2.83×10^{15}
5	9.59×10^4	5.75×10^4	0.37	1.32×10^{15}
average	9.59×10^4	6.13×10^4	0.26	1.51×10^{15}

Conclusions

Based on the results of Jupiter's mass and volume analysis, the two values were calculated or the density of Jupiter. The following formula is shown in the equation.Mass M = 1.215×10^{27} Kg, Volume V = 1.51×10^{15} $(Km)^3$ D = 1.06 g/cm^3. The standard density of Jupiter is 1.33 g/cm^3. Show that this method used to study the density of Jupiter is close to the standard.

Acknowledgment

I would like to thank Mr.Prachong Watthanachai, Mr.Chan Thaowannee, Mr.Matipon Tangmatitham and the National Astronomical Research Institute of Thailand (Public Organization).

Reference

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