A Study of Speed and period of the rotation of Saturn's ring

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Abstract

This study is to compare between the speed and the period of rotation surrounding the inner and outer rim of Saturn's ring by taking pictures of Saturn's ring spectrum and find the redshift and the blueshift. The objectives of this study are to (1) study the speed and the period of the rotation of Saturn's ring, (2) apply skill of science process and technology to search information needed, and (3) learn research process using astronomy research process. The research tool is a spectrograph form Thai National Observation, Nakhonratchasima province. The data are examined with the use of mean ($\overline{X}$) and standard deviation (S.D.). After studying, it can be seen that the rotation speed of the inner rim is 8.134 kilometers per second (S.D. = 0.668) and the period is 16.075 hours per round (S.D. 1.344). The rotation speed of the outer rim is 7.970 kilometers per second (S.D. = 1.161) and the time is 30.757 hours per round (S.D. = 4.277). It can be seen that the rotation speed of the inner rim of the Saturn's ring is more than the rotation speed of the outer rim, but the rotation period of the inner rim is less than the outer rim. It's consistent with the third Kepler's law.

Introduction

Saturn is an outer ring planet in the solar system. It is bigger than the earth nine times. When looking through a telescope, the ring surrounding the Saturn is seen. This is very stranger than other planets. It is so beautiful and outstanding that it is called 'the queen of astronomy'. The speed and period of the rotation of the inner rim and outer rim are very important and interesting topic.

Methods

1. Spectrum of Saturn's ring is taken pictures by the telescope by Mr.Samanchan Chandaiam, (Thai National Observation, Nakhonratchasima province.)

No. 1 : the surrounding of outer rim rotating to the earth

No. 2 : the surrounding of inner rim rotating to the earth

No. 3 : the surrounding of inner rim rotating out of the earth

No. 4 : the surrounding of outer rim rotating out of the earth

2. The data are assessed with the use of AudeLa program to study the redshift and the blueshift of the two rims by H-α wave spectrum and calculated by the following these equations :

(1) $v_r = \frac{\Delta\lambda}{\lambda} \times c$ (2) $v = \left(\frac{1}{4} v_r\right) \cos\theta$

When V_r = Speed radius

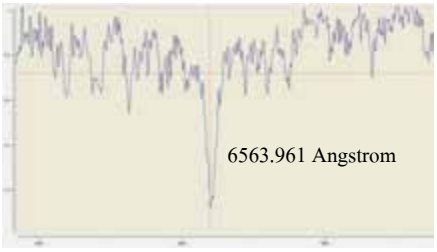
$\Delta\lambda$ = The different of wave length rounding rotating to and out of the Earth

λ = The wave length averaging surrounding rotating to and out of the Earth

c = Light speed (300,000 kilometers/second)

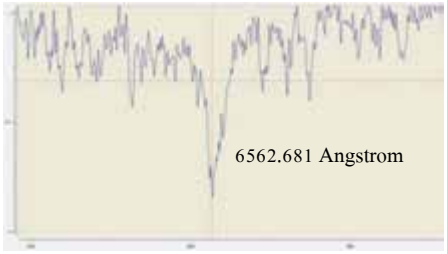
3. To find the one round of turning around rotation period of the ring is the length of the outer ring circle and the inner ring circle and divided by the speed found. After that it is changed into hour per round unit to find the rotation speed and time of all the ten rings each. And then the rotation speed and period are taken to find the average. Finally, the data are taken to calculate and compare, conclude and discuss.

According to the data analyzed with the use of the program, the H-α wave length can be read as the following examples:



The figure No.4 (The data No.1)

The surrounding of inner rim rotating out of the observer



The figure No.1 (The data No.1)

The surrounding of outer rim rotating to the observer

Result

Table : Comparison of the average of rotation speed and period of the inner and outer rim of the Saturn's ring

Rim	Rotation speed (kilometers per second)	S.D.	Rotation period (hour per round)	S.D.
Inner	8.134	.668	16.075	1.344
Outer	7.970	1.161	30.757	4.277

After studying, it can be seen that the speed of rotation surrounding the inner rim is 8.134 kilometers per second and the period of rotation is 16.075 hours per round and the speed surrounding the outer rim is 7.970 kilometers per second and the period of rotation is 30.757 hours per round. In conclusion, the rotation speed of the inner rim is more than the outer rim and the rotation period is less than the outer rim.

Discussion

From the study, it meets that the rotation speed of the inner rim of the Saturn's ring is more than the outer rim, but the rotation period is less than the outer rim because the radius length is less than. It's consistent with the third of Kepler's law said that "the square of the orbital period is proportional to the cube of the distance from the center". That is the speed of rotation is increased when the orbital period decreases.

Acknowledgements

I owe deep gratitude to a project teacher, Mrs. Pannaporn Boonthos, for her advice and encouragement. I would also like to thank Mr.Samanchan Chandaiam and Mr. Matipon Tangmatitham, the officers of the National Astronomical Research Institute of Thailand (Public Organization), Thai National Observation, Nakhonratchasima province, facilitated from several the Advance Astronomy Workshop for Teacher project, The National Astronomy Research Institute of Thailand (NARIT) and The Institute for the Promotion of Teaching Science and Technology (IPST) for their support and promotion for this study.

References

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