

PRECISE POSITION OF SATURN OBTAINED FROM A STELLAR OCCULTATION BY TETHYS

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ABSTRACT. A stellar occultation of a 9.1 magnitude star by Saturn's satellite Tethys was observed on 2002 Dec. 15 in Japan and in Europe. From them a precise position of Tethys relative to the star was obtained, and using orbital theories of Tethys around Saturn a precise position of Saturn was obtained. This paper gives a preliminary results of the analysis.

1. INTRODUCTION

The occultation of TYC 1310-02435-1 (9.1 mag) by Saturn's satellite Tethys on 2002 Dec. 15 (early morning of Dec. 16 in Japan Standard Time) was originally predicted by David Herald in Australia about a year before the event. He predicted that the event would be visible in the southern part of China, the Sahara Desert in Africa, etc. However, just 4 days of the event Jan Manek, a member of the International Occultation Timing Association (IOTA) in Czech Republic recalculated the prediction, and found that the event would be visible in Japan and in Europe. Based on this prediction the occultation was detected by 7 observers in Japan and 2 in Europe.

The observations provide a very precise position of Tethys with respect to the star, and hence a very precise position of Saturn with respect to the star at the time of the occultation.

2. OBSERVATIONS AND ANALYSIS

The observations were made by the following people:

Positive video observations:

Mitsuru Kashiwagura, Hiromi Hamanowa, Hideo Takashima, Katsuhiko Kitazaki,
Eisaku Katayama (Japan)

Positive visual observations:

Akira Yaeza, Akie Hashimoto (Japan), Vitali S. Nevski (Belarus), Wojciech Burzynski (Poland)

Negative observations:

Pic du Midi Observatory (France), Rui Goncalves (Portugal), Oscar Canales Moreno (Spain), Ricard Casas (Spain), Hilari Pallares Albalat (Spain), Carles Schnabel (Spain), F. Izquierdo (Spain)

The observations fit very well with the diameter 1060 km of Tethys which was obtained by the Voyager spacecrafts. The results of our preliminary analysis are as follows:

Geocentric position of Tethys relative to the Tycho-2 positions of the occulted star TYC 1310-02435-1 for the epoch of 2002 Dec. 15 18^h 58^m 00^s TT is

R.A. 05^h 51^m 33^s.9493 ± 0^s.0001 and Dec. +22° 03' 31".687 ± 0".002.

By taking into account the accuracy of the Tycho-2 positions of the star, the accuracies of the position with respect to ICRF become ±0^s.0015 and ±0".026, respectively.

The theories of the motion of Tethys around Saturn by Harper & Taylor (1993) and by Dourneau (1987, 1993) were used to obtain the positions of Saturn. The resulting corrections to the JPL DE405 positions of Saturn for the epoch of 2002 Dec. 15 18^h 58^m 00^s TT are

$\Delta\alpha = +0^s.0106$ and $\Delta\delta = +0''.036$ via Harper & Taylor (1993), and

$\Delta\alpha = +0^s.0080$ and $\Delta\delta = +0''.079$ via Dourneau (1987).

Hence the mean corrections to the JPL DE405 position of Saturn with respect to ICRF are $\Delta\alpha = +0^s.009 \pm 0^s.001$ and $\Delta\delta = +0''.06 \pm 0''.02$.

Details of the observations and analysis will be published elsewhere.

3. CONCLUSION

From the observation of a stellar occultation by Tethys a precise position of Saturn at the time of the occultation was obtained.

4. REFERENCES

Harper D., Taylor D. B., 1993, *Astron. Astrophys.*, **268**, 326–349.

Dourneau G., 1987, Doctoral Thesis, 1993, *Astron. Astrophys.*, **267**, 292–299.