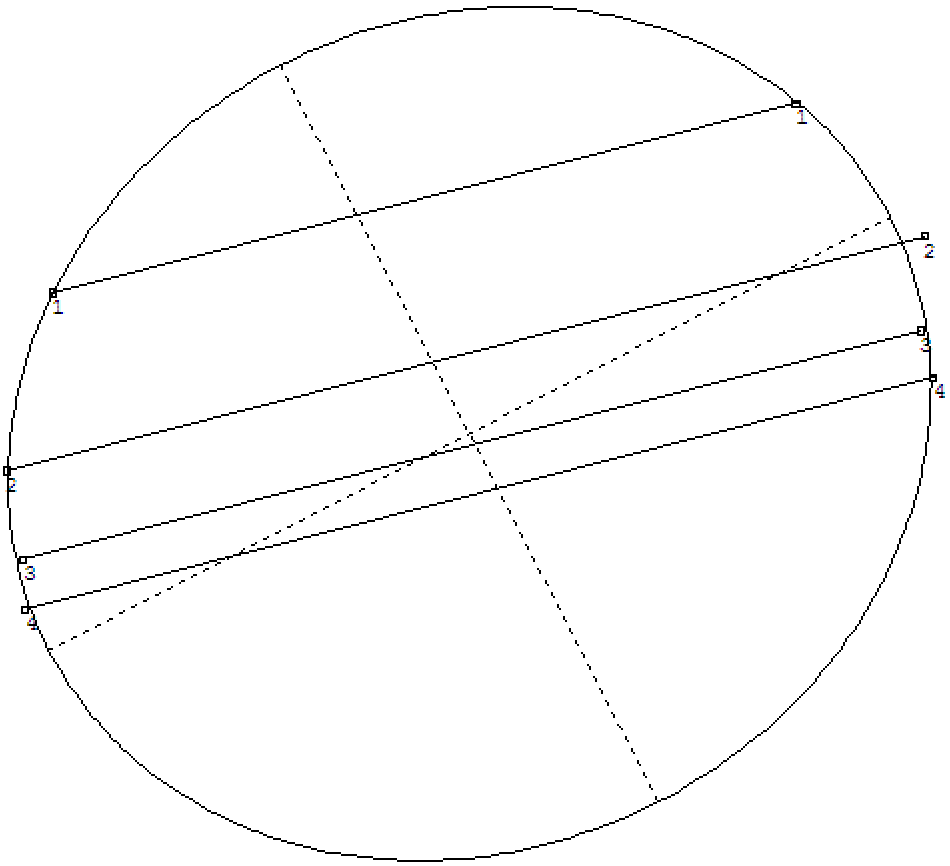
Occultation Newsletter

Volume 13, Number 1 January 2006 $5.00 North Am./$6.25 Other

(2) 2006 Jun 12 524.9 ±2.9 x 459.0 ±30.8 km PA -62.8 ±8.0
Geocentric X 2678.1 ±1.7 Y 1146.2 ±8.2 km

N

E



Roger Venable's Four Station Occultation Event

In this Issue

ON THE COVER:

Figure from Roger Venable's four station occultation event. Here's Roger's description:

When 2 Pallas at magnitude 9.6 occulted a Tycho catalog star at mag 11.7 on the night of June 11-12, I was waiting with four stations. I set up one in my backyard in Augusta, GA, one an hour down the road, and one an hour past that. I had planned to drive an hour further south for the fourth station, but as I drove south I ran into the cloud bands of hurricane Alberto, so I hastily returned northward and set up the fourth station between my second and third ones, just in time for the event. As luck would have it, there were no clouds at the north and south stations, and the other two had intermittent cirrocumulus. All four stations recorded a hit. This is the first time an observer has gotten four hits on a single event. I have never gotten three to match David Dunham, so I just leapfrrogged him. Five, anyone? 8-)

The mag drop was only 0.15, and the videos do not reveal the drop when I am watching them. However, Limovie brings out the data beautifully for the north and south stations. The attended station required only a small amount of data mining, with good results. However, the second station (north-middle station) required lots of data mining and I was able to extract with surety only the reappearance. The disappearance may have an uncertainty as large as a second. So, I got 7 really good timings out of 8, and one fair timing. Since the occultation lasted about 36 seconds, the one-second error is not so bad. Using the plotting function of WinOccult, I get an asteroid shape that's an ellipse with major and minor axes of 500 km by 536 km. This agrees well with the shape & size obtained by the May 29, 1983 event that had hundreds of timings -- that, as I recall, was 530 by 513.

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Please note: The date shown on the cover is for subscription purposes only and does not reflect the actual publication date.

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All other areas-Jan Manek; (see address at left)

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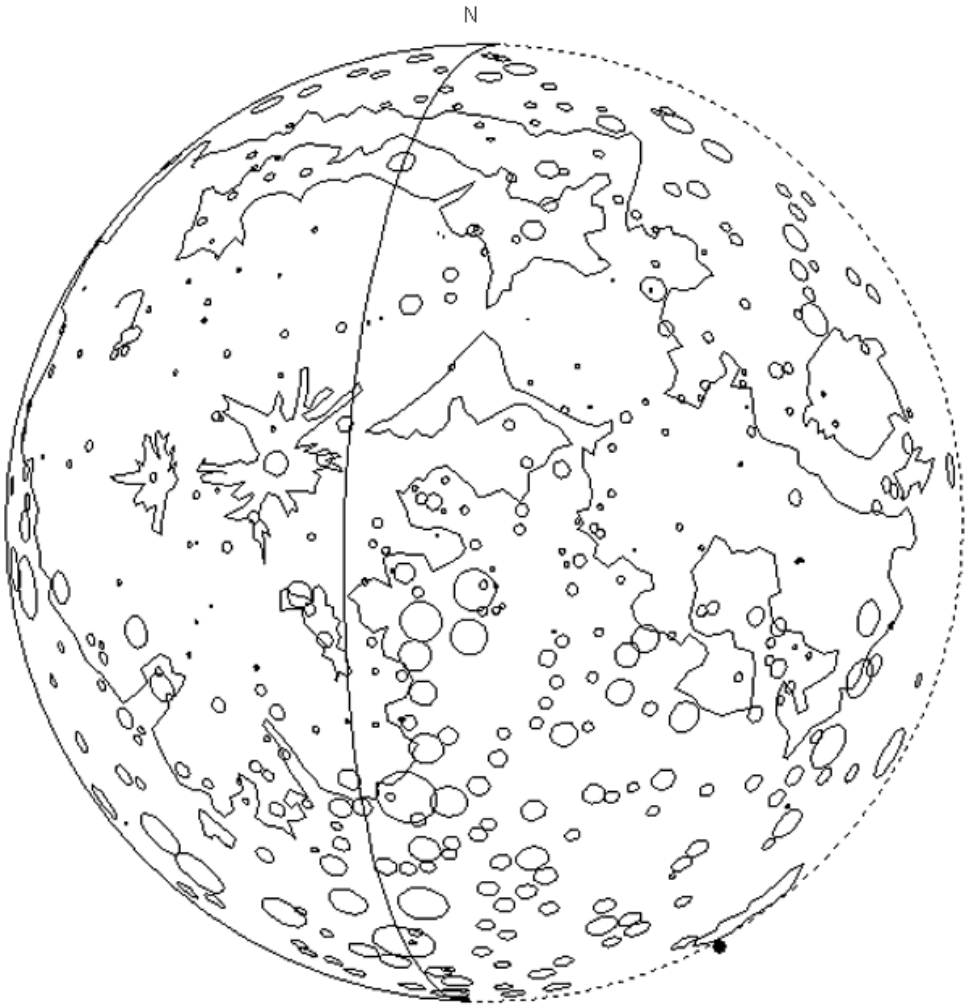
Stellar Photometry and Astrometry during Lunar Occultations

Dave Gault

WinOccult[1] provides a wealth of information for the occultation observer, where the user enters their own site coordinates and telescope specifications and the program will search for events and provide all the information that is necessary to successful observations. Below is an example of the information generated by WinOccult for an event I observed 31st May 2005; the reappearance of ZC3514 (aka 24 Piscium), a bright double star in Pisces, with luck a step event might be observable, where each component of the double star reappears separately and it appears as though the star switches on in stages.



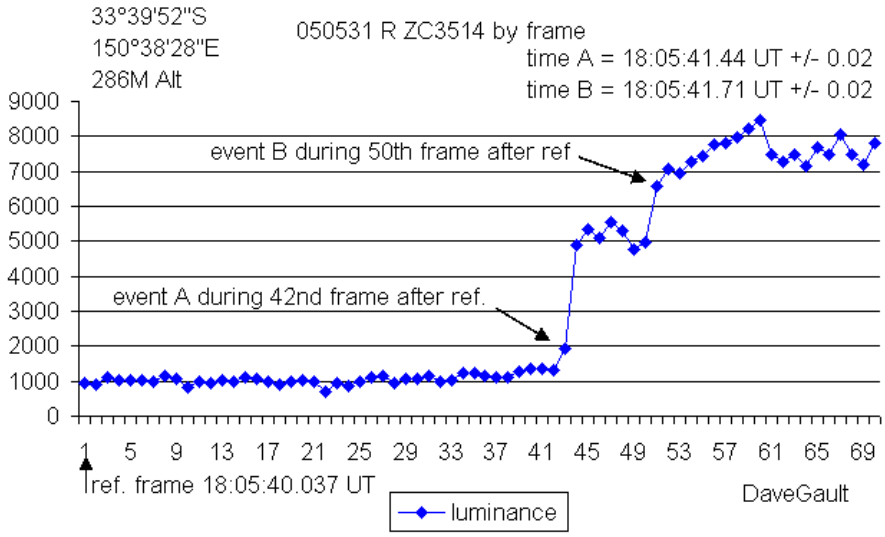
Occultation Predictions for Hawkesbury Hts in May 2005
E.Long. 150 38 52.0 Lat. -33 39 28.0 Alt. 285m. T.dia 245mm. dMag -1.0

	day	Time	P	Star	Sp	Mag	%	Elon	Sun	Moon	CA	PA	VA	WA	Libration		A	B	RV	Cct	R.A. (J2000)		Dec	
y	m d	h m s		No	D	V	ill		Alt	Alt Az	o	o	o	o	L	B	m/o	m/o	"/sec	o	h m	s	o	m s
05	05 31	18 5 43	R	3514cG9		5.9	35-	73		37 66	31S	187	317	209	+6.0	+2.6	+0.3	+2.7	.301	-133	23 52	55.6	- 3	9 20

3514 = 24 Piscium
3514 is double : 6.7 6.7 0.095" 43.4

I got up at 3:30am and quickly had the scope, video and GPS timing gear running and navigated to the right spot. I saw the step event 'live' on the monitor but the fun really started once I had the sequence transferred onto the PC where I could analyze it properly.

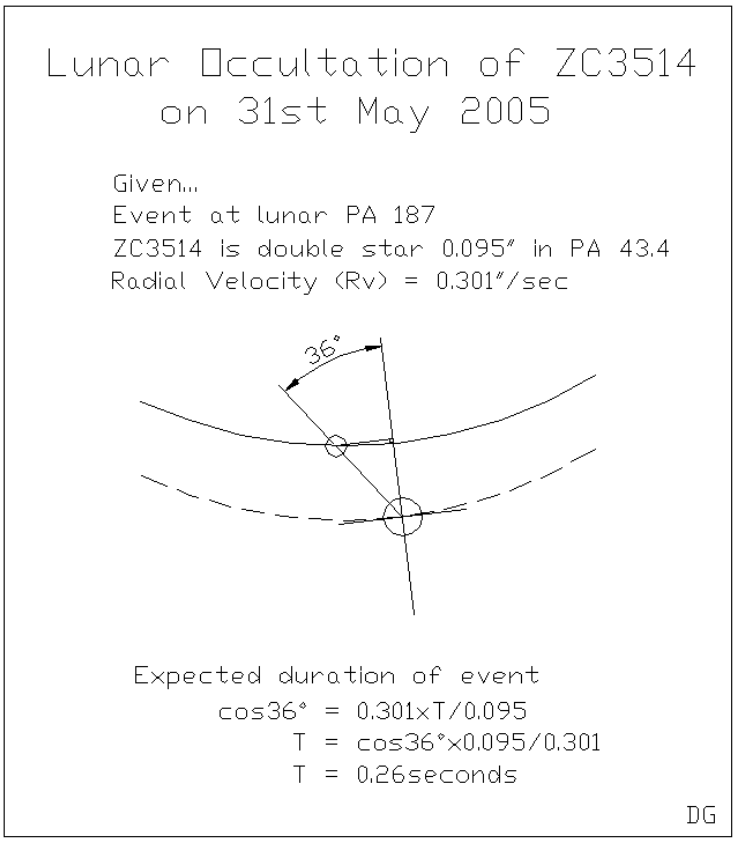
Limovie[2] allows for the measurement of the subject for every frame of the recording which can be plotted using spreadsheet techniques. Here is the light curve for the event.



-The vertical value is calculated from measurements within 2 apertures set by the user of Limovie. The algorithm compares the target aperture to the background aperture and give a unit-less reading.
-The horizontal value is the number of video frame. It is difficult to align the curve to the scale on this plot, however the user of the software can point to one of the dots on the line to receive the reading for both values.

Calculating the event times[3] was the first task and these were entered into WinOccult for sending to ILOC[4].

The WinOccult details that the two stars have a separation of 0.095" and have a position angle (PA) of 43.4 degrees and the event occurred at PA 187 from this we can calculate the time it would take for the two stars to reappear and then compare that to the observed time to determine if the separation and PA figures are correct. The method is as follows;



The expected duration of 0.26seconds matches the observed difference between the timed events of 0.27seconds and confirms the separation and PA figures.

The catalogue also details that these stars have the same magnitude; 6.7 and 6.7, however the light curve chart shows that the first star to reappear is brighter than the second[5]. I had very little understanding how to calculate the star's magnitudes from the chart[6] so I went looking on the internet. I found a web page[7] that showed the method that I could use to calculate the magnitudes of my two stars, as follows;

from the chart...	luminance of first star =	5200-1000
	=	4200 units
	luminance of second star =	7500-5200
	=	2300 units
	luminance of the pair =	6500 units
from the catalogue...	magnitude of the pair =	5.9
the formula...	$m_1 - m_2$ =	$2.5 \times \log(b_2/b_1)$
the difference in magnitude of the two stars is...		
	m_1-m_2 =	$2.5 \times \log(4200/2300)$
	=	0.65
if the mag. of the pair is 5.9 then the mag. of the first star is...		
	$m_1-5.9$ =	$2.5 \times \log(6500/4200)$
	$m_1-5.9$ =	0.474
	m_1 =	6.37
then the magnitude of the second star is	=	7.02

It is worth noting that the Dawes Limit for a 10inch objective is 0.48 arc seconds and I think it is amazing that using a video camera and an occulting disk (the moon) one can make precise measurements of stars that are closer than this threshold by a large margin, in this case 0.095 arc seconds.

History of events concerning this star.
WinOccult[1] has the capability to search for historical occultations and I found a previous event[6] where a step event occurred. On the morning of 16th October 1986 (15thUT) Seizi Futinoue recorded (photo electrically) a step event of 0.12 second duration from the Bisei Observatory in Okayama Japan. At the time ZC3514 had different separation and PA figures and Seizi had to combat a 95% full moon. It is possible to extract data for the star/moon interaction and estimate a duration of 0.08 seconds, however due to the difficult observing conditions and the very brief duration, this event can not confirm separation and PA for this star.

Conclusion
My observation confirms the separation and PA of ZC5314 at the time, however the measured magnitudes (6.4 & 7.0) differ considerably from the stated figures (6.7 & 6.7). This could be explained by differences in spectral colour of the two stars as my simple video camera is more sensitive to the red end of the spectrum.
I have been contacted by Brian Mason of USNO, who comments that my measurements should be included in the Washington Double Star database for this star; WDS No. 23529-0309. I am most pleased. This whole exercise has been a great and worthwhile learning experience for me.

Notes and Acknowledgements…

1) WinOccult by Dave Herald http://www.lunar-occultations.com/iota/occult3.htm
2) Limovie by Kazuhisa Miyashita http://www005.upp.so-net.ne.jp/k_miyash/occ02/limovie_en.html
3) Which frame to choose? Due to the diffraction of light at the lunar limb the event is said to occur when the star appears to be at 25% of it's un-occulted brightness.
4) International Lunar Occultation Centre http://www1.kaiho.mlit.go.jp/KOHO/iloc/docs/iloc_e.html
5) First mentioned by Brian Loader of RASNZ http://occsec.wellington.net.nz/
6) Dave Herald did this first and aided in searches and calculations

See… http://www.astro.wesleyan.edu/~anna/Astro211/0326a.html ■

New Double Star Discoveries

Henk J.J. Bulder

This publication is a follow-up on the publication in ON v12, No.4 , pages 9-10.

First of all I have to make a correction on the correction I published last time. Thorough investigation learned that OCC 235 (Taygeta) was not confirmed to be double by Bob Sandy and Hal Povenmire as I stated but was in fact discovered to be double by them. The double star files have been altered accordingly. Bob and Hal more than deserve the credits for this discovery made back in 1969.

In the past Jean Bourgeois video recorded occultations of stars with a double star code without recording any gradual or step event. Personally I visually observed such stars without seeing any fades or steps. In 2006 Dave Herald and Dave Gault video recorded such events and reduced the records with LiMovie. The resulting graphs showed no step events nor any fades. Together we have come to the conclusion that when such observations are made by two independent observers the double stars should be considered to be single. From now on we will keep a log of such observations. So, if you have made such negative observations of doubles in the past, please report them to me. Table 1 contains all corrections made. The original discoverer is mentioned between parenthesis.

OCC	X	SAO/ZC	MAG1	MAG2	SEP	PA	DATE	DISCOVERER	REMARKS
132	11060	1122	3.8	-	single		20060309	(W M Worssell)	video D Herald & D Gault iota Geminorum
133	12917	1279	6.3	-	single		20060504	(W M Worssell)	video D Herald & D Gault upsilon 2 Cancri
134	12894	80234	8.6	-	single		20060504	(W M Worssell)	video D Herald & D Gault
135	12873	1274	5.7	-	single		20060504	(W M Worssell)	video D Herald & D Gault upsilon 1 Cancri
235	4831	539	4.6	6.1	.1	0	19690806	R Sandy & H Povenmire	correction of discoverer 19 Tauri (Taygeta)

TABLE 1 Corrections on previous discoveries of double stars

Since the last publication I received several nice graphs of observed new double stars. Most of them concern video records that were processed using LiMovie. I have included a single example here concerning XZ 117172 sent to me by David Gault. I strongly urge other observers to process their video recordings of occultations with LiMovie to see if any double effects are present.

In table 2 all 13 (possible) new double stars are presented. For stars for which no estimates were given for the individual components both components are assumed to be equal in magnitude. If the sum of the reported estimates does not match the total magnitude of the pair, the estimates are up- or downgraded until they do. That is why the magnitudes can differ from the ones reported. If the first component is reported to be fainter than the second 180 is added to position angle.

OCC	X	SAO/ZC	MAG1	MAG2	SEP	PA	DATE	DISCOVERER	REMARKS
1117	5200	76371	9.9	9.9	.03	52	20060305	J Bourgeois	
1118	6352	76857	9.7	9.7	.05	55	20060306	H Bulder	
1119	7786		10.5	10.5	.1	82	20060307	H Bulder	
1120	9053		9.6	9.6	.15	62	20050122	H Bulder	
1121	10122	78899	9.9	9.9	.06	88	20050319	R Sandy	
1122	11372	1149	4.1	8.5	.04	70	20050416	D Breit et al.	graze upsilon Geminorum
1123	14708	98744	9.6	9.6	.25	113	20060505	B Mills	
1124	15874	99197	9.6	11.6	.6	90	20060603	D Gault	
1125	64253		11.1	11.1	.05	27	20060304	H Bulder	
1126	78191		9.8	12.0	.05	115	20060404	S Messner	
1127	108624		10.6	12.0	.17	117	20060504	S Messner	
1128	117172		11.0	11.4	.6	78	20060506	D Gault	
1129	175991		11.5	11.7	.06	294	20051108	D Gault	

TABLE 2 New double star discoveries till 1-8-2006

The graze of upsilon Geminorum was observed by Breit, Morgan, Morana, and Nolthenius using video equipment. All videos clearly showed duplicity and were examined by Michael Richmond to come to estimates of separation, position angle and magnitude.

Updated XZDoubles.DAT, XZDoubles Discoveries.DAT and XZConfirmations.DAT can be downloaded from http://www.lunar-occultations.com/iota. Copy these files to the StarCats directory in WinOccult. Don't forget to use option 6 (Update XZ catalogue if new double files...) in star catalogues menu to make them active. ■

The Spectacular Lunar Occultations of the Pleiades over the United States on July 20, 2006

Hal Povenmire

On the morning of July 20, 2006, the 23% sunlit waning Moon made a spectacular Pleiades passage across east central United States. An expedition was planned for the most favorable graze, Alcyone across Illinois, Indiana or Michigan. The weather pattern did not permit observations of this graze so the grazing occultation of 24 Tauri (Z.C. 549) which ran parallel and to the east was chosen. This binary star, a magnitude +6.3, AO spectral class Pleiad was favorable. It grazed approximately 12° on the dark north limb.

Three observers, David Dunham and Wayne Warren from Greenbelt, Maryland and Hal Povenmire from Indian Harbour Beach, Florida met in Columbus, Ohio to map out a final strategy. The site chosen was near a small town northeast of Columbus called Marengo. David Dunham attempted to set up several remote video stations. Wayne Warren used a single video station and Hal Povenmire used a base visual station.

The sky was very thick with aerosols and the Moon was extincted and reddened by about 2 magnitudes. The seeing was only fair to poor. In spite of this, several stations got good data on 24 Tau and also recorded a number of reappearances of stars from the dark limb of the Moon. Several of the brighter stars were recorded disappearing on the bright limb. Frances Graham also timed a number of total occultations from East Pittsburg, Pennsylvania.

All of these observers were long-term veterans of the Graze Program and the accumulated observing experience was well over 145 years. In spite of weather problems, this graze was well observed. A south shift is suspected but the reduction must be made to confirm this. This data will be reported to IOTA and ILOC. ■

The Discovery of Minor Satellites of Asteroids
The Asteroidal Occultation of (129) Antigone on October 12, 1974

Hal Povenmire

Gordon Taylor of the Her Majesty's Nautical Almanac Office (HMNAO) issued a notice of asteroid (129) Antigone occulting Z.C. 1281, a magnitude +6.26, binary star in Cancer, across extreme southeastern United States on October 12, 1974. This star is of KO spectral class and is also known as SAO 97913 and HIP 42010. I would not likely have attempted this observation but there was a lunar grazing occultation of Z10378 (SAO 118338) about 2 hours later than the asteroidal occultation. I chose an observing site just west of Cooper City, Florida. The night prior to the two events, I memorized the star field for the asteroidal occultation.

At the time of occultation, the star and asteroid were only about 12° elevation over the Atlantic Ocean. The sky was transparent but the seeing was the typical tropical seeing which was only fair. The Moon was 12% sunlit and in the waning phase. The magnitude of Antigone was +13 so it was never observed. The star briefly blinked out for approximately .7 second very near the predicted time. I was certain that this was a definite occultation instead of the tropical seeing.

It was my impression that I must have just caught the tip of the asteroid. I did not think of the concept of an asteroidal satellite. I reduced this observation and also the graze of Z10378 and reported these observations to Gordon Taylor, David Dunham and Brian Marsden at the Minor Planet Center in Cambridge, Massachusetts. Shortly after, Gordon Taylor sent me a note of congratulations. David Dunham made no response at the time and Brian Marsden sent me a note indicating that he was very skeptical. I then sent him a tape of the two events and let him reduce them himself. He later followed up with a note but stated that this was not a proven case. David Dunham wrote me a note that later astrometry indicated that the asteroid path had gone way south over Colombia, South America. This was far greater than the predicted diameter of (129) Antigone so this observation was clearly not accepted as genuine. It was not worth any argument from my standpoint so I carefully filed the observation and put it out of my mind.

This observation was forgotten about until March 10, 1978. Approximately 880 days later, Gordon Taylor announced that (6) Hebe was going to occult magnitude +3.6 magnitude Gamma Ceti across southern United States. At this time I was Director of the Satellite Beach Observatory that had an excellent 16" telescope. The skies were clear and I watched the asteroid (6) Hebe sail right past the star without a blink. This is called a clean Miss.

In Victoria, Texas, a highly experienced occultation observer, Paul Maley observed this same event and saw the star blink out for approximately .5 second. Shortly thereafter, word reached David Dunham that consistent reports of multiple stations in Mexico had recorded the occultation of (6) Hebe near the predicted path. Almost immediately, David Dunham and some astronomers at the U.S. Naval Observatory declared that asteroids had satellites.

Calculations indicated that the primary asteroid's gravitational influence could extend out to about 50 radii of the diameter of the asteroid strong enough to hold a satellite.

In the years following, there were several photoelectric recordings of possible secondary objects during asteroidal occultations but most of them were considered weak evidence. The science of predicting asteroidal occultation events also became more refined. This controversy was finally ended when the Galileo Spacecraft passed close to asteroid (253) Ida and discovered a small 1.6 km. diameter moon orbiting it. This moon was later named Dactyl. The case for asteroids having satellites was now considered proven. Since that time, many other asteroids have been found to have satellites. It is now believed that at least 20% of asteroids have satellites. Many of these are binary asteroids and some asteroids have multiple satellites.

In August 2006, astronomer, Richard Nugent who specializes in astrometry used the revised diameter of 144 km. for (129) Antigone and the improved orbital elements of Antigone to reconstruct the October 12, 1974 observation. This revised computation placed the path much closer to Florida and well within the expected distance from the primary. The time was also within 6.0 seconds of the predicted time. Even though it took 32 years to see this observation corrected and vindicated, it still gave some satisfaction to see this controversy put to rest. ■

Hal Povenmire
215 Osage Drive
Indian Harbour Beach, FL 32937

In Memoriam, Denise Nye
1946-2006

Photo courtesy of Tom Polakis

Denise Nye, wife of Derald Nye, died suddenly 13 March 2006. Denise was an avid astronomer and world traveler and accompanied Derald on 28 solar eclipse trips. She visited all the world's continents, 60 countries and 52 islands.

Roger Venable wrote: "Denise accompanied Derald on all his eclipse-chasing trips, and as such was a real world traveler. There are only a few persons in the world who have seen more solar eclipses than Denise saw (and, I think, one of those few is Derald himself). Many times I have listened fascinated to the tales the two of them had to tell about the things they had seen and done together. Prominent in my mind is the trip to Ascension Island to videotape (with complete success!) the simultaneous lunar occultations of Jupiter and Venus, an event of which the path of visibility had no landfall except that isolated island. (You and I can see a similar event about 4,000 years from now, if we care to wait.) Year after year, their travels brought them special views such as that one. Denise and Derald have been a pair of master occultationists"

Gene Lucas wrote: "I found in my briefcase several postcards sent to me by Denise and Derald on their various trips to strange and exotic places, usually chasing some occultation shadow (lunar or solar), a transit or whatever. The JOURNEY was the thing, I think. The latest card came in the mail just a few days ago.... marked "via international air mail", but more likely partly carried by boat, donkey back, or whatever, typically arriving about the same time they would be back in Tucson! Denise was usually the one to write, encapsulating a stage of their latest adventure in a few words. The last one read (in part): 'After twelve nights on board, and 12 nights at the Captain's table ... arrived offshore (the island) today. Derald and I will descend down a rope ladder to a small dinghy to go ashore tomorrow for our visit...' Over the years, every Christmas would arrive a nice long travelogue with another spectacular photo of an eclipse or a rare occultation, often as not taken by Denise"

Countries/Areas visited with Denise - (listing by Derald Nye)
Antarctica
North America (3 countries) – Canada, Mexico, United States
Middle America (13 countries) – Bahamas, Barbados, Bonaire, Costa Rica, Curacao, Dominica, Grenada, Martinique, Panama, Puerto Rico, St. John, St. Thomas
South America (7 countries) – Argentina, Bolivia, Brazil, Chile, Columbia, Ecuador, Peru,
Europe (21 countries) – Andorra, Belgium, Denmark, England, France, Germany, Gibraltar, Greece, Iceland Italy, Luxembourg, Monaco, Netherlands, Norway, Portugal, Scotland, Spain, Sweden, Switzerland, Vatican City, Wales
Asia (10 countries) – China, Cyprus, India, Japan, Malaysia, Philippines, Singapore, Taiwan, Turkey United Arab Emirates
Africa (5 countries) - Cape Verde, Kenya, Morocco, Senegal, South Africa,
Australia (8 Territories) - Australian Capital Territory, New South Wales, Northern Territory, Queensland, South Australia, Tasmania Western Australia, Victoria
Islands (52) – Ascension, Bali, Borneo, Cape Verde, Christmas Island, Kiribati, Cook Islands Group – Atiu, Manuae, Raratonga, Crete, Easter Island, Falkland Islands, Fiji, Galapagos Islands, Gambier Islands Group – Mangareva, Greenland, Guam, Java, Madeira, Majorca, Majuro Marquesas Islands Group – Fau Hiva, Hiva Oa, Ua Pou, Micronesia Group – Chuuk, Kosrae, Pohnpei, Yap, New Zealand, Palau, Pitcairn Islands Group – Ducie, Henderson, Pitcairn, St. Helena, Saipan, Society Islands Group – Bora Bora, Huahine, Mopelia, Raiatea, Tahiti, South Georgia Spitsbergen, Taiwan, Tenerife, Tinian, Tristan da Cunha, Tuomoto Group – Ahe, Manihi, Mataiva, Puka-Rua, Vanuatu – Efate, Espirito Santo, Tana. ■

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IOTA on the World Wide Web

(IOTA maintains the following web sites for your information and rapid notification of events.)

IOTA Member Site
http://www.occultations.org

This site contains information about the organization known as IOTA and provides information about joining IOTA and IOTA/ES, topics related to the *Occultation Newsletter*, and information about the membership--including the membership directory.

IOTA Lunar Occultations, Eclipses, and Asteroidal and Planetary Occultations Site
http://www.lunar-occultations.com

This site contains information on lunar occultations, eclipses, and asteroidal and planetary occultations and the latest information on upcoming events. It also includes information explaining what occultations are and how to report them.