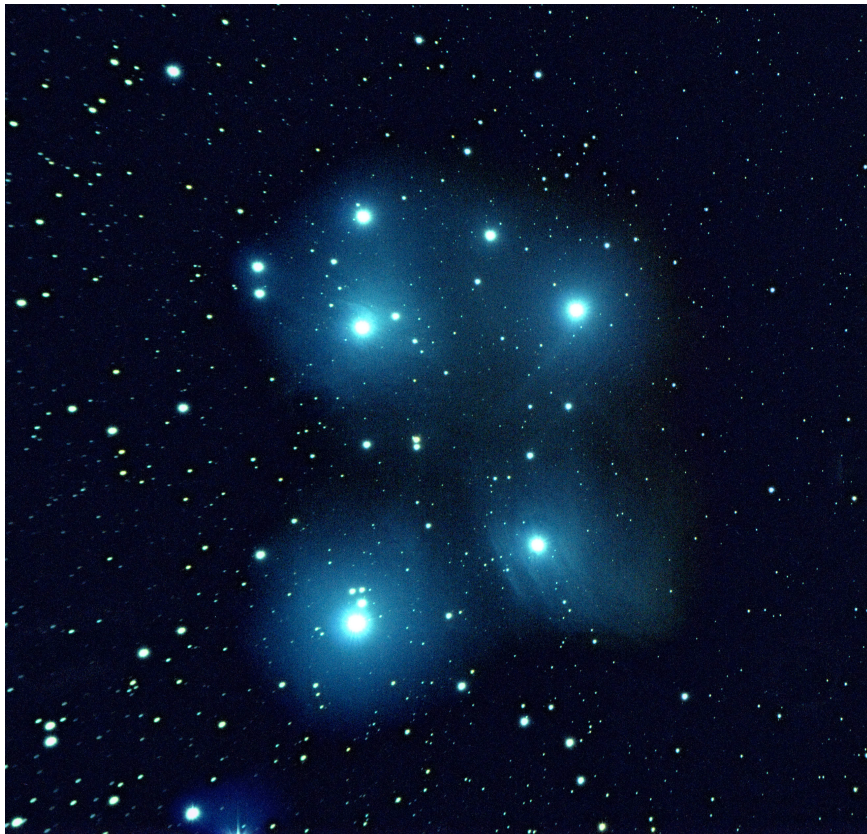




OASI News

The newsletter of the Orwell Astronomical Society



M45 imaged on 25-11-17. Canon 1200D with an Explore Scientific ED80 CF Refractor on a HEQ5 Mount. Processed with Deep Sky Stacker and Photoshop CC.

Photo: Andy Gibbs

Trustees: Mr Roy Adams Mr David Brown Mr David Payne
Honorary President: Dr Allan Chapman D.Phil MA FRAS

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Society Contact details

Observatory (meeting nights only)

07967 519249

Email queries: info@oasi.org.uk

Facebook: <https://www.facebook.com/groups/445056098989371/>

Twitter: @OASlpswich

The OASI Facebook pages are proving very popular. Several non-members are active contributors.

Other contact details will be issued to members on a separate printed list.

Please send material for the OASI web site and newsletter e.g. observations, notices of events, general interest articles, to

news@oasi.org.uk

Access into the School Grounds and Observatory Tower

Please use the third gate into the school grounds by the gym.

Areas out of Bounds

Access to the Observatory is **only via the black door** at the foot of the Observatory tower, which leads to the staircase and thence to the spiral staircase up to the Observatory. If the black door is locked, please phone the observatory mobile, 07967 519249 during meeting hours.

Please do NOT explore other routes. When in doubt, ask or call the Observatory mobile.

Remember this is a school and straying into the main part of the school where the pupils reside would cause the society big problems and could see us losing the use of the observatory. Any member found to be anywhere other than the approved access route or the observatory area will face serious sanctions up to and including expulsion from OASI.

Please note that access time for all observatory member nights is after 20:15

The key to the toilets in the school gym is located in the seating area in the Belvedere room.

Articles for OASI News

News, pictures and articles for this newsletter are always welcome. Please send them to

news@oasi.org.uk

The CLOSING date is the 15th day of the month

Please submit your articles in any of the following formats:–

Text: txt, rtf, rtf, doc, docx, odt, Pages, pdf

Spreadsheets: xls, xlsx, OpenOffice/LibreOffice, Numbers

Images: tiff, png, jpg

Please send tables as separate files in one of the above formats.

If you don't feel up to writing a major article, perhaps you might write a short note for OASI News along the lines of *"This month I have mostly been observing/constructing/mending/reading/etc."*?

Articles win points! See page 15.

The full colour version is available from the OASI web site.

[Newsletter archive www.oasi.org.uk/NL/NL_form.shtml](http://www.oasi.org.uk/NL/NL_form.shtml)

Authors, please note that your articles will now be publicly available worldwide!

Reproducing articles from OASI News

If you plan to reproduce an article exactly as per OASI News then please contact the [Editor](#) – otherwise, as a matter of courtesy, please seek permission from and credit the original source/author. You may not reproduce articles for profit or other commercial purpose.

Committee 2017

Chairman	David Murton	Set overall agenda for OASI, Chair committee meetings, Press and publicity, Public appreciation of astronomy, Outreach activities.
Secretary	Roy Gooding	Outreach meetings (jointly with Chairman), observatory decoration.
Treasurer	Paul Whiting FRAS	Finance, Supervision of applications for grants, Visits by outside groups, Observatory tours, Public appreciation of astronomy (jointly with Chairman).
Committee	James Appleton	Committee meeting minutes, Web site
	Martin Cook	Membership, Tomline refractor maintenance & user testing
	Peter Richards	Lecture meetings, Email distribution lists
	Martin Richmond-Hardy	Newsletter
	John Wainwright	Equipment curator
	Mike Whybray	Astronomy Workshops, Child protection officer, Orwell Park School Astronomy Club.
Co-opted	Avtar Nagra	Newbourne Observing Group
	Matt Leeks	Safety & security
	Andy Wilshire	Librarian

Society Notices

Annual General Meeting

Saturday 20 Jan 2018, starting at 7.30pm.

Location: Museum St Methodist Church Rooms

David Murton is standing down as Chairman.

Avtar Nagra is standing down as Newbourne Co-ordinator.

2018 Membership Fees

At its November meeting the Committee unanimously agreed to maintain membership fees at £20 for 2018.

Signing in and out

Please ensure you sign in and out when visiting the Observatory and/or Newbourne.

This is for fire safety precautions and also provides an historic record.

Welcome New Member

Martin Newman

2018 AGM Saturday 20th January 2018

All members are invited to attend the AGM

Venue: Methodist Church Hall Black Horse Lane

Time: 19:30 (Note time)

Nomination for 2018 committee

Name of Nominee

Proposed by

Seconded by

The committee will be short of two members for 2018. Any members who are nominated must have given their consent. All forms/nominations must be returned to the Secretary (Roy Gooding secretary@oasi.co.uk) before the AGM. Members who are elected to the 2018 committee. will be expected to attend as many committee meetings as possible. Committee meetings are usually held about every six to eight weeks. Every committee member is given an area of responsibility to help with the running of the society.

Annual General Meeting Agenda

Saturday 20th January 2018

- 1 Apologies
- 2 Matters Arising
- 3 Minutes of Last Meeting
- 4 Chairman's Report
- 5 Secretary's Report
- 6 Treasurer's Report
- 7 Trustee's Report
- 8 Other Reports
 - 8.1 Membership
 - 8.2 Workshop
 - 8.3 Library
 - 8.4 Web Site
 - 8.4 Newsletter
 - 8.5 Safety
 - 8.6 Visits
 - 8.7 Lectures
 - 8.8 Equipment
 - 8.9 NOG
- 9 Election of Officers for 2018
- 10 Election of Committee for 2018
- 11 Events for 2018
- 12 Observing Projects for 2018
- 13 Annual Subscriptions for 2018
- 14 Wish List Equipment and Acquisitions 2018
- 15 Newbourne Matters
- 16 Any Other Business
- 17 Next Committee Meeting

OASI and BAA Events

For the latest event details, please see www.oasi.org.uk/Events/Events.php

There's a Google Calendar on the OASI web site with the latest dates (and corrections!). If you want to easily add OASI Events to your own computer/phone/tablet calendar application click this button on the website Events page.



Download the OASI 2016 year planner from the web site. An A3 printer is advised.

For other astronomy news and astro pictures try our

Twitter feed <https://twitter.com/OASIpSwich>

Facebook page <https://www.facebook.com/pages/Orwell-Astronomical/158256464287623>

Subscribe to the OASI Yahoo group by emailing oasi-subscribe@yahoogroups.com

Date and Time	Location	Contact	Event
Weekly, every Wednesday, 20:15–22:00	Orwell Park Observatory	Martin Cook, Roy Gooding	General observation (weather permitting) using a variety of telescopes. Entry via the third gate left. NOT the main gate
Tuesday, 9 January 20:00	Orwell Park Observatory	Paul Whiting, FRAS treasurer@oasi.org.uk	Observatory Tour Public access event. Observatory tour. Booking essential.
Monday, 15 January 19:00	Newbourne Village Hall	Newbourne Observing Group.	NOG+Skynotes+Workshop on Telescope Eyepieces
Saturday, 20 January 19:30	Museum St Methodist Church Rooms, Ipswich	Roy Gooding secretary@oasi.org.uk	OASI AGM
Monday, 29 January 19:00	Newbourne Village Hall	Newbourne Observing Group.	NOG
Monday, 12 February 19:00	Newbourne Village Hall	Newbourne Observing Group.	NOG+Skynotes
Tuesday, 13 February 20:00	Orwell Park Observatory		Observatory Tour Public access event. Observatory tour. Booking essential.
Monday, 26 February 19:00	Newbourne Village Hall	Newbourne Observing Group.	NOG
Monday, 12 March 19:00	Newbourne Village Hall	Newbourne Observing Group.	NOG+Skynotes
Tuesday, 13 March 20:00	Orwell Park Observatory		Observatory Tour Public access event. Observatory tour. Booking essential.
Monday, 26 March 20:15	Newbourne Village Hall	Newbourne Observing Group.	NOG

Outreach meetings

1 Bentley Star Party

The meeting will be open to the villagers

Venue: Playing field at the end of Case Lane, next to The Case is Altered pub.

Option 1 Saturday 6th January

Setup time: 19:30

Event: 20:00 to 22:00 (Moon rises at 21.59 if clear may overrun)

Option 2 Saturday 24^h February

Setup time: 18:30

Event: 19:00 to 21:00 First quarter is on 23rd

A go no go will be made on the preceding Wednesday

2 Framlingham Country Show April 8th and 9th

Arrangements still in progress.

3 Sutton Hoo Solar Event June 16th or 17th

Venue: Sutton Hoo Visitors Centre on the grass outside the cafe

Option 1 Saturday 16th

Setup time: 10:30

Event time: 11:00 to 16:00

Option 2 Sunday 17th

Setup time: 10:30

Event time: 11:00 to 16:00

More details nearer the date

4 Other possible events

Holywells Park Family Day

August date not yet known

Solar Event in Christchurch Park

No dates fixed yet

Bentley Family Day

Date not yet known. Usually a Sunday in September.

Go Stargazing

Disappointingly, Dara O'Briain recently confirmed that BBC Stargazing Live will not be taking place in 2018. (<https://twitter.com/antoleary3/status/936286863387758592>).

Given that during the three nights of the last show Go Stargazing helped ~25,000 website visitors find their nearest stargazing event, we were keen to do this again! Over recent years the TV programme has had a positive effect in raising awareness of astronomy to a wide and increasingly interested audience and it will be missed by many.

The Go Stargazing Team believe there is an opportunity to organise a nationwide, collaborative stargazing event without direct involvement from the BBC whilst continuing to share the same objective - to encourage the general public to participate in UK stargazing by attending a local stargazing event.

In summary our idea is to coordinate public stargazing events so they take place on Friday 16th and Saturday 17th of February. We've chosen these dates as it coincides with the National Parks

Dark Skies Festival (<http://www.darks skiesnationalparks.org.uk/>). We have ideas to create on-line coverage of these events through social media.

This is a great opportunity to build upon the momentum generated by past BBC Stargazing Live programmes and give real focus to UK stargazing, this whilst also raising awareness of the numerous astronomy societies, clubs, observatories and stargazing venues across the country.

Along with our website platform we have bounds of energy and enthusiasm to make this happen. We would do this not for profit but, like you, through our eagerness as amateur astronomers to share our passion for our subject. Working together collectively could make this a success!

If you are interested in participating please do let us know. We would be very happy to hear your thoughts and ideas. And we will be in touch again with you soon to share more of our ideas with you!

Clear skies!

Neill, Wil, Richard and Robbie (The Go Stargazing Team)

web: www.gostargazing.co.uk **email:** team@gostargazing.co.uk

twitter: @gostargazing **facebook:** Go Stargazing

Newbourne Observing Group

Avtar Nagra nog@oasi.org.uk

We normally meet at Newbourne Village Hall, Mill Lane, IP12 4NP on the 2nd and 4th Mondays (with a few exceptions, like December and January).

The Newbourne Observing Group (The NOGs) is a good place to start for beginners. If you are thinking of buying a scope or binoculars, come and try before you buy and talk to owners about the strengths and weaknesses of particular models. If you've already splashed the cash, bring your new scope along to use or for advice on setting-up and adjustment. All welcome, with or without telescopes. We would like visitors to join OASI to enjoy the full benefits of membership.

Newbourne Observation Group Stargazer's guide

On the first meeting each month Bill Barton will give a short presentation of what can be viewed in the following 4 weeks. For armchair stargazers (on those cloudy nights) there is a small branch of the OASI Library held at Newbourne and a copy of the full catalogue.

NOG Meetings in 2018

15 Jan (S+W)	29 Jan	12 Feb (S)	26 Feb
12 March (S)	26 March	9 April (S)	23 April
14 May	28 May	11 June	25 June
9 July	23 July	13 Aug	27 Aug
10 Sept	24 Sept		

We open up for all meetings at 7pm. Star Guide (S) and Workshops (W) start at 8pm.

Please check the web site diary for any changes during the year.

Editor's note: Avtar is standing down as Newbourne co-ordinator. We are very grateful for his hard work in liaising with the hall manager, opening up, organising refreshments and ensuring everything is tidied away at the end of the evening.

Astronomy Workshops

Contact Mike Whybray

Location: Newbourne Village Hall IP12 4NP

Doors open at 7:00pm.

Workshops start at 8:00pm

Workshop at Newbourne Village Hall, 8pm, 15th January:

Telescope Eyepieces

Looking at one of the old unmarked eyepieces used with the Tomline Refractor, I became intrigued as to how you might measure some basic eyepiece parameters such as focal length, field of view and eye relief. Thus began my voyage of discovery into eyepiece optics! I learnt a thing or two about optics generally and eyepieces in particular along the way so I've put it together into a workshop about eyepieces, and in particular how I managed to measure those three parameters. Also some general information about eyepiece designs, suitability for different scopes etc. If you have an eyepiece yourself that you are not sure about, bring it along and I'll see how it measures up. Anyone who has optics expertise - please come along and correct my beginner mistakes!

Mike Whybray

If you are a new OASI member, or haven't been to one of these informal workshops before, they are a mixture of events of different characters including beginners talks, interactive workshops, films, etc., suitable for all. They are also a chance to chat with other members over a cup of tea and a biscuit, in a venue rather warmer than the observatory dome on a winter's night!

Given a clear night, we can make use of the field for a workshop or continue afterwards with some observing – something not possible at the previous venue, Nacton village hall.

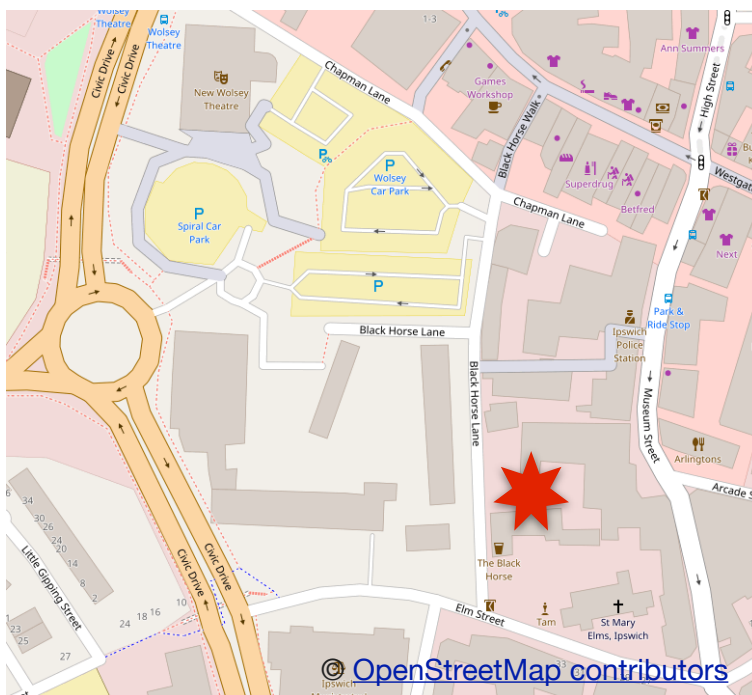
Do you have a subject you could workshop? You could do a short one, or share the effort with a partner. Drop Mike Whybray a line! workshops@oasi.org.uk

Lecture Meetings

Contact: Peter Richards lectures@oasi.org.uk

These take place in [Museum Street Methodist Halls](#), Upstairs room, Black Horse Lane, Ipswich

There is some parking at the venue but if there is no space at the venue you can drive to the end of Black Horse Lane and turn left to find a pay and display car park which charges (at the time of writing) £2 for parking between 6pm and 6am. Free after 8pm. There is also the spiral car park by the New Wolsey theatre.



DASH Astro Events – 2018

See <http://dash.moonfruit.co.uk> for the latest details.

All DASH Astro observing sessions will take place at WESTLETON COMMON. ASOG observing sessions and locations may be arranged at the time of observation.

Unless stated all group meetings will take place at WESTLETON VILLAGE HALL from 7:30 pm

Observing sessions:



Galaxy M33 in Triangulum

Andy Gibbs



Imaged on 25-11-17. Canon 1200D attached to Explore Scientific ED80 CF Refractor. 4x 360 seconds lights and darks at ISO 800. Processed in Deep Sky Stacker and Photoshop CC. Shame about the tracking/guiding error in bottom left corner of image.

Lunar Occultations during 2018

Introduction

During 2018, there are almost 600 lunar occultations potentially observable from East Anglia, although many involve faint stars. The tracks of nine grazing occultations cross the region during the year. No lunar occultations of planets are visible from the region during the year.

This article summarises circumstances of the best occultations during the year. It provides details for the location of Orwell Park Observatory; differences will in general be negligible for locations throughout East Anglia.

Predictions below are calculated as follows:

- Details of total occultations are calculated from software based on algorithms in "Astronomy on the Personal Computer" by O. Montenbruck and T Pfleger, Springer-Verlag, 1994.
- Circumstances of grazes are calculated from the package Occult, created by Australian amateur David Herald (version 4.2.5.0).

Occultations of bright stars

Table 1 lists occultations during the year, of stars brighter than magnitude 6.0, where circumstances are favourable. The events should be readily visible in small telescopes or binoculars. The first two columns of table 1 list the date and time (UT) of the occultation. Column three gives the phenomenon: 'D' denotes a disappearance and 'R' a reappearance. The table lists circumstances of disappearances and reappearances as dictated by the visibility of each phenomenon (determined by altitude, lunar phase, etc). Column four details the lunar phase ('+' for waxing and '-' for waning). Columns five and six give the altitude of the Sun and the star, both in degrees. (A negative solar altitude means that the Sun is below the horizon.) Columns seven and eight provide the star's magnitude and catalogue number.

Date	UT	D/R	Lunar Phase	Sun Alt (°)	Star Alt (°)	Mag	Star
05 Jan	08:23:31	D	0.85-	2	16	1.4	Regulus
	09:17:43	R		7	7		
25 Jan	17:37:54	D	0.59+	-10	47	5.9	ZC 444
27 Jan	18:25:56	D	0.80+	-17	48	5.5	ZC 741
	18:37:46	R		-19	49		
29 Jan	01:25:35	D	0.91+	-53	35	5.2	71 Ori
08 Feb	03:14:42	D	0.45-	-38	12	3.9	38 Lib, γ Lib
	04:17:45	R		-29	18		
23 Feb	16:39:13	D	0.54+	6	50	0.9	Aldebaran
	17:46:31	R		-4	54		
22 Mar	20:18:55	D	0.30+	-20	32	5.0	75 Tau
	21:15:27	R		-27	23		
23 Mar	22:41:50	D	0.41+	-34	21	4.3	119 Tau, CE Tau
	23:35:08	R		-36	13		
23 Mar	23:17:28	D	0.42+	-36	16	5.7	120 Tau, V960 Tau
08 Apr	03:24:35	R	0.51-	-16	9	2.9	41 Sgr, π Sgr
20 Apr	20:03:45	D	0.27+	-9	35	5.8	68 Ori
	20:58:30	R		-16	27		

Date	UT	D/R	Lunar Phase	Sun Alt (°)	Star Alt (°)	Mag	Star
08 May	02:56:17	R	0.50-	-10	9	4.3	32 Cap, ι Cap
29 May	01:35:49	D	1.00+	-13	16	5.5	49 Lib
24 Jun	23:33:26	D	0.90+	-14	17	5.4	44 Lib, η Lib
28 Jun	21:46:05	D	1.00-	-9	8	3.8	39 Sgr, ο Sgr
	22:45:05	R		-13	13		
04 Jul	02:42:17	D	0.72-	-7	25	4.2	91 Aqr, ψ ¹ Aqr
	02:53:31	R		-6	26		
05 Aug	00:06:28	D	0.47-	-21	9	5.9	ZC 444
	00:59:10	R		-20	17		
21 Aug	22:49:28	D	0.82+	-24	11	5.9	ZC 2704
21 Sep	20:29:13	D	0.90+	-23	20	3.7	40 Cap, γ Cap
	21:21:16	R		-29	21		
23 Sep	21:08:22	D	0.98+	-29	24	4.2	91 Aqr, ψ ¹ Aqr
23 Sep	21:43:43	D	0.98+	-32	27	4.4	93 Aqr, ψ ² Aqr
03 Oct	01:55:55	D	0.42-	-35	29	5.1	56 Gem
	02:36:07	R		-30	35		
03 Oct	04:03:52	D	0.41-	-18	47	5.9	61 Gem
	05:15:31	R		-8	55		
28 Oct	02:21:49	D	0.86-	-39	57	4.9	104 Tau, m Tau
	02:34:06	R		-38	57		
30 Oct	00:01:01	D	0.68-	-51	30	4.0	43 Gem, ζ Gem
	01:00:43	R		-48	39		
21 Nov	20:51:04	D	0.97+	-44	43	4.3	87 Cet, μ Cet
30 Nov	02:26:15	D	0.48-	-46	29	5.3	53 Leo, l Leo
	03:27:21	R		-38	37		
19 Dec	00:42:41	D	0.82+	-60	24	4.3	73 Cet, χ ² Cet
21 Dec	03:28:25	D	0.96+	-40	21	5.6	63 Tau
21 Dec	19:24:50	D	0.99+	-32	36	4.9	104 Tau, m Tau
31 Dec	21:27:23	D	0.98+	-49	53	4.3	119 Tau, CE Tau

Table 1. Occultations of stars brighter than magnitude 6.0.

Occultation seasons

The Moon's orbit is defined by a range of periodicities, both short and long term. The short term periodicities cause the Moon's path through the sky to follow a pattern whereby it almost repeats

every month. The longer term periodicities gradually shift the orbit so that no particular pattern of approximate repetition can last more than a few years. This results in so called “occultation seasons”, lasting for months or years, during which particular stars are repeatedly occulted, or repeatedly not occulted. In 2018, the phenomenon is evident through repeated occultations of 91 Aqr, 104 Tau and 119 Tau.

Nights with many occultation events

During the year, the Moon traverses some rich star fields. When this happens, a large number of occultations can occur during a single evening. Table 2 lists all evenings throughout the year when the Moon occults 10 or more stars. The large numbers of occultations on 19-21 April are associated with the passage of the Moon through the rich star fields of Taurus, Orion and Gemini.

Date	No occs		Date	No occs		Date	No occs		Date	No occs
21 Jan	11		22 Jan	11		19 Feb	19		20 Feb	15
22 Feb	13		24 Feb	12		23 Mar	21		19 Apr	28
20 Apr	74 (!)		21 Apr	17		18 May	20		19 May	15
27 Jul	10		12 Nov	19		---	-		---	

Table 2. Evenings with 10 or more occultations.

Grazing occultations

The tracks of nine grazing occultations cross East Anglia during the year. Table 3 summarises the circumstances. Columns one and two give the date and time of the graze and column three specifies the lunar limb involved. Column four indicates the distance between Orwell Park Observatory and the closest point on the track, on land. Column five details the lunar phase (positive for waxing, negative for waning); column six the altitude of the Sun (a negative solar altitude means that it is below the horizon); and column seven the altitude of the star. Columns eight and nine specify the star and its magnitude.

Date	Time (UT)	Limb	Dist from OPO (km)	Lunar Phase	Sun Alt (°)	Star Alt (°)	Mag	Star
21 Feb	17:37	N	33	0.32 +	-3	46	4.3	μ Cet
25 Mar	20:45	S	15	0.64 +	-14	13	6.4	ZC 1130
23 Apr	21:43	N	2	0.61 +	-12	42	8.3	ZC 1374
02 Jul	01:41	S	54	0.87 -	-11	19	3.7	γ Cap
04 Jul	02:49	N	40	0.71 -	-6	25	4.2	ψ ¹ Aqr
03 Sep	02:32	N	22	0.50 -	-22	39	7.9	Hip 21630
02 Oct	06:15	S	6	0.52 +	+2	58	4.1	ν Gem
27 Nov	04:04	S	31	0.80 -	-32	57	5.4	85 Gem
27 Nov	22:14	S	51	0.72 -	-55	14	3.9	δ Cnc

Table 3. Grazing lunar occultations.

Table 3 lists many more observing opportunities than has been the norm in previous years. In part, this is due to:

1. A graze for which circumstances in general are not ideal but the track passes close to Ipswich, meaning that a lengthy journey to a distant observing site is not required: ZC1374 on 23 April.
2. Two grazes where the Sun will have only just set, but the star is relatively bright so should be visible: μ Ceti on 21 February and ψ¹ Aqr on 04 July.
3. A graze for which the Sun will not quite have set but the star is relatively bright, and the track passes close to Ipswich: ν Gem on 02 October.

Figure 1 illustrates the tracks of the above grazing occultations through East Anglia. Weather permitting, the usual band of OASI occultation observers will organise observing trips. Please get in touch if you are interested in participating. Further information, including plots of the tracks in Google Earth, is on the OASI web site: <http://www.oasi.org.uk/Occs/Occs.php>.

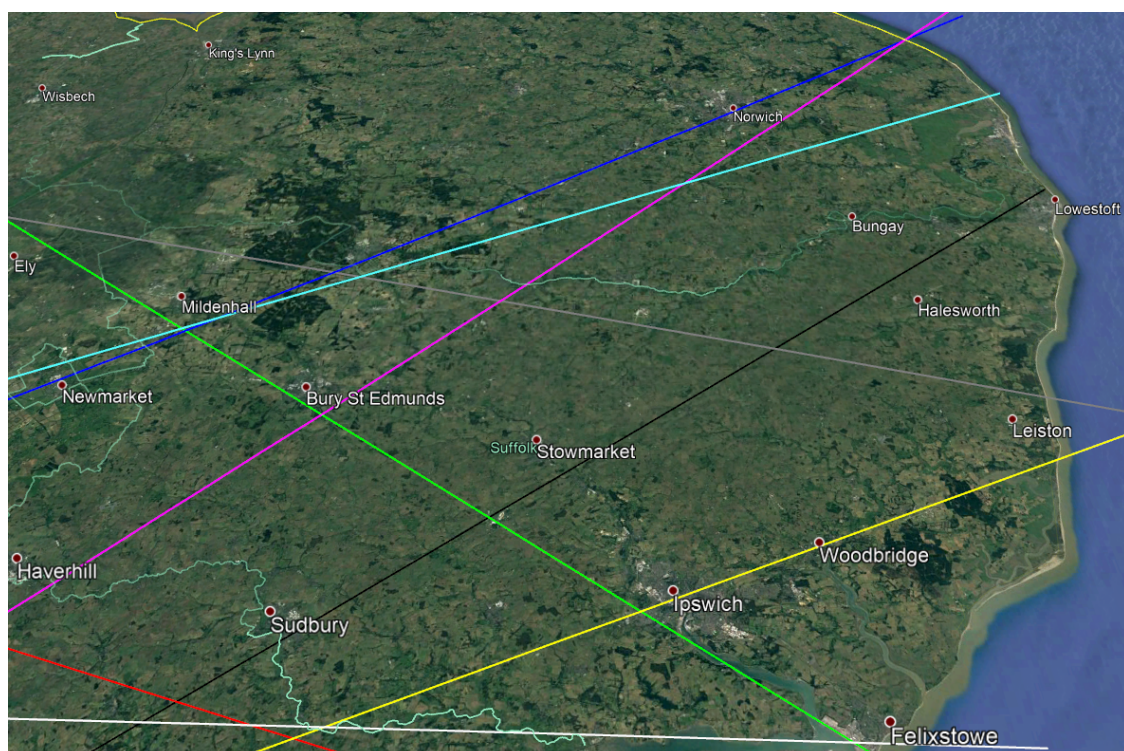


Figure 1. Graze tracks, colour coding as follows:

2018 Feb 21: yellow
2018 Jul 01: blue
2018 Oct 02: white

2018 Mar 25: red
2018 Jul 04: pink
2018 Nov 27 am: grey

2018 Apr 23: green
2018 Sep 03: black
2018 Nov 27 pm: turquoise

James Appleton

The Night Sky in January

Martin RH

All event times given are for the location of Orwell Park Observatory 52.0096°N, 1.2305°E

Times are in UTC (=GMT)

Moon

Source: <http://heavens-above.com/moon.aspx>

New Moon	1 st Quarter	Full Moon	Last Quarter
17 January 02:17	24 January 22:20	02 January 02:24 31 January 13:27	08 January 22:25

Sun, Moon and planets

Source: <http://heavens-above.com/PlanetSummary.aspx>

Object	Date	Rise	Set	Mag.	Notes
Sun	1	08:03	15:54		
	31	07:37	16:41		
Moon	1	15:41	06:56		
	31	16:48	07:29		
Mercury	1	06:17	14:22	-0.2	Jan 01 Max. western elongation 25 Jan Aphelion
	31	07:25	15:18	-0.5	
Venus	1	08:06	15:34	-3.8	Jan-09 Superior conjunction Jan-23 Aphelion
	31	08:04	16:58	-3.8	
Mars	1	03:21	12:37	1.5	
	31	03:08	11:24	1.2	
Jupiter	1	03:35	12:44	-1.7	
	31	02:01	10:56	-1.8	
Saturn	1	07:25	15:07	0.5	
	31	05:41	13:24	0.6	
Uranus	1	11:55	01:30	5.8	
	31	09:58	23:30	5.8	
Neptune	1	10:46	21:21	7.9	
	31	08:50	19:28	8.0	

Occultations during January 2018

James Appleton

The table lists occultations during the month under favourable circumstances. The data relates to Orwell Park Observatory, but will be similar at nearby locations.

The events should be readily visible in small telescopes or binoculars. The first two columns list the date and time (UT) of the occultation. Column three gives the phenomenon: 'D' denotes a disappearance and 'R' a reappearance. The table lists circumstances of disappearances and reappearances as dictated by the visibility of each phenomenon (determined by altitude, lunar phase, etc). Column four details the lunar phase ('+' for waxing and '-' for waning). Columns five and six give the altitude of the Sun and the star, both in degrees. (A negative solar altitude means that the Sun is below the horizon.) Columns seven and eight provide the star's magnitude and catalogue number.

The data relates to Orwell Park Observatory, but will be similar at nearby locations.

Please note that **times are shown in UTC**.

Date	Time (UT)	D/R	Lunar Phase	Sun Alt(°)	Star Alt(°)	Mag	Star
05 Jan	08:23:31	D	0.85-	2	16	1.4	Regulus
20 Jan	18:56:56	D	0.12+	-23	8	6.7	ZC 3355
22 Jan	20:13:21	D	0.28+	-35	17	7.1	ZC 66
25 Jan	17:37:54	D	0.59+	-10	47	5.9	ZC 444
25 Jan	21:23:35	D	0.60+	-44	38	7.1	AQ Ari
25 Jan	23:25:45	D	0.61+	-56	22	6.0	ZC 462
26 Jan	23:28:58	D	0.72+	-56	32	6.0	ZC 608
27 Jan	18:25:56	D	0.80+	-17	48	5.5	ZC 741
	18:37:46	R		-19	49		
29 Jan	01:25:35	D	0.91+	-53	35	5.2	71 Ori

Paul's Astronomy Podcast for January

Paul Whiting FRAS Podcast, January 2018 www.oasi.org.uk/2018_01_pod.mp3

David's Radio Broadcast

On 1st Tuesday of the month, 1.40pm on the Lesley Dolphin show on BBC Radio Suffolk - now digital (channel 10c) and FM 103.9 (Ipswich), 104.6 (west Suffolk), 95.5 (Lowestoft), 95.9 (Aldeburgh).

Bill's Radio Broadcast

ICRFM (Ipswich Community Radio) 105.7 MHz at about 08:25 in the morning of the first Wednesday of each month. I aim to cover what there is to see in the sky and then a little bit on something topical.

ICRFM is also available to listen to over the Internet and there is a listen again option on their website. <http://www.icrfm.com>

Visible ISS passes $\geq 15^\circ$ max altitude

Martin RH

Source: <http://heavens-above.com/PassSummary.aspx?satid=25544>

Times are UTC. Predictions are approximate (15 Dec) due to craft adjustments. Check the day before.

Date	Mag	Start			Highest point			End		
		Time	Alt.	Az.	Time	Alt.	Az.	Time	Alt.	Az.
01 Jan	-1.9	05:20:17	26°	SSE	05:20:19	26°	SSE	05:23:08	10°	E
01 Jan	-3.6	06:53:12	10°	WSW	06:56:29	72°	SSE	06:59:47	10°	E
02 Jan	-3.4	06:02:51	33°	SW	06:04:03	57°	SSE	06:07:17	10°	E
03 Jan	-2	05:12:38	31°	ESE	05:12:38	31°	ESE	05:14:45	10°	E
03 Jan	-3.8	06:45:17	15°	W	06:47:58	85°	S	06:51:15	10°	E
4 Jan	-3.8	05:54:59	60°	SW	05:55:28	77°	S	05:58:44	10°	E
05 Jan	-1.6	05:04:36	26°	E	05:04:36	26°	E	05:06:13	10°	E
05 Jan	-3.8	06:37:15	20°	W	06:39:24	85°	S	06:42:41	10°	E
06 Jan	-4	05:46:49	85°	SSW	05:46:51	86°	S	05:50:09	10°	E
06 Jan	-3.3	07:20:01	10°	W	07:23:16	56°	SSW	07:26:30	10°	ESE
07 Jan	-1.2	04:56:21	21°	E	04:56:21	21°	E	04:57:37	10°	E
07 Jan	-3.7	06:28:59	25°	W	06:30:45	72°	SSW	06:34:02	10°	ESE
08 Jan	-3.7	05:38:30	71°	ESE	05:38:30	71°	ESE	05:41:31	10°	E
08 Jan	-2.8	07:11:26	10°	W	07:14:30	37°	SSW	07:17:33	10°	SE
09 Jan	-0.9	04:48:00	18°	E	04:48:00	18°	E	04:48:56	10°	E
09 Jan	-3.4	06:20:38	28°	W	06:22:01	51°	SSW	06:25:13	10°	ESE
10 Jan	-3.1	05:30:09	50°	SE	05:30:09	50°	SE	05:32:45	10°	ESE
10 Jan	-2.1	07:02:57	10°	W	07:05:36	23°	SSW	07:08:15	10°	SSE
11 Jan	-2.7	06:12:18	28°	WSW	06:13:10	33°	SSW	06:16:09	10°	SE
12 Jan	-2.2	05:21:51	30°	SSE	05:21:51	30°	SSE	05:23:50	10°	SE
13 Jan	-2.1	06:04:04	20°	SW	06:04:09	20°	SW	06:06:38	10°	SSE
14 Jan	-1.3	05:13:42	16°	SSE	05:13:42	16°	SSE	05:14:36	10°	SSE
27 Jan	-2.1	18:28:07	10°	SSW	18:30:18	21°	SSE	18:30:18	21°	SSE
28 Jan	-1.9	19:10:48	10°	SW	19:12:27	26°	SW	19:12:27	26°	SW
29 Jan	-2.9	18:18:14	10°	SW	18:21:15	35°	SSE	18:21:54	31°	SE
30 Jan	-2.2	17:25:52	10°	SSW	17:28:34	24°	SSE	17:31:16	10°	E
30 Jan	-2.9	19:01:25	10°	WSW	19:03:54	47°	SW	19:03:54	47°	SW
31 Jan	-3.5	18:08:40	10°	WSW	18:11:52	53°	SSE	18:13:15	29°	E
31 Jan	-0.9	19:44:57	10°	W	19:45:52	17°	W	19:45:52	17°	W

Iridium flares

Too many to list but see <http://heavens-above.com/IridiumFlares.aspx>

Meteor Showers

Source: BAA Handbook 2018 p97-99

Shower	Limits	Maximum	ZHR at Max	Notes
Quarantids	Jan 1-6	Jan 3d 21h	80+	Blue and yellow meteors. Diffuse radiant except at peak. High rates in 2014. Unfavourable.

The BAA's latest newsletter

The BAA's Sky Notes for December & January have been published in the December BAA Journal. As usual we are making these freely available to both members and non-members. They can be read online at our website here: https://britastro.org/journal_item/11759

There is other content in the current edition of the Journal which readers may find interesting, including:

- Update on auroral activity, July to October
- Report on the BAA at New Scientist Live, 2017
- Observations of the occultation of UCAC4-410-143659 by Triton, 2017 October 5
- As well as my President's round up.

Also new on our website:

- A Great Year for the Geminids!
- Upcoming Opportunity to Video Lunar Impact Flashes from the Geminid Meteor Shower
- Amazing Juno's images showing another significant change on Jupiter
- A tutorial on 'The turning sky'
- And lots of observations uploaded by BAA members to the Member Pages

I'd also like to let you know about some upcoming meetings for the amateur astronomer.

- BAA Ordinary Meeting - Meteors and Spectroscopy, Burlington House, London, Saturday, 2018 January 20
- Deep Sky Section Annual Meeting, Bedford, Sunday, 2018 March 04
- Back to Basics Workshop, Bristol, Saturday, 2018 March 10

As the new President of the BAA I am very keen to hear from you if there are ways you think the BAA can help support local clubs and societies, as well as amateur astronomers in general - please do get in touch.

Callum Potter

President, British Astronomical Association

president@britastro.org

Insight Astronomy Photographer of the Year will open soon!



The world's greatest astrophotography competition will open for entries on 15 January 2018.

You can submit up to 10 images for the chance to win huge cash prizes and see your winning image displayed in a major exhibition. Please encourage your members to enter!

Deadline for entries is midday (GMT) on 9 March 2018.

Visit www.rmg.co.uk/astrophoto to find out more.



Alysia Calderwood, Exhibitions Project Manager

Royal Museums Greenwich : National Maritime Museum | Cutty Sark

Royal Observatory | The Queen's House

+44 (0)208 858 4422

What is the speed of gravity, and does it travel at the speed of light?

Andy Wilshire – Another note from the library.

Recently we had a very pleasant evening at the Methodist Halls in Museum Street, Ipswich. Dr Sarah Hutton gave an interesting talk about active galactic nuclei.

During the Q & A at the end, a question was presented by one of our members as to the speed of gravity, is it instantaneous and how fast can the gravity force travel? I thought that this would be interesting to attempt to put her answer and a little extra into a few words for our monthly magazine.

The speed of light has been known for some time. In 1865 James Clerk Maxwell proposed that light was an electromagnetic wave and therefore travelled at the speed 'c', found in his theory of electromagnetism. In 1905 Albert Einstein in his work on the theory of relativity showed that 'c' had application outside the hypothesis of light and magnetism. In 1975 the speed of light was known as 299,792,458 m/s with an uncertainty of 4×10^{-6} . Thus if the Sun were to disappear we on this planet would receive its light for a little over 8 minutes before it stopped. So, what would happen to gravity, and our planetary orbit. Would we fly away in a straight line, or would we continue just as we are? This discussion is one of the main facets between Newton and his theory of gravity and Einstein's General Relativity. According to Newton, force is determined by the distance between two masses, take one away and the force vanishes. This presupposes that the speed of gravity is infinite. However, in general relativity all types of energy form gravity, which affects the curvature of space, and from this our Sun would govern the curvature of our space, leaving the earth to travel in a circuit within the curved space.

It postulates that gravity is not instantaneous, but journeys at the speed of light, and that velocity and changing gravitational fields have an overall affect on gravity. It also suggests that gravitational fields repeatedly renew through mediums that reproduce at tremendously high speeds. The speed of light therefore is also the speed of gravitational waves and any other particle that doesn't possess mass e.g. gluons, photons and gravitons.

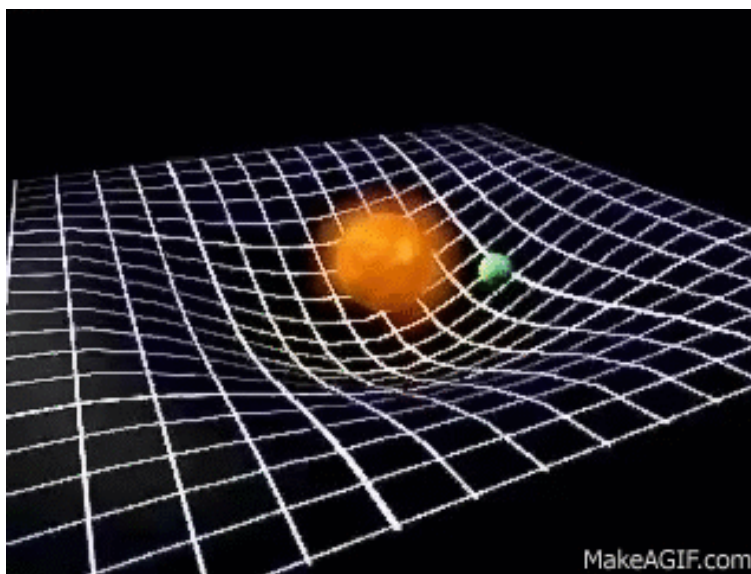


Image credit :https://en.wikipedia.org/wiki/Speed_of_gravity

So the chance to measure gravity occurred on the 8th September 2002 when two physicists Sergei Kopeikin and Edward Formalont from the National radio Astronomy Observatory in Charlottesville, Virginia used a network of radio telescopes in the United States (Very Long Baseline Array) and Germany (100 meter) to attempt to verify Einstein's theory. On this date, Jupiter passed in front of J0842 + 1835, a far distant quasar. Quasars are active galactic nuclei of high brightness and consists of a supermassive black hole and an orbiting accretion disc of gas. As gas falls into the black hole energy is given out in the form of electromagnetic radiation, which can be observed at many wavelengths including radio.

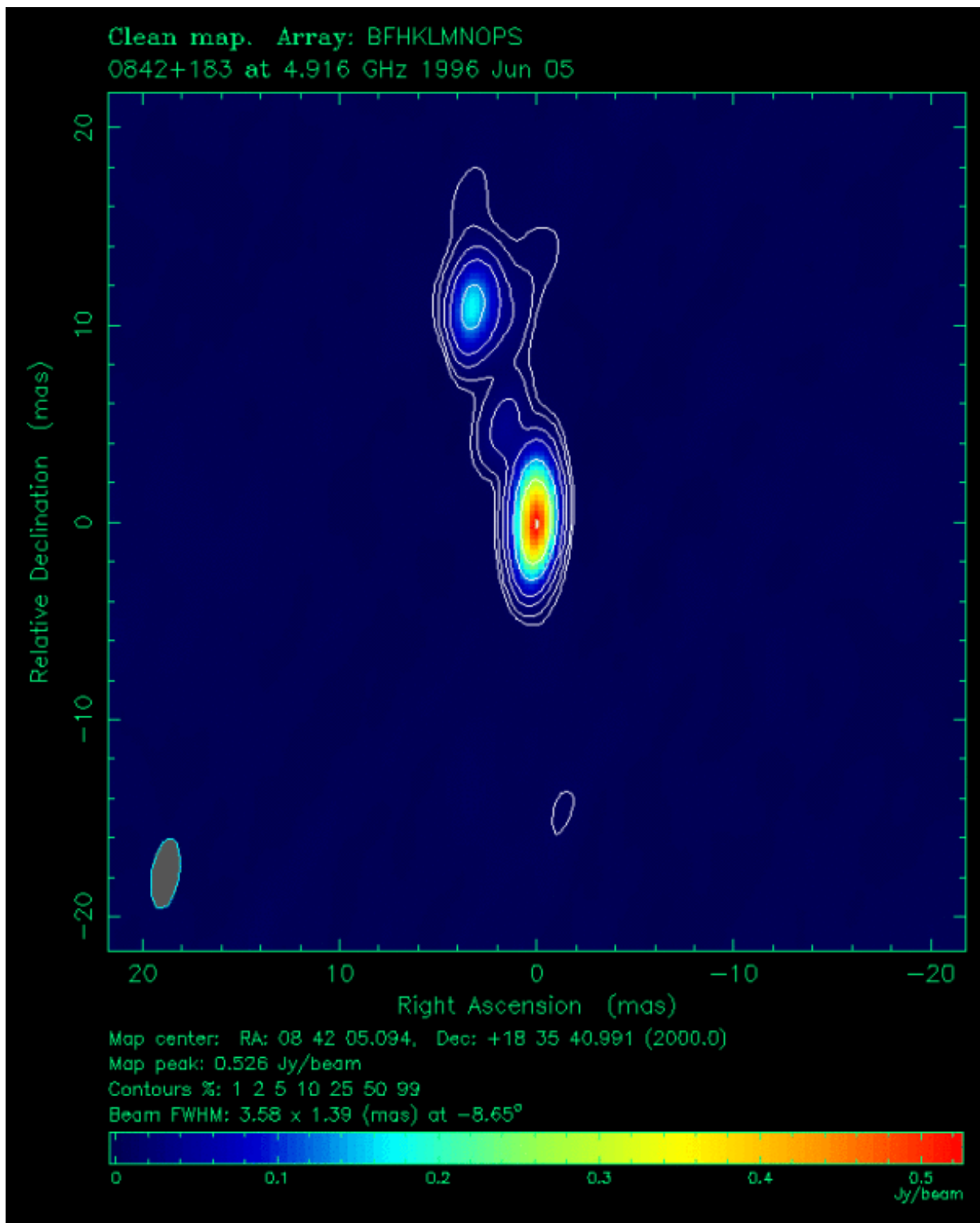


Image credit:

http://scienceblogs.com/startswithabang/files/2016/04/1-5uje_JzSxV93nedWdky_VA-600x750.gif

The eclipse by Jupiter of the quasar causes the planet to bend the radio waves generated by J0842+1835. This relocated the apparent position of J0842+1835 in the sky. Kopeikin, a theoretical physicist predicted two scenarios. Firstly if the speed of gravity were infinite, then J0842 would have traced out a circle in the sky as Jupiter flew by. Secondly, if gravity had some restricted speed an eclipse would be produced. They found a minute distortion using interferometry, thus substantiating indirect confirmation that the speed of gravity and the speed of light are the same. Some theorists consider the

possibility that there may be more than our usual four dimensions in space, through which gravity may be able to increase speed by cruising through them as a short cut. However gaining the knowledge of the possible speed of gravity is only the initial building block of the premise, and changing some scientists beliefs will take some time.

Recently gravitational waves have been detected by LIGO (Laser Interferometer Gravitational Wave); the Europe based Virgo detector; and other space and land based observatories. The gravitational signal named GW 170817 was detected on August 17th 2017, by two identical LIGO detectors. Colliding neutron stars were noted spiralling together emitting gravitational waves for 100 seconds that were recorded. At the point of collision a gamma ray flash was produced which arrived on Earth two seconds later. The main content of both neutron stars combined to form one ultradense mass. As both gravitational and light waves were recorded, the results provided confirmation of the speed that both were travelling. This seemed to substantiate Einstein's general theory of relativity, and that gravitational waves appear to travel at the speed of light.

References:

<http://ligo.org/detections/GW170817/press-release/pr-english.pdf>

<http://www.nature.com/news/1998/030106/full/news030106-8.html>

<https://tallbloke.wordpress.com/2012/04/13/tom-van-flandern-the-speed-of-gravity-what-the-experiments-say/>

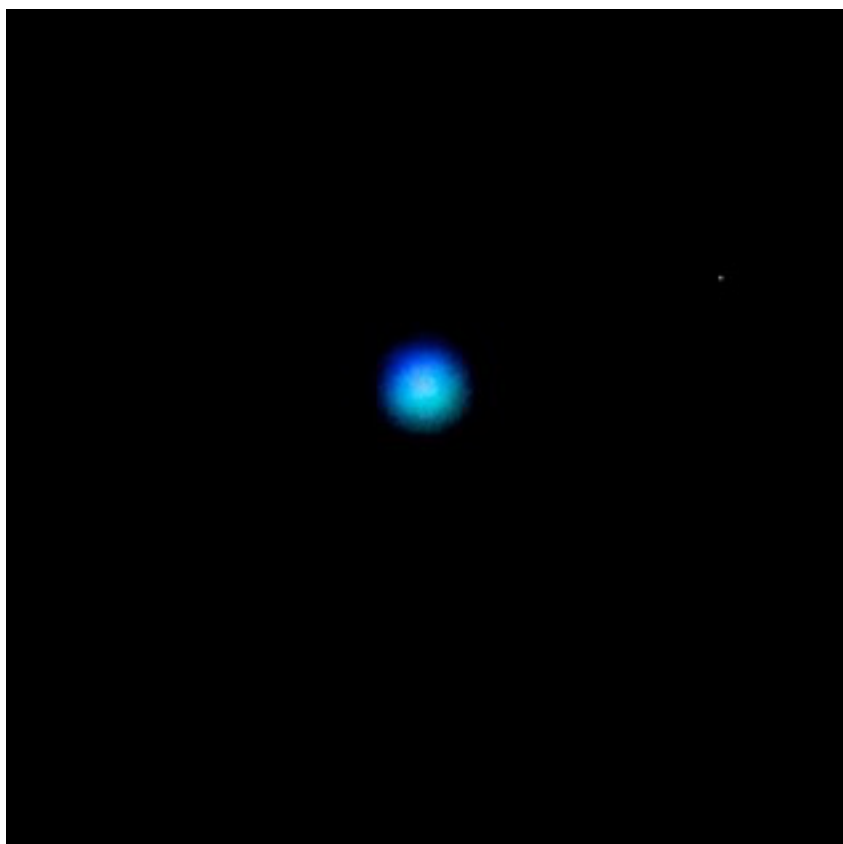
https://en.wikipedia.org/wiki/Speed_of_gravity

Neptune

Mike O'Mahoney

At a distance of 4.5 million km Neptune sits at the edge of our solar system. Looks very beautiful tonight (30 Nov.)

235 mm SCT with 2.5x Power Mate (f25) and Canon 60 Da, 6 sec@ 1500 ISO



A grazing occultation of V4190 Sgr

Alan Smith

The third of this years' grazing occultations was predicted to take place during the early evening of Wednesday 25th October 2017.

Again, the grazes have been plotted using a freely available software suite (Occult 4.0), which produces detailed plots of the lunar topography and draws a Google Earth line showing the very narrow path of visibility across the Earth. This graze was predicted to pass north of Ipswich close to the village of Finningham.

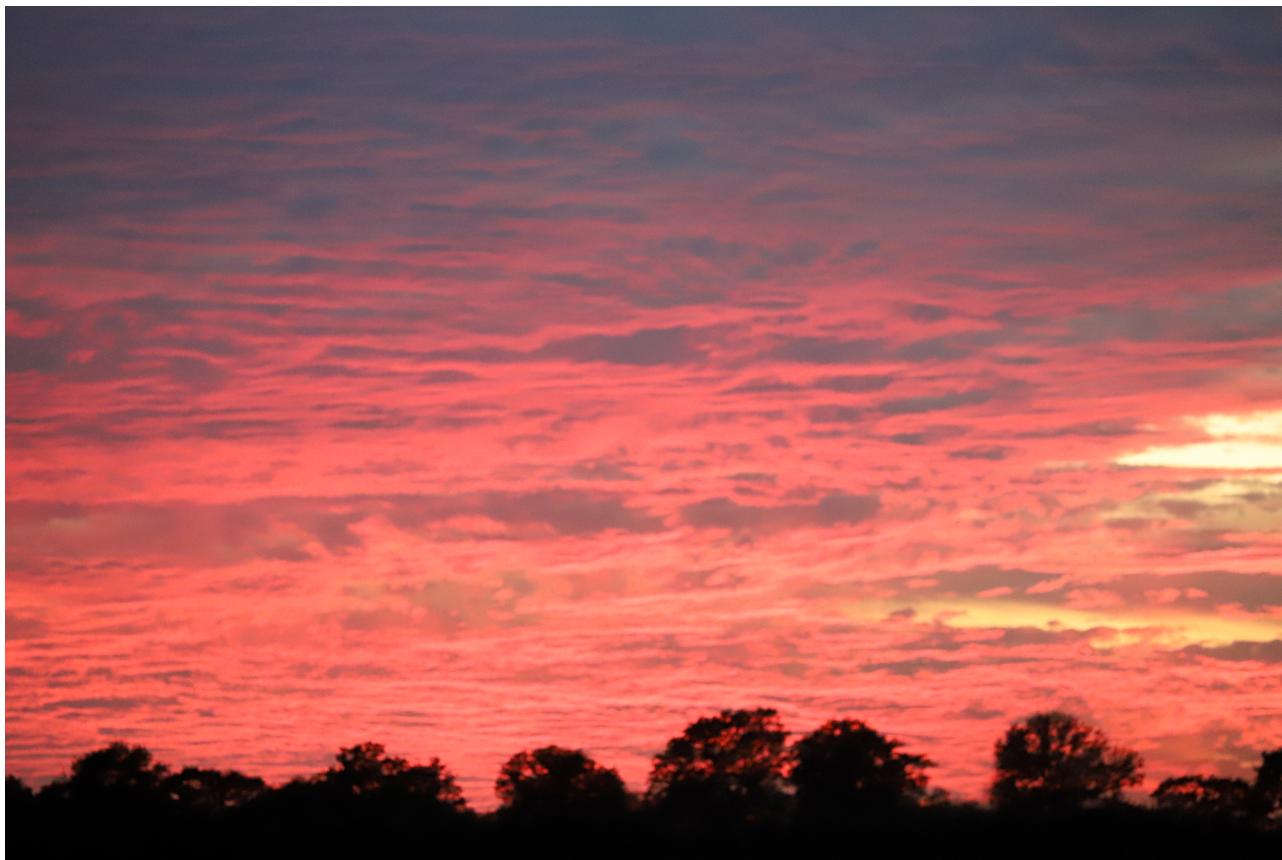
As is now usual, a search along the line using Google Earth was made to find the most promising location for us to set up our telescopes, away from vehicles, light pollution and too much interference. A total of four possible sites were found but a ground level reconnoitre eliminated two of the sites and gave a clear 1st choice (marked as site 4 on the picture below) with a 2nd choice (marked site 3). Contact with the land owner of both sites saw permission readily granted as one member of the family was studying astronomy. Obviously the family were invited to attend the event. The site, just off the B1113 between Finningham and Walsham Le Willows was located on a private farm track. A bit muddy if wet but a glorious southerly view



This particular graze was only just 'admissible' as a possibility: at magnitude 6.5 it was almost on the limit to be visible against the glare of the moon, it was still in 'astronomical twilight', low down in the south western sky and would mean travelling almost 50km during the rush hour.

Unusually, there were half a dozen intrepid observers who are available (and willing) to attend the primary site with Dave Murton attempting an observation from a separate site located at a family members house close to Norton (about 11 km from the main site). This multi site approach is ideal but usually there are insufficient members available to set this up. As is normal for these events, a 'go/no-go' conference call was set up for 16:00hrs on the 25th of October, with those who had expressed an interest in attending the graze being invited to join the call. In the event, the weather forecast and the sky conditions meant that an attempt was unanimously agreed.

I set off for the site at 17:00hrs, arriving at about 17:45hrs to meet James Appleton and Matt Leeks who had arrived a few minutes previously. The sky was still very light and predictably almost totally cloud covered! Some breaks in the cloud low in the west gave a spectacular, almost apocalyptic sunset however.



Picture by James Appleton taken at 1801 hrs.

Such were the conditions that we didn't bother to set up our telescopes until the rest of the team arrived, and only then, more in hope than expectation did we all set up. Those with computer controlled equipment were unable to align their 'scopes as they needed at least 2 stars to be visible!

The family of the land owner had arrived by about 1815 hrs just as some small cloud breaks high overhead had formed. They were treated to a clear view of M57 (The Ring nebula) but the moon was covered in the thickest of the cloud. As the time of the graze approached (graze time 1907 hrs BST) there were some tantalising glimpses of the moon but it was not to be! Graze time came and went with no moon visible. Then, as is always the case, by 1916 hrs (only 9 mins. late) the moon was in the clear and I could clearly see the grazing star, well clear of the moon's limb by then but never the less visible.

Instead of packing up immediately, the family group was invited to look at the moon at both high and low magnification using Mike O'Mahonys' telescope.

The sky by this time was almost clear (what a surprise) with even Saturn visible low in the west. The trip home was accompanied by the moon grinning through the windscreen the whole way, as if to say 'you stupid boy', and only by about 2030 hrs did the sky cloud over.

For the first time in 40 years of organising these grazing occultation 'expeditions', there was to be a footnote to this event. I am always aware that a group of cars parked in an obscure location might cause concern, so I always get the permission of the land owner and if using public land I always ensure that any properties nearby are informed of the event. On this occasion, a 'concerned' member of the public reported the gathering to the Suffolk constabulary, taking note

of at least one vehicle number plate. It is noticeable, that the police were 'unable' to attend the site but waited for one member of the team to return home before approaching him alone.

Explanations were given, and (hopefully), given that the landowner and members of his family were in attendance, all is well.

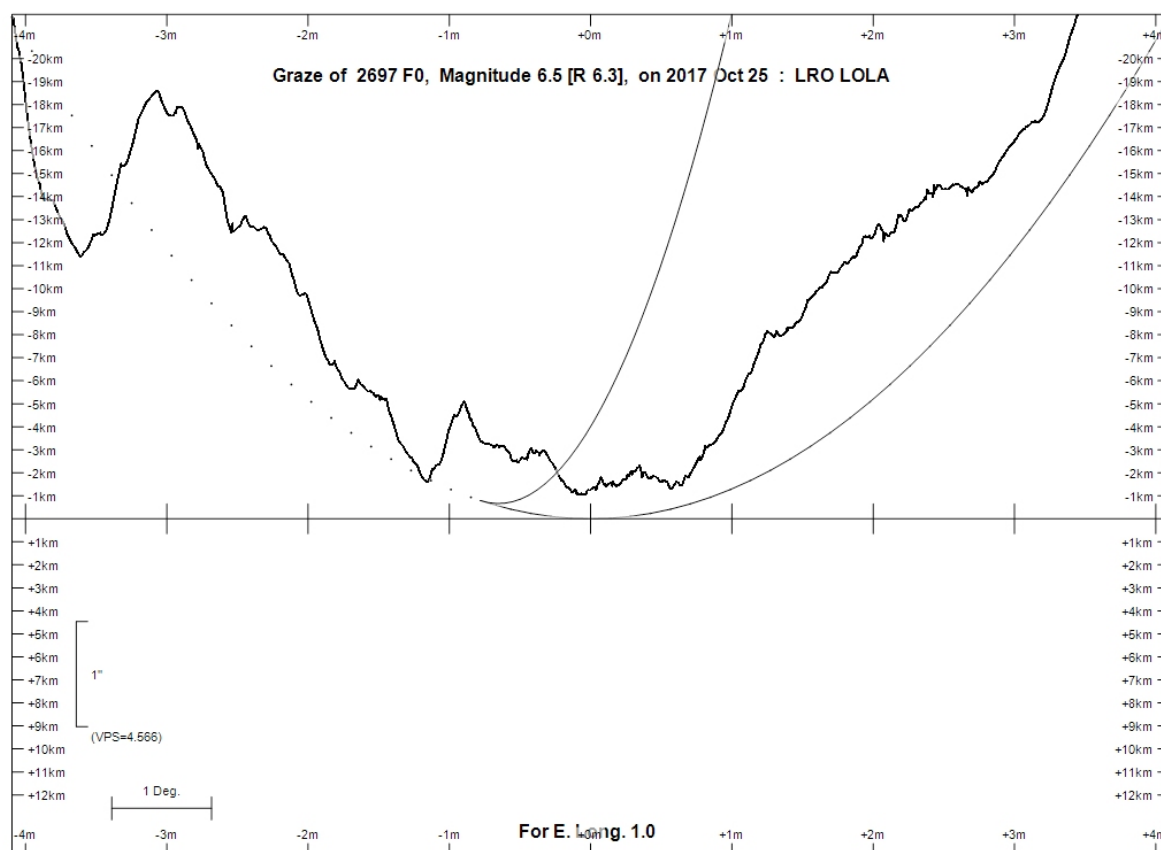
And now the "scientific" bit....

The circumstances of the graze of HIP 91132 (V4190 Sgr) were not ideal:

- The star is a magnitude 6.45 object (located in Aquarius).
- The graze was a south limb event. In general terms, the lunar southern limb is well cratered but the prospect of observing multiple disappearance and reappearance events was reduced.
- The Moon on the evening of 25 October was not very long past new (phase 30% waxing).
- The apparent approach of the star was against the dark limb.
- The event took place at the very inconvenient time of 18:07 UT (Rush our)!
- The altitude of the moon was only 13°.
- Astronomical twilight doesn't end until 1834 UT, meaning that the crucial minutes before graze, and the event itself were in a still bright sky.

The *Occult 4.0* software limb predicted the limb profile below for the event. The site was about 3km north of the line.

Occult 4.2.2.1



Members attending this event were: Joe Startin (Mr. Black), Andy Gibbs (Mr. Blonde), Matt Leeks (Mr. White), James Appleton (Mr. Green), Mike O'Mahony (Mr. Orange), and Alan Smith (Mr. Grey)

Dave Murton (Mr. Pink) was located about 11km away.

A Grazing Lunar Occultation of ZC1522

James Appleton

The third and final grazing lunar occultation of the year visible from East Anglia occurred at approximately 06:30 on Saturday 09 December. (All times in this report are expressed as UT.) The star, ZC1522 in Leo, was relatively faint, but nonetheless worth observing, so Alan Smith and James Appleton made the usual arrangements. They used the freeware software package *Occult 4.0*¹ to calculate the graze line for the event; this crossed Suffolk from NW to SE, passing only some 17km from Orwell Park Observatory. As usual, potential observing locations were identified with Google Earth and then, on 30 November, Alan carried out a reconnaissance of prospective sites. He found the best site to be at the eastern edge of Rendlesham Forest, in Butley, an isolated location just off a quiet public road, unlikely to be disturbed by passing traffic (precise location is given below).

The first two grazes which members of OASI attempted to observe during 2017 (in February and October) were clouded out. Hopes were therefore high that, by the law of averages, the weather for the final event would be better and, indeed, it turned out to be so. In the days immediately preceding the graze, the forecast was consistently for low temperatures, clear skies and occasional gusty wind. At 22:00 on the evening before the graze, prospective observers attended the customary go/no-go audioconference and the decision to proceed with observations was an easy one.

First to arrive at the observing site, shortly after 05:30 UT, was Alan, followed soon after, in order, by Andy Gibbs, James Appleton, Mike O'Mahony, Joe Startin and Martin Cook. Martin, last to arrive, suffered a more stressful journey than most, arriving first at the wrong site and being forced to turn around by a ploughed field, hitting some wire fencing while undertaking the manoeuvre. *Doh, don't you just love it when the satnav malfunctions!* On arrival, the sky was clear and transparent, dominated by the Moon and Jupiter, in Libra, shining at magnitude -1.7 at altitude 8° above the south-east horizon. There were occasional gusts of wind, strong enough to cause telescope shake.

James took up position immediately in the lee of the edge of the forest, providing some shelter from the wind, and the other observers located themselves on the other side of the road, sheltered by their vehicles. Immediately after setting up, James found the bright star nearest to the lunar south pole and announced *I've found it!* Fortunately Alan, experiencing difficulty finding the star, looked through James's finderscope and immediately realised that the supposed star had already been passed by the Moon, and was not about to be grazed! James's second attempt at locating the star rapidly succeeded. *Phew, what a narrow escape!*

Unfortunately, the viewfinder on Joe's telescope turned out not to work reliably, in consequence of which he was unable to align the instrument so that it tracked the motion of the heavens. He was unable to undertake any meaningful observations until after the graze, by which time he obtained a good view of the star with the Moon nearby but receding. The other observers fared rather better and, by 06:15, had set up their equipment and were following the Moon as it approached the star: Alan, Martin and Andy were observing visually; Mike and James videoing the event. The observers hoped for multiple disappearance/reappearance events as suggested by the predicted lunar limb profile. Figure 1 illustrates the predicted profile: the blue line represents the position of the observers, offset 610m south of the nominal graze line to maximise the chances of observing multiple events, and the red line represents the expected limb profile presented at the observing location.

By 06:30, the event was over. Andy, Alan and Martin had each observed at least two disappearance/ reappearance events and Mike and James had captured video footage for later analysis. By the end of the graze, dawn was breaking, and the south-eastern horizon showed a

¹ *Occult 4.0* is developed by the amateur astronomer David Herald. It may be downloaded from his website: <http://www.lunar-occultations.com/iota/occult4.htm>

lovely colour transition (captured in the background of the team photo, figure 4, below). Jupiter, having risen to an altitude of 22° , so prominent when the observers arrived on site, appeared less intense against a brightening sky. The observers packed up and, following the obligatory team photo (which, for reasons unknown, James's pocket camera almost refused to take!), headed for home.

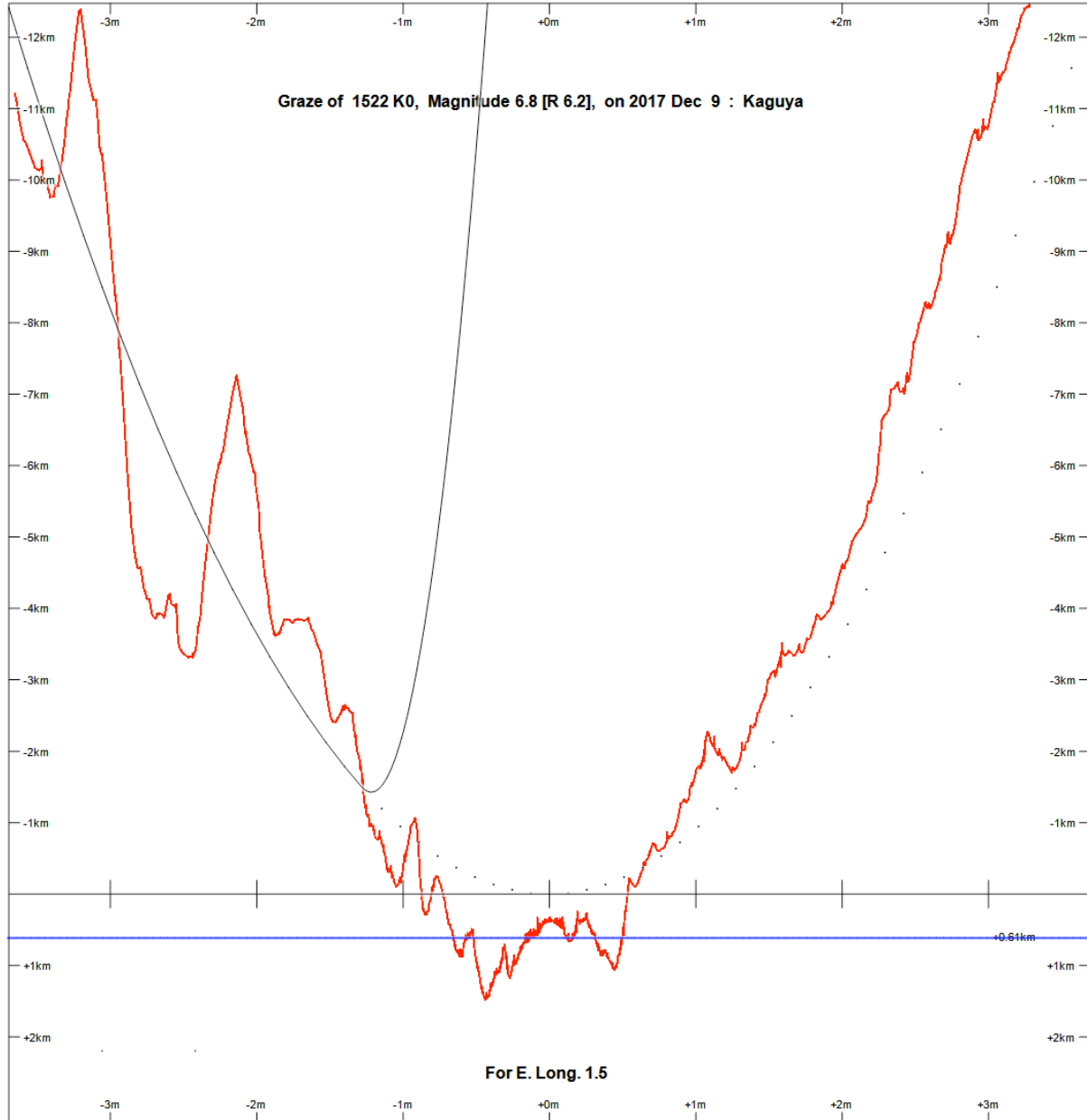


Figure 1. Predicted limb profile.

Table 1 provides key information about the event.

Star	ZC1522
Magnitude	6.8
Constellation	Leo
Lunar phase	91% waning
Lunar elongation	103°
Lunar libration	$\lambda = +7.20^\circ$, $\beta = -1.27^\circ$
Approach	Bright limb
Limb	South
Predicted central time	06:27:29 UT
Altitude of Sun	-12°
Altitude of star	45°
Azimuth of star	209°
Observer location (WGS84)	1.454791° E, 52.092549° N, 14m elevation

Table 1. Key information.

Both visual and video observations were difficult as the star was relatively faint, and the event took place entirely against the bright limb, with considerable associated glare. Figure 2, a still from James's video, shows the limb close to the star, illustrating well the difficulty caused by glare: for the star to be visible, the video had to be set such that most lunar features were bleached out. The difficulties resulted in a wide spread of recorded timings. As is so often the case, agreement between theory and observation was poor. Table 2 lists the equipment used by the observers and figure 3 illustrates both theoretical and empirical timings.



Figure 2. The lunar limb close to ZC1522.

Observer	Equipment and Observations
James Appleton	250 mm Meade LX200 SCT on altaz mount with x2 Barlow and Canon EOS camera in movie mode (50 fps @ 1/50s exposure, ISO 25600). Recorded video for offline analysis. Timing reference from Martin's MSF clock. Audio notes via sound channel on video recording.
Martin Cook	254 mm Dobsonian reflector. Timing reference from MSF clock. Audio recording on Android app. Problems with telescope drive meant that Martin had to keep moving the telescope manually: this compromised the accuracy of timings.
Andy Gibbs	Orion XX12i push-to Dobsonian, 14 mm eyepiece (107x magnification). Audio memos app on iPhone and radio wrist watch.
Mike O'Mahony	Celestron 230 mm, F10 SCT on Skywatcher HEQ5 Pro mount. Canon 60Da camera in movie mode (1/40s exposure, ISO 1600). (The effective magnification of the optical train was x100, approximately.) The ground under Mike's tripod was spongy and, as a result, the image shifted during the recording. Recorded video for offline analysis.
Alan Smith	250 mm Newtonian, F6, 10mm super-plossl eyepiece (150x magnification). Dobsonian mount with electric drive. Audio recording via MP3 audio recorder. Manual timings referenced to MSF clock. Note: there was a one second discrepancy between time shown by the MSF clock and that on a smart-phone. Despite experiencing problems with ice on the primary mirror and a malfunctioning electric RA drive, Alan successfully observed and timed multiple disappearance/ reappearance events.
Joe Startin	OASI's 200mm Celestron Nexstar 8SE SCT. Unfortunately, problems with the viewfinder meant that it was no possible to align the instrument, and observations were not possible.

Table 2. Observers and results.



Figure 3. Event timings.

Mike based the selection of exposure time and ISO for his video recording on his previous experience of videoing grazing occultations. Unfortunately, initial examination of the recording showed that the star was barely visible. It remains an exercise for the future to undertake image enhancement to enable event times to be estimated.

James fared better, perhaps through beginner's luck! This was his first effort at videoing a grazing occultation (following recent investment in equipment), so camera settings were tentative. Fortunately, results were as good as could be hoped for, providing a reasonable balance between over-exposure of the lunar surface and the need to record the star itself. However, due to glare, the star could only be seen intermittently against the limb, and it was not possible to

estimate event times. Nevertheless, in broad terms the video provided broad confirmation of the events reported by Alan.

Analysis of James's video combined with Alan's description of his observations made it possible to identify the lunar features associated with the extended disappearance events reported by Alan. These are highlighted in figure 4 (a still extracted from the video), together with the most prominent craters on the lunar disk. The disappearance/ reappearance events were associated with the southern limb craters Malapert and Amundsen. (Note that in figure 4, the ISO setting for the video was adjusted so that lunar features were visible, meaning that the star was invisible.)

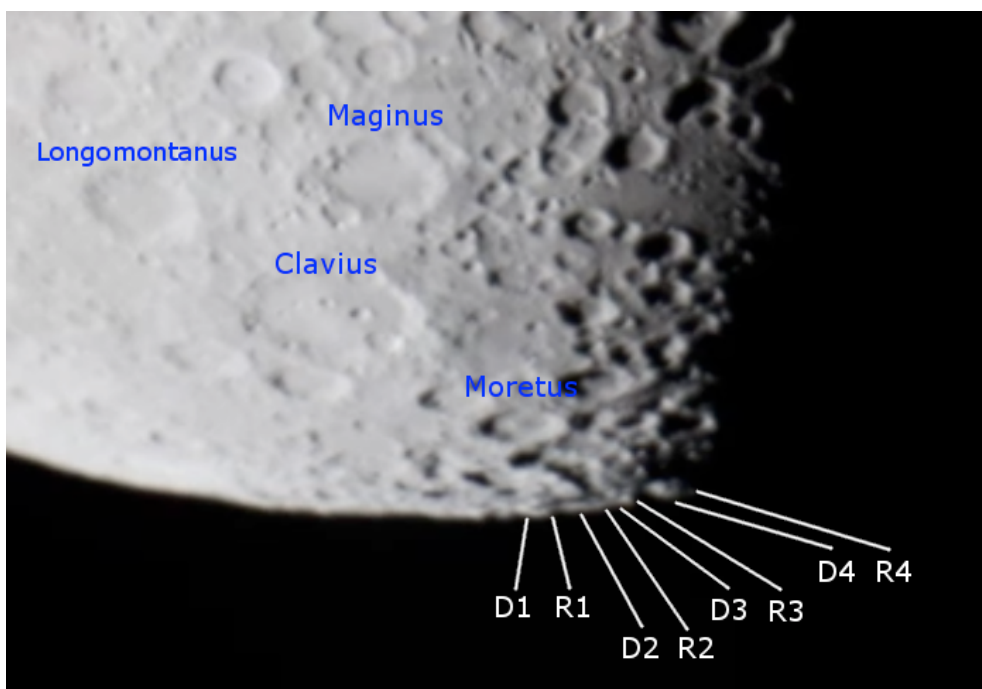


Figure 4. Lunar features.



Figure 4. Team photo, against the background of dawn breaking.