The Newsletter

of the

Orwell Astronomical Society (Ipswich)

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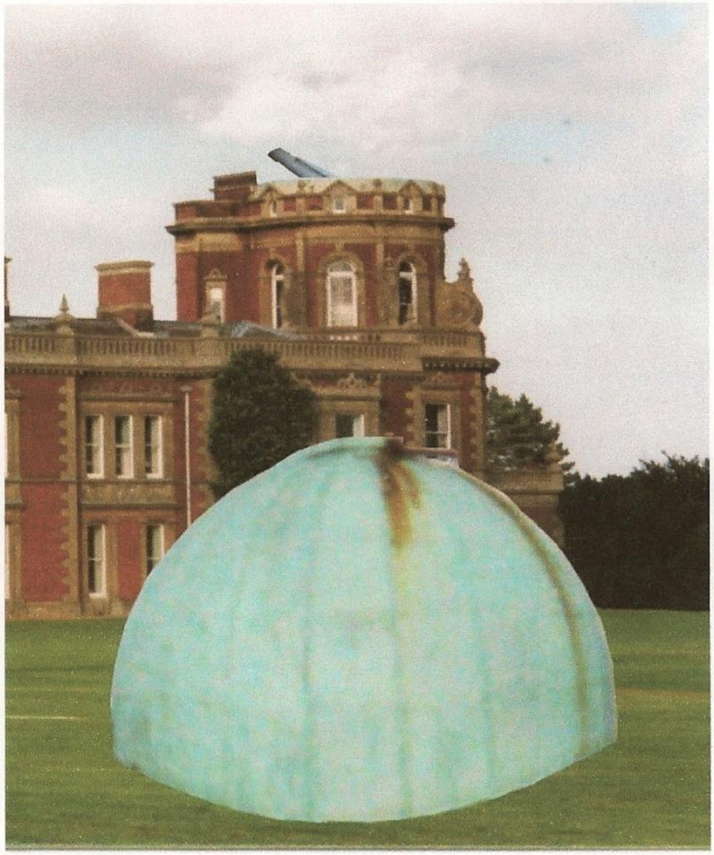


Unique photo of the Tomline Telescope with the dome removed.
The dome was lowered to the ground so that the shutter could be repaired easily and safely.

Society News (Roy Gooding)

1 Committee Meeting Saturday 18th June

All members are invited to attend the next Committee meeting, on Saturday 18th June . Start time 20:00. Venue Methodist Church Hall

2 Access into the School Grounds and Observatory Tower

Please use the third gate into the school grounds, this is the gate behind the Gym. If the Black door entrance at the base of the observatory tower is locked, you will have to phone someone in the observatory to let you in. My mobile number is [redacted]. (Roy Gooding) alternatively the Observatory mobile is [redacted] during meeting hours. The gate code is on the back of your membership card

3 Welcome to New Members

Stephen Hubbar
Martin & Wendy Chapman
Tim Burr
Ben Dover
Roger Howells-Harris
Colleen Cardd
Rick Kleiner
Russell Ingleaves
Kenny Dewitt
Andrew Coulson
Bill Ding

4 Events Programme for 2011

This provisional event list will be updated through out the year

Meeting	Venue	Date
BAA one day meeting	UEA Norwich	Saturday 7th May
Summer Barbecue	Newbourne Village Hall	Saturday 25th June 13:00 to 24:00
FAS Convention		TBA
Autumn Equinox Sky Camp 2010 Organised by Loughton Astronomical Society with the support of the SPA	Kelling Heath, Norfolk	19 - 30 September
Open Weekend		TBA
Lecture Meeting Telescopes from Hell: (what to watch out for when buying a telescope) by Martin Mobberley	Methodist Church Halls, Blackhorse Lane	Friday 14th October 20:00
Lecture Meeting Are We Star Dust or Nuclear Waste? (Stellar Evolution) by Robin Catchpole	Methodist Church Halls, Blackhorse Lane	Friday 4th November 20:00
Ipswich Beer Festival		TBA
Christmas Meal	Venue TBA	Wednesday 14th December

5 Observational Out Reach Meetings 2011
Spring Star Party: Chantry Park New Venue

Ipswich Parks department have asked us if we could change the event to Chantry Park. They presumably, would like more events to be held here. I have surveyed the park, and have found a suitable site.

The first date, 12th March, was cancelled due to bad weather.

Directions:

- **Enter Chantry Park from the Hadleigh road entrance. It is the drive way to the Sue Ryder home.**
- **This drive does not have any gates so access is always open**
- **At the top of the drive take the left hand road. There are about 3 speed humps along here.**
- **At the end of this road, which is about 200 yards long , there is a small car park.**
- **The observing site is adjacent to this car park**

Hopefully this area is at a sufficient distance from the lighting on London road. There are a few large trees here, but there is enough room between to find a clear view of the sky. Equipment will not have to moved any further than on Christchurch park

Meeting	Venue	Date
Chantry Park "Star Party"	Chantry Park, car park	Saturday 9th April Members arrive at 19:30 Visitors arrive at 20:00 Ends at 22:0 0

Astronomy in the Park: Spring Event

Arrive about 30 minutes before the start to set up equipment

Meeting	Venue	Date
Astronomy in the Park "Observing the sun" 1st option	Christchurch Park Reg Driver Centre	Saturday / Sunday 21st / 22nd May 11:00 to 16:00
Astronomy in the Park "Observing the sun" 2nd option if 1st is cloudy	Christchurch Park Reg Driver Centre	Saturday / Sunday 28th / 29th May 11:00 to 16:00

Night Sky (April)

All times GMT

Moon

New Moon	1st Quarter	Full Moon	3rd Quarter
3rd	11th	18th	25th

Object	Date			Mag	Notes
		Rise	Set		
Sun	1	05:31	18:29		
	30	04:28	19:18		
Mercury	1	05:33	19:50	1.2	Mercury is at inferior conjunction on the 9th
	30	04:00	16:44		
Venus	1	04:40	15:03	-3.8	Venus is very low down in the drawn twilight sky
	30	03:49	16:27		
Mars	1	05:19	17:15		Mars is to close to the sun to observe this month
	30	04:01	17:29		
Jupiter	1	05:47	18:44		Jupter is at conjunction on 6th April
	30	04:05	17:30		
Saturn	1	18:24	06:03	0.3	Saturn is at opposition on 4th April
	30	16:18	04:05		
Uranus	1	05:21	17:25		Uranus is too close to the sun to observe this month
	30	03:30	15:39		
Neptune	1	04:27	14:27		Neptune is too close to the sun to observe this month
	30	02:34	12:37		

Meteor Showers (BAA Handbook)

Shower	Maximum	Limits	ZHR
Lyrids	April 24th	April 19th to 25th	10

OCCULTATIONS DURING APRIL

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

Date	Time (UT)	D R	Lunar Phase	Sun Alt (d)	Star Alt (d)	Mag	Star
05 Apr	19:31:28	D	0.04+	-9	13	7.4	Hip 11112
07 Apr	19:13:08	D	0.15+	-6	33	4.4	37 Tau
	20:12:34	R		-14	24		
07 Apr	19:39:24	D	0.15+	-10	29	5.9	39 Tau
	20:24:39	R		-16	22		
08 Apr	22:33:09	D	0.24+	-28	12	6.7	V1154 Tau
09 Apr	19:23:18	D	0.32+	-7	47	7.2	Hip 27956
09 Apr	21:48:13	D	0.33+	-24	26	7.5	1324-1719-1
09 Apr	22:42:50	D	0.33+	-28	18	6.4	141 Tau
13 Apr	21:49:49	D	0.76+	-23	42	7.2	Hip 47446
15 Apr	21:14:01	D	0.93+	-19	34	4.8	87 Leo
18 Apr	01:27:50	D	1.00+	-24	19	5.5	75 Vir

James Appleton

OASI member Trefor Haries would like to
Make contact with any other members who
Live in the Colchester / North Essex area with
A view to possible car sharing to the observatory
On viewing nights. Any contacts will be welcome.
My contact details are:
treforharries@btinternet.com Tel: [redacted].

The Observatory

by Tina Hammond

Over the years much has been documented in the OASI Newsletter about the history of Orwell Park Observatory.

However, in recent times not much has been written about its inception, and I hope that this article goes some way to righting this omission.

Orwell Park Observatory is that rare thing, an observatory that is integral to a house. It is not known why Tomline opted for this far more expensive option, but one can surmise it was not only because he wished to impress his friends, but also because he could afford the luxury of doing do.

The first problem that arises as a consequence of this action is the uninterrupted view which is much easier to obtain if it is constructed upon a nearby hill. In order to overcome that, the floor of the Equatorial Room was stipulated to be 6' (1.8m) above the highest chimney of the mansion, as well as 53' (16m) from the ground (the top of the dome being 86' (26m) from the ground).

The foundations were, of course, crucial and although the soil at Nacton was of the hard loamy type, the depth they needed to be dug to support such a structure meant that the occasional odd pocket of water was found (it is after all, near a river and a spring); these were filled in with solid concrete, in addition to the 4' (1.2m) bed of solid concrete foundations that the Observatory building sits upon, and extend 3' (1m) out beyond the lowest footings.

The Turkish bath was sited on the principal floor, with the *sundarium* and *tepidarium* in an adjunct to the observatory tower, and the *frigidarium* being the current day 'boot room'. The furnace in the basement was able to heat the water to 200'F (93'C) and, naturally, the temperature in the three chambers could be altered at whim to suit the bathers.

The *frigidarium* was decorated with oriental luxuriance and had shelves of polished marble, plus dado and wall linings of coloured marble and a veined marble floor, the groined vaulted ceiling being executed in plaster and intended for coloured and painted decorations.

Large couches were placed in the large recesses to the sides, thereby enabling it to double up as a sumptuous and agreeable general purpose area as well as being the *frigidarium,* and displaying a more thrifty side - multiple uses for a single room! - to Tomline than has previously been encountered. The arched ceilings were intended to give an atmosphere of Turkey, and were continued up into the floors immediately above, which were the Muniment Chamber and Belvedere.

The bottom of the building is octagonal in shape, and there the internal diameter is 32' (9.75m); however, the walls become circular in shape above the Muniment Chamber, at the Belvedere level, and by the time the Equatorial Room is reached, the inside diameter is only 19' 6" (5.8m), with the internal diameter of the dome being 20' (6m).

The doorway to the Equatorial Room had to be 6' (1.8m) high and 2' 6" (0.75m) wide, Airy stipulating that the height be restricted so

that the extreme top of the Equatorial Room wall be exactly 6' 5" (2m) above the floor level.

The Equatorial Room walls are 22 ½" (0.57m) thick and the room was lit by small windows in the walls and heated by air flues from the boiler of the Turkish bath below. Gas lights were added at a later stage, as was a gas fire in the Belvedere, adjacent to the 'cubby room'. There surely cannot be many observatories that boast heating in the main observing room! One has to assume that that little luxury was reserved strictly for Tomline and his guests, and does cast doubt as to whether the Observatory was built because he was interested in astronomy or merely because he thought it would be a good idea with the impending transits of Venus fast approaching.

The dome which consists of iron ribs, each 4" (0.1m) thick, weighs three tons, and has 16 wheel boxes, which were rotated by a rope attached to the turning wheel. It was covered on the outside with deal boarding and the traditional copper sheathing forming the exterior covering affixed to that wood. The inside of the dome was lined with polished mahogany boards, radiating to the apex. The walls were also lined with polished mahogany.

The casting which formed the support of the Tomline refractor was securely bolted to the top of the central pier and the constructor's scaffolding was specified to be of sufficient strength so as to hoist up the refractor mount which weighed several tons.

A 5' x 3' (1.6m) hard York stone was fixed to the floor of the transit room to form the foundation for the transit instrument.

Tides – what's really going on?

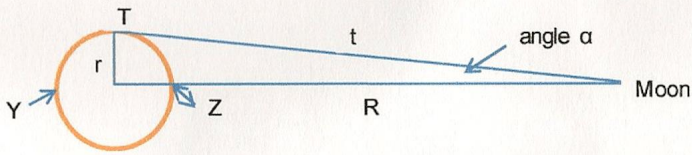
I never quite got tides when I was at school. The part about the sea being pulled upwards on the side towards the Moon was OK. But we were told the sea also bulges out on the far side too – and this was glossed over very quickly. Immediately diagrams including the Sun were produced, and we moved onto springs and neaps before anyone had time to ask awkward questions.

Recently I sought an explanation on the web. This was one of the better offerings: "The side of the Earth nearer to the Moon experiences a stronger gravitational pull than is needed to keep it in orbit with the rest of the Earth. It is therefore pulled towards the Moon. Conversely, on the far side of the Earth the gravitational force of the Moon is weaker than the average."

This is still not easy to understand, and it is not clear why diagrams always show the bulges on each side are the same size. Also it would be nice to know how big to expect them to be.

This is the simplest convincing explanation I can come up with.

<u>The underlying mechanism</u>



Earth, on left, has radius r, and its centre is a distance R from the centre of the Moon.

Tides arise from the variation of the gravitational acceleration at different points on the Earth's surface, caused by a body such as the Moon. We will take the reference point of this variation as the Earth's centre of mass. There, the gravitational acceleration is GMR2, where G is the gravitational constant and M is the mass of the Moon. We also consider the acceleration at two points along the Earth/Moon axis, each on the surface at a distance r from the centre. The acceleration at the point closer to the Moon, Z, is GMR-r2 , and at the farther point, Y, it is GMR+r2 .

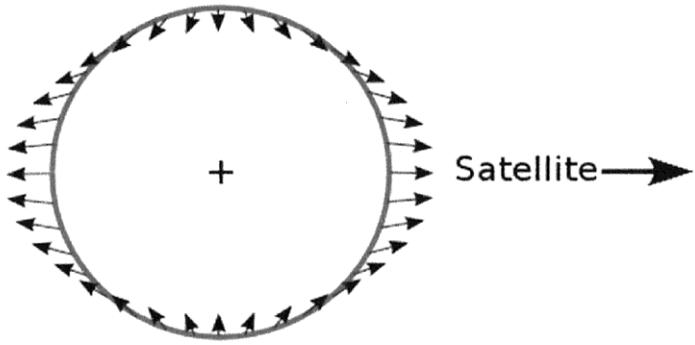
The near-side tidal acceleration at Z, in the direction away from the centre of the Earth's centre of mass, is therefore GMR-r2 - GMR2 . This rearranges to GMR211-rR2 -1. By a

similar argument, the far-side tidal acceleration at Y, away from the centre of the Earth and so in the opposite direction, is $GMR^2/(1-1+r/R)^2$.

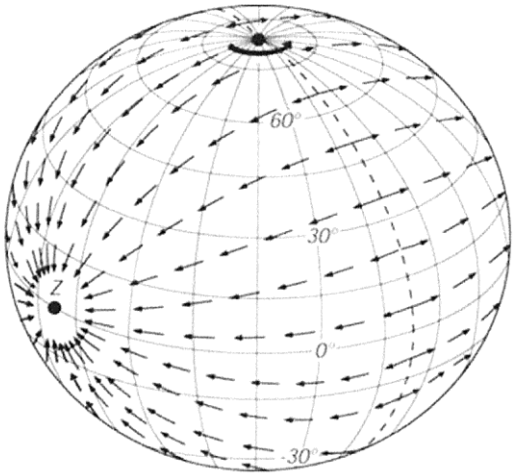
This shows that the tidal effect is not exactly the same on each side of the Earth. However, we know r is much smaller than R. We can expand using the binomial theorem, and ignore the higher order terms involving r/R. The result in both cases is $2GMr/R^3$, so the effect on each side is the same for most practical purposes. Also, the effect drops as the cube of the distance to the tide-inducing body, and this goes some way to explaining how the tidal effect of the Sun comes to be rather less than that of the Moon.

Now consider point T in the diagram, at a distance t from centre of the Moon. The gravitational acceleration owing to the Moon has a component downwards, perpendicular to the Earth-Moon axis. This is wholly tidal, as it is entirely absent at the centre of the Earth. The downwards component is $GMt/r^2.\sin\alpha$, or GMt/r^3 . The distance t can be worked out using Pythagoras, but ignoring higher order terms in r/R as before, the component is GMr/R^3, which is half the size of the effect at points Y and Z.

The tidal effects all the way round can be found from a fuller analysis, as in http://oceanworld.tamu.edu/resources/ocng_textbook/chapter17/chapter17_04.htm. But enough work has been done to make the picture below plausible.



It is actually horizontal forces in the ocean which create the tides, and it can now been seen that these will be strongest in the mid-latitudes. Another picture, showing the flows if the Earth was entirely covered in liquid:



The Moon is above point Z, but note that Z is not always on the equator. It can be anywhere in the tropics.

Height of the tide

What sort of value does this approach imply for the size of the bulge? We are interested in h, the difference in the heights of the ocean at Z (or Y) and at T. For a unit test mass, this represents a difference in potential energy of gh, where g is the acceleration due to gravity at the surface of the Earth.

Imagine taking the unit test mass from the centre of the Earth to point Z. The average assisting force from the tidal effect would be 12.2GMrR3 , operating over a distance r. The work supplied to you would be GMr2R3. To take it from the centre of the Earth to T, the tidal effect would resist you, and you would have to do work of 12.GMr2R3 on it. So the difference in potential energy of the unit mass at Z and at T is 3GMr22R3 .

We can equate this to gh. Also, by considering the gravitational attraction of the Earth, of mass E, on a test mass at the surface, we know that g=GEr2.

This leads to h=32.ME.rR3.r.

(Incidentally, this applies to the ocean whatever liquid it is composed of – water, mercury, liquid ammonia, etc.)

The Earth has about 80 times the mass of the Moon, so ME is 1/80, and the Moon is about 60 Earth radii away, so rR is 1/60. The radius of the Earth is 6370 km. This implies h = 0.55 metres. This is not very large, but it is not far off what is observed at many mid-ocean locations. It needs a lot of interpretation before it can be related to marine tides in general.

Doing the same sum for the Sun's tidal effect on the Earth gives h = 0.25 metres.

Consideration of the 'barycentre'

Some explanations of the tide get very hung up about something called the barycentre. This is simply the centre of mass of the Earth-Moon system. It actually sits inside the Earth itself, about 1000 miles below the surface.

Strictly the Moon does not revolve around the Earth, but the whole system rotates around the barycentre. The classic picture is of a highly asymmetrical dumbbell rotating in space, with the Earth doing a kind of wobble.

Some attempts to explain the tides go on to examine this motion about the barycentre, but either they are glib and unconvincing, or they become unnecessarily complicated.

This motion does need to be accounted for, but the dumbbell idea is misleading. It all becomes clearer if you imagine stopping the Earth rotating on any axis through its centre, while still allowing the system to rotate about the barycentre. The Earth's centre will move in a circle, whose radius is its distance from the barycentre. I can then just about get my head around the idea that every other point inside the Earth, and on its surface, will move at the same speed as the Earth's centre, and in the same direction, describing a circle of the same radius. The centre of each point's circle will be displaced from the point itself in the direction parallel to the Earth-Moon line. Because every point moves in exactly the same way it has the same acceleration. This can be accounted for by the Moon's gravitational attraction at Earth's centre of mass. It is the $GMR2$ term seen earlier, acting parallel to the Earth-Moon line.

A final thought

The rotation of the Earth about its own axis, once every sidereal day, also causes it to bulge around the equator. It is very much higher than a tidal effect bulge – about 13 miles - but because it applies to the whole Earth as well as the oceans, and does it not move around, it goes largely unregarded.

In the next newsletter I will say more about the tides, as seen on the Earth, within the solar system, and beyond.

PORTABLE HOME

(PORTABLE DOME)

Spotted at Kelling Heath
Autumn Equinox Sky Camp
Saturday 15th September 2007

FOR SALE

Meade ETX 125EC

127mm Matsukov-Cassegrain catadioptric telescope.

Ideal for the Moon, planets and the brighter fuzzy objects

Including:

Autostar Controller (GOTO computer)

Deluxe Field Tripod

T-Adaptor

Hard Case

Electric Focusser

PC Cable Kit & Software

AC (240V) adaptor

12V DC extension cable

"How to use the ETX" books (x2)

hardly used.

£500

Contact: Paul Whiting [redacted]

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OASI Committee Contacts & Responsibilities

Neil Morley	Chairman	☎ [redacted]	Chair committee meetings. Represent OASI to external bodies.
Roy Gooding	Secretary	☎	Respond to enquiries. Press & publicity. Observatory decoration. Open days.
Paul Whiting FRAS	Treasurer	☎	Finance. Visits by outside groups.
James Appleton	Committee	☎	Minutes of committee meetings. Web site.
Bill Barton FRAS	Committee	☎	Safety & security.
Martin Cook	Committee	☎	Membership. Tomline Refractor maintenance.
Tina Hammond	Committee	☎	Librarian.
Peter Richards	Committee	☎	Lecture meetings. Email distribution lists.
Eric Sims	Committee	☎	Newsletter.
John Wainwright	Committee	☎	Equipment curator.
Mike Whybray	Committee	☎	Workshops.

Trustees

Mr Roy Adams
Mr David Brown
Mr David Payne

Honorary President

Dr Allan Chapman D.Phil MA FRAS

DIARY for APRIL

STONs **Monday 4th 8.00pm** at the observatory **Monday 18th** **7.30pm at** Newbourne Village Hall	**SMALL TELESCOPES OBSERVING NIGHTS AT THE OBSERVATORY** Main observing targets: Leo and associated Messier Objects and Asteriods Juno, Tika Massala. ☎ Paddy O'Sullivan [redacted] ☎ Gerry Pilling [redacted]
Wednesdays **From 8.00pm**	**OBSERVATORY CLUB NIGHTS** Observing with the Tomline Refractor and other telescopes if skies are clear. ASTEROID OBSERVING PROJECT. ☎ Martin Cook [redacted], mobile [redacted] ☎ Roy Gooding [redacted] mobile [redacted]
Wednesday	**OASI WORKSHOP** Nothing Arranged At Nacton Village Hall ☎ Mike Whybray [redacted]
Thursday **7th 8.00pm**	**OBSERVATORY VISITS BY LOCAL COMMUNITY GROUPS** Norfolk Amateur Radio Club ☎ Paul Whiting FRAS [redacted]
Saturday **18th June** **8.00pm**	**NEXT COMMITTEE MEETING** **Venue: The Methodist Church Hall** **Blackhorse Lane** **Ipswich**

TUESDAY 5TH APRIL TASTER EVENING.

OPEN FIELD OBSERVING
Newbourne Village Hall
Monday 18th April 7.30pm

STAR PARTY CHANTRY PARK
FIRST OPTION WAS CLOUDY
Second option Saturday 9th April 19.30 for 22.00 start

Society Contact Details

Observatory tel. no. (meeting nights only): [redacted]
Secretary: Roy Gooding [redacted] (day) [redacted] (evening)
E-mail queries: **info@oasi.org.uk**
Chairman: Neil Morley [redacted]