FAS Newsletter

Federation of Astronomical Societies http://www.fedastro.org.uk

FAS Comms are now in YOUR Hands!

The membership renewal exercise for 2011 is now virtually complete, but for the mopping up a few late responders, and at the time of writing there are still many cheques waiting to be presented at the bank. Once that has been done (and it will be in manageable batches, when I can fit it in) then those societies will get a formal receipt by email. Well over 50% of societies have already had those confirmation emails from me.

So, most treasurers and secretaries will be aware of the change in the way we are now handling renewals, but hopefully others of you will also be interested. All renewals are now done on-line, using FAS OnLine, a database system built for us by our WebMaster, Samuel George, currently working in Alberta, Canada. Hitherto we had used an MS Access database, and everything was handled on paper, i.e. renewal letters were generated using a mailmerge, and then all the eventual data entry handled by yours truly. This was one heck of a chore, and one that, understandably, is one that I am delighted to see the back of. From my communications with some officers of Member Societies, I get the distinct impression that many believe the FAS Council are full timers, manning an office to service the FAS's administration. This is not the case, we're all volunteers just as are the officers of our member societies, and FAS admin jobs just have to wait until there is a time slot available – hence the need to reduce the manual element as far as we possibly can.

For this year's renewal we generated a batch email to each Society's primary contact as identified on the MS Access database. This was on 27th January. We repeated last year's offer of an Early Payer discount of approx 50% of the annual subscription, and we also held down the Public Liability Insurance (PLI) to last year's figure of £28.00 – effectively subsidising all Members' PLI Cover out of FAS funds. The email contained the URL address for the new FAS system, together with a generic User Name and Password, common across all members. Society specific -Society ID and Society Code - provided the next layer of security. Societies were then asked to enter all pertinent data, such as website and meeting location, number of members, full contact details for Secretary and Treasurer.

I think the very first access and renewal was actually on 28th Jan! Many societies kindly commented on the ease of using the new system, such as "What a good system, a doddle!". However several others, perhaps less familiar with on-line data entry, took a while to get the idea.

There is still a manual element, one that hopefully will be removed next year. Societies are still asked to send a cheque, the details of which I have to key in as part of our audit procedure. We wish to go fully on-line next year, but have yet to decide the best mechanism, most likely using a system such as Paypal to process payments. We do of course recognise that some societies will resist such a move, and insist on cheque, and so we will of course have a twin-track approach, but we are sure that the vast majority will be only too keen to complete the move into the 21st century. The abolition of cheques is still several years away, but it does loom, and so societies will have to think how to deal with this eventuality.

Now that the membership data is on-line, we can cut-out the middle -man, i.e. me! My intention is to minimise the job of the Membership Secretary to the point that the need for the post becomes nonexistent! Societies can now go on-line and maintain their own data, rather than emailing me to make the changes for them. So as soon as you have an AGM and change either Secretary or Treasurer, or move house, get a new email, move to a new society website, change the number of your

(Continued on page 2)

Another Successful IoW Star Party

Credit: Stephen J Griffiths **The Happy Band** Full Story on Page X

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Presidents Spot

Well by the time you read this article Spring will have sprung (hurrah!) and we'll once again have to wait that extra hour of BST each evening for the sky to get dark (boo!). Without seeking to wish away many months of hopefully excellent observing in between, can I ask you all to make a note on your calendars of the Annual Convention & AGM of the FAS to be held this year on 15th October. Once again at the Institute of Astronomy in Cambridge, and we will have a great programme of speakers and many trade stands. We'll post the details on the FAS website as they emerge. Hopefully the Convention will be preceded a week earlier on the 8th October by views of a marvellous display of the Draconid meteor shower, if the predictions are correct and the weather cooperative.

I think there's a parallel between the prediction of a good display of meteors and seeking nominations from you all to fill a few FAS Council posts. One hopes to see a lot of them turn up but sometimes, perhaps more often than not, one is greatly disappointed! Actually I'm more likely to see a major meteor storm than to see a volunteer for FAS Council come forward! So by way of that rather poor link, and please don't switch off, can I appeal again for anyone interested in sitting on the FAS Council to let us know. You can find descriptions of the various Council posts on the FAS website. We also need someone to write the minutes of the Council meetings. There are 3 Council Meetings each year, usually at the RAS, Burlington House, Piccadilly, London and reasonable travel expenses are paid to Council members. We will need new blood if the FAS is not to go into serious decline.

Finally do please let the FAS know if there is something you would like it to consider doing for the benefit of its member societies.

Best Wishes and Clear skies!

Richard Sargent

to TWITTER or not to TWITTER'!!!!

You can now follow us @fedastro

The FAS now has a twitter account so you can follow the every move of the FAS in the digital age. Twitter is a place to share short messages about what you are doing. For the FAS this will primarily be what you lot do. As a means of promoting all things amateur astronomy we are primarily using it to post the event updates that you put in our society diary. Don't expect updates about our the council's drinking habits, there are many others you can follow for that sort of thing. We will also put up important items as a means of reminding you, basically you can never get away from us when we want you to renew your membership.

So go, follow us - http://twitter.com/fedastro

Samuel George

(Continued from page 1)

members – then go straight to FAS OnLine and record those changes, keeping them up-to-date. A note to Society Chairmen or Presidents – please make sure that someone is assigned this responsibility within your committee, and safely keeps a record of your access codes. Also, if a Secretary or Treasurer doesn't actually have an email, please provide an email of some other committee member who can receive, then pass on, any contact we might make. This on-line data will from hereon be the single source for all FAS listings – i.e. the list of Societies on our website, the list that appears in BBC Sky at Night Magazine, and of course our 'allfassocs' FAS email distribution system. In future we will include in this the email addresses for Secretary, Treasurer and, where given, a general email for the society. That way more than one officer in a Committee should be in receipt of any FAS-wide emails.

So, I've described the benefits of our new approach from my perspective and that of the Council, but if you have any observations then please let me know, so that we can take them into account when we consider how best to move fully on-line.

John Axtell FRAS
Membership Secretary

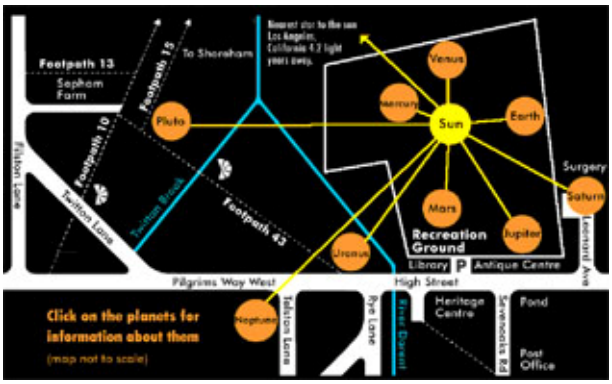
Places to Visit : The Solar System

John Murrell

If you want to get a good idea of the scale of the solar system and just how insignificant our home planet is visit the Scale Solar System Model in Otford in Kent. The model was built as part of the millennium celebrations and has models of the planets in the positions they were in at the start of 2000. The Sun and inner planets are in the local recreation ground with the planets beyond Mars being placed at various places in the Village.

Pluto which was still a proper planet in 2000 is located in nearby fields down a footpath that can be somewhat muddy in wet weather.

The model also includes the nearest stars but you will need your passport as they are located overseas. I will not spoil the secret of telling you where but be prepared for a big hit on your credit card and several days of travel.



More details on the model including the location of the models of the nearest stars can be found in the Otford Parish Council & Heritage Centre but this has limited opening hours.

Combine the visit with a lunch in a local pub or restaurant and it makes a good day out. There is a local car park but it gets quite busy later in the day, there is also a local train station.

More details are on their website at:
http://www.otford.org/solarsystem/index.htm. and at
http://www.vamplew.co.uk/otford.html

Images courtesy of Otford Solar System
Also courtesy: SAGAS Newsletter

Isle of Wight Star Party

Three nights of observing and one evening of interesting and entertaining talks were enjoyed by astronomers attending the annual Isle of Wight Star Party. The event was held between 3rd and 7th March 2011, at Brighstone Holiday Centre.

General View of the site *Credit: Stephen J Griffiths*

"As ever, I had an amazing time at the Isle of Wight this year," said Iain Melville, who has attended all four IOW Star Parties. "We had a a near perfect celebration of practical amateur astronomy, with Thursday night and Friday night being clear well into the early hours. Both nights were cold, with our equipment ending each night with a healthy layer of ice encrusted upon it, but Friday offered calmer conditions wind-wise, although we were in agreement that transparency was better on the Thursday."

He continued "Saturday was largely cloudy and offered a chance for us to kick back with a few beers and enjoy a relatively early (2AM) end to proceedings. Sunday night was teasing us with the promise of some clear skies, but it turned out to be a better evening for observers, with good transparency and excellent seeing on offer. However, things were over too soon for us as we had to be packed for the morning, and we made the call at about midnight to start packing up. True to form, it was all-clear til dawn from 1:30AM but by then we had had enough and had turned in, in anticipation of the journey home the next day, which involved a 1 o clock ferry."

Viewing highlights included views of M17 and M16 before dawn and some very good views of the bright globulars M3, M4 and M5. For deep sky observer Owen Brazell, one of his highlights was the Planetary IC972/Abell 37 in Virgo which he saw for the first time from the UK. He said "I also had a very nice high power view of NGC 3242 in Hydra showing lots of structure, lots of new galaxy observations in Virgo and some nice galaxies in Leo Minor which I had not targeted before."

Over one hundred people attended the event this year, with some astronomers travelling over 200 miles from towns such as Macclesfield and Norwich to take advantage of the dark skies and low southern horizon the island offers.

The comfort of a heated chalet and wonderful cooked breakfasts, served at the astronomer-friendly hours of 10-11, was also a draw for many. The site also has facilities for camping, and a few hardy souls took this option.

Daytime activities included visits to observatories on the island, Trade stands, astrojumble and a guided tour around Ventnor Botanical Gardens, where many Mediterranean plants thrive in the mild micro-climate.

General View of the site *Credit: Stephen J Griffiths*

Many thanks again to all the supporters of the event, particularly Opticron (UK distributors for Vixen), Springer Books, Ian King Imaging, Modern Astronomy, Astronomy Now Magazine, Astronomia, Astronomy for Everyone, Astroparts, BC&F, The British Astronomical Association and David Hinds.

The date for next year has been set as 22nd - 26th March 2012 - see www.iowstarparty.org for more details.

Dr Lucy Rogers
Lucy@iowstarparty.org
www.iowstarparty.org

Credit: Glennn Bates

Carl Kimberley from West Midlands *Credit: Stephen J Griffiths*

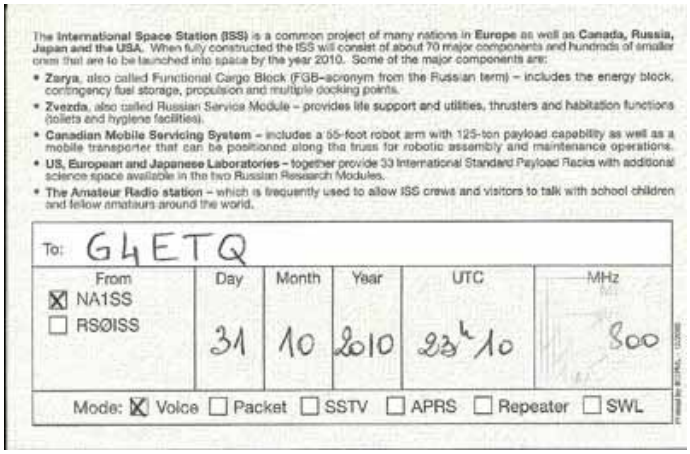
Space QSO by John Davies

I hold an Amateur radio class A licence and have always been interested in astronomy. Late on the evening of the 31st Oct I was sitting in my radio shack thinking about an amateur radio expedition in February to a remote island in Antarctica that would be using the callsign VP8ORK over 8,000nmiles away. I wondered if I would be able to worked them on CW, wireless telegraphy [morse] as my low

power would cause the signals to be weak at that distance and noise would be a problem. Like astronomers, amateurs also suffer from increasing pollution - ours mainly coming from the now comon use of plasma tvs, routers and switch mode power supplies. In the shack the vhf set was running and tuned to the amateur radio/ International Space Station frequency and the computer was running the star map programme 'Stellarium'.

At 2300utc I was just starting to nod off when I noticed ISS, or Zarya if you are Russian, come up above my south western horizon. I picked up the handset and called " NA1SS this is G4ETQ, Golf Four Echo Tango Quebec over". Time slowed right down and a good 6 seconds passed and then I heard " G4 Echo Tango Quebec, we have got you loud and clear, welcome aboard the International Space Station NA1SS"

I re-



The **International Space Station (ISS)** is a common project of many nations in **Europe** as well as **Canada, Russia, Japan and the USA.** When fully constructed the ISS will consist of about 70 major components and hundreds of smaller ones that are to be launched into space by the year 2010. Some of the major components are:

- **Zarya**, also called Functional Cargo Block (FGB-acronym from the Russian term) – includes the energy block, contingency fuel storage, propulsion and multiple docking points.
- **Zvezda**, also called Russian Service Module – provides life support and utilities, thrusters and habitation functions (toilets and hygiene facilities).
- **Canadian Mobile Servicing System** – includes a 55-foot robot arm with 125-ton payload capability as well as a mobile transporter that can be positioned along the truss for robotic assembly and maintenance operations.
- **US, European and Japanese Laboratories** – together provide 33 International Standard Payload Racks with additional science space available in the two Russian Research Modules.
- **The Amateur Radio station** – which is frequently used to allow ISS crews and visitors to talk with school children and fellow amateurs around the world.

To: G4ETQ					
From	Day	Month	Year	UTC	MHz
☒ NA1SS ☐ RSØISS	31	10	2010	23h10	800

Mode: ☒ Voice ☐ Packet ☐ SSTV ☐ APRS ☐ Repeater ☐ SWL

plied with my signal report, and gave him my name John and QTH of Falmouth, over.

He continued in an American voice" Ok, John, it's great to talk to you, and have you aboard, I'm up here in the Russian service module, it's pretty much the command post of the International Space Station. We have just docked a Progress re-supply vehicle yesterday bring us fresh food and vegetables to eat. We will be here for maybe one more month or so, then Dr Shannon Walker and I will return to the planet in our Soyuz capsule and be home for the holiday. So 73 to you, Col. Doug Wheelock and the entire crew of ISS over"

I replied with " many thanks for that Doug, I wonder if you could say 'hello' to my wife Margaret who is standing by me, over?"

Doug replied with " Oh, it's great to meet you Margaret, I love that name. That's my mom's name, I just adore that name Margaret. It's great to talk to you, Col Doug Wheelock on the ISS - we are coming over the North Atlantic right now. We will be crossing the European coastline near northern Spain. It's great to talk with you this evening

73, G4ETQ this is NA1SS clear"

At this point many European amateur operators called him. They operate Ham radio from ISS in their rest time and it is used as an education tool, linking up with many schools around the world for arranged talk sessions. Although it is not too difficult to work the ISS, as signals from them are strong on overhead passes, there are other problems to overcome. These include the position and times of passes, whether the station is operating voice mode, repeater or slow scan tv etc, and will they be able to pick your callsign out amongst many hundreds of stations calling them from earth. However, it did make my day for quite a while afterwards. All radio qsos are confirmed with a card and I was 'over the moon', astronomically speaking to receive my card.

And yes I did work VP8ORK on the South Orkney Islands , Antarctica .....after putting up a sloper antenna facing them at 200degs. Yes, CW (morse) is old and not used much in the commercial world now but in the amateur world it is still used extensively and is the perfect mode, it never fails to get through.

Best 73 as we say, John/G4ETQ .- .-. ... -.-

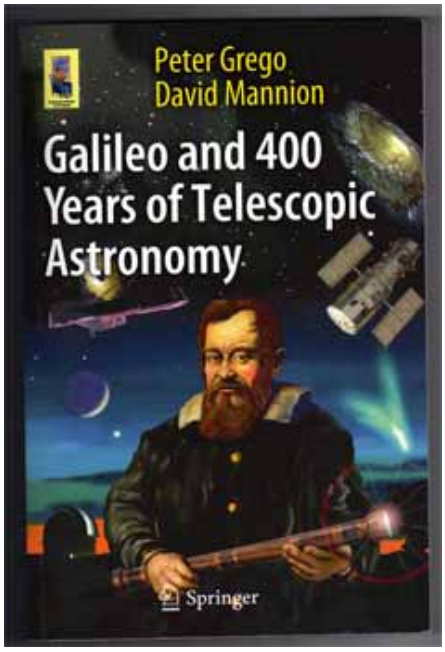
Book Reviews

Galileo and 400 Years of Telescopic Astronomy.

Grego, Peter. Mannion, David.
Paperback, Astronomers' Universe, Springer ISBN 978-1-4419-5592-0. £26.99

'This is an extraordinary book', was my impression as I reached the end of chapter two. Far from being a dry history of the past four centuries of telescopic astronomy, I found a novel mixture of sound historical fact admixed with practical lessons in how to build astronomical equipment of the period, and much, much more.

Grego and Mannion's book is a broad, yet deceptively detailed overview of observational astronomy. The first chapter on pre-Galilean astronomy started off fairly predictably with prehistoric perceptions and classical ideas about the night sky and is rounded off with the sun-centred Copernican theory and the analysis by Kepler of Tycho's detailed observations in the immediate pre-telescopic era. Nothing new here, but then it began to dawn on me that the authors' treatment of the subject was so different to anything I'd read before that here was a new and very entertaining way of presenting the history of telescopic astronomy to their readers.



It's really three books rolled into one; a sound historical overview, a practical explanation of the historical observations, and a useful reference with lists of deep sky objects, future planetary phenomena, conjunctions, transits and the like. The familiar historical outline of astronomy with all the usual characters is well told. The arrangement of the chapters follows a logical historical timeline, the main part being the early telescopic observations made by Galileo followed by Newton's development of physics, the observation and development of visual planetary astronomy and then that of extra-solar system observations. But throughout the book, and this is what I particularly liked, there was a lot of unfamiliar information and detail that brings this book bang up to date. For instance the Antikythera mechanism is rarely mentioned in other discussions of classical astronomy, Galileo's unintentional observation of Neptune is strikingly illustrated in juxtaposition with the view given by modern planetarium software, and I had not heard of Hodierna's list of 40 nebulae published in 1654, a century before that of Charles Messier.

The details of how observations were made and the maths and physics used are explained clearly and augmented by a series of projects for the readers to do for themselves. Learn how to measure the earth's circumference and the height of lunar mountains. Some of the techniques, like drawing sunspots and lunar features at the telescope were familiar, but I have yet to tackle cybersketching on a PDA ! (What's a PDA ??)

What didn't I like ?...well, not much. The blurb on the back cover seemed a little harsh on the Church, but no big deal. In the body of the text there were some interesting omissions, like no reference to Horrock's and Crabtree's first observation of the transit of Venus in 1639. It is mentioned, but they aren't. Neither is Flamsteed's star atlas, Atlas Coelestis, for over a century the mainstay of European astro-cartography, whilst John Bevis does get a mention as producing a detailed and accurate star atlas in the mid-18th C (Uranographia Britannica is so rare that only two dozen copies are known to exist). I also wondered about the inclusion of transient lunar phenomena in the discussion of lunar astronomy, very contentious but they may yet stand the test of time and establishment astronomy proved wrong. These are minor quibbles, there may be others, but don't detract from a well researched and well presented book.

We clearly have a meeting of two minds, Peter Grego, an experienced practical amateur observer and writer and Dr David Mannion, a professional lecturer specialising in physics and astronomy. Together they have created a remarkable book that skilfully combines aspects of telescopic astronomy in a way that is both very readable and stimulating.

Buy it. *Galileo and 400 Years of Telescopic Astronomy* is a refreshingly new way to present observational astronomy in its historical context and would be a great introduction to anyone starting out in practical amateur astronomy. It is definitely a 'must have' for the bookshelves of school libraries and astronomical societies.

Kevin J Kilburn FRAS
General Secretary,
The Society for the History of Astronomy
Former president, Manchester AS

Exoplanets Editor: Sarah Seager.

Publisher: The University of Arizona Press.
ISBN: 978-0-8165-2945-2. Price: £25.95 (Hardback).

Exoplanets is the latest in the University of Arizona Space Science series and in common with many of the other publications is a collection of chapters written by a wide range of specialist authors. It captures a snapshot of the current position in Exoplanet research and thus provides the reader with a comprehensive flavour for how Exoplanets may be studied and our current understanding of their nature, structure and evolution.

Sarah Seager (Editor) is Professor of Planetary Science and Professor of Physics at the Massachusetts Institute of Technology. Her research focuses on theoretical models of atmospheres and interiors of all kinds of exoplanets. She was part of a team that co-discovered the first detection of light emitted from an exoplanet and the first spectrum of an exoplanet.

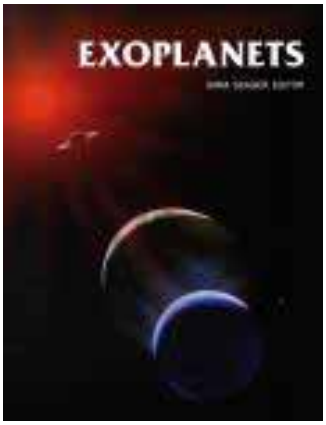
The book is divided into five main sections. In addition to the introduction to exoplanets, the remaining sections consider observing techniques, exoplanet dynamics, formation and evolution and finally, interiors and atmospheres. Each section addresses the principle concepts at a graduate level and leaves the reader with a thorough and up to date summary of the current state of the art.

Exoplanets is a highly readable text with a large number of supporting images and diagrams. The mathematical content, while comprehensive, is not overwhelming and the reader is left feeling that the topics have been explained clearly and in a manner that makes for enjoyable reading. Each chapter is concluded with a reference list of further material to direct the reader toward specific articles of interest.

Exoplanetary transit photometry is an area of observation that is developing within the amateur community (see http://var2.astro.cz/ETD/index.php for amateur exoplanet transit observations) and whether you are an armchair astronomer, amateur or indeed professional observer this book offers a wealth of useful information.

In conclusion, I would highly recommend this book to any amateur astronomer with more than a passing interest in the exciting and dynamic field of exoplanets. While the field is moving quickly and new discoveries are being made with regularity, much of the content of this book will remain relevant and useful for a long time to come. Encouragingly also the cover price is very reasonable for a book of this nature and quality and thus I am sure that it will become a popular reference for those with an interest in Exoplanets.

Darryl Sergison



Astronomical Spectroscopy for Amateurs - *Ken Harrison*

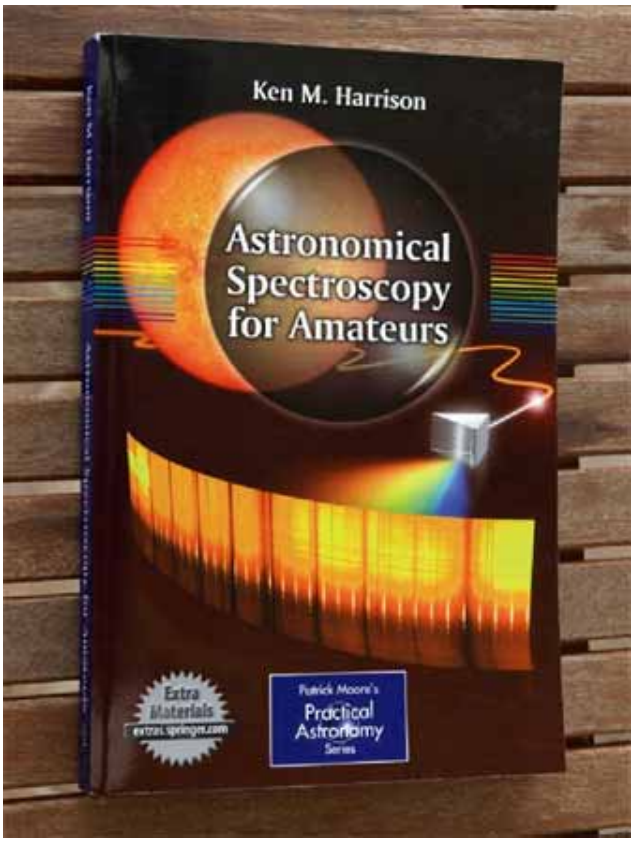
Springer ISBN 978-1-4419-7238-5

I've just finished reading my copy of Ken's new book and I must say Ken has done a great job! Published by Springer as part of Patrick Moore's Practical Astronomy Series, this is an excellent guide and reference for the amateur astronomer active or just interested in spectroscopy.

Ken has taken a slightly different approach to many other texts on spectroscopy: a very low key, plain English delivery of enough theory and practical skills to get someone from, say, basic astronomy skill level to producing meaningful spectra. It's not heavy duty reading.

One of the tricks that Ken has used in the book to keep it simple and help it work the way its intended to is to include a "Further Reading" section and a "Web Pages" section at the end of each chapter. So if you want to know more, you can go there, but if you don't you don't have to.

The book is divided into three parts, and



as Ken claims in his Preface, each part stands well alone. It isn't necessary to read the whole book, it works very well just reading what you want to know now (assuming you have the basics I guess).

Part one is an introduction to spectroscopy. Logically, it starts with the history of spectroscopy to build the background and big picture, before delving into the theory of spectroscopy. Don't be alarmed by the use of the words "theory" and "spectroscopy" in the one sentence – its not so scary, at least it's not the way Ken tells it! There are a few formulae, but you really don't need to know these formulae to get started, and the diagrams in the book can convey the meaning of the formulae very clearly and easily. "Theory of Spectra" covers just 19 pages, but it is clear and concise, and nowhere near as daunting as some whole texts on the matter. If you eventually want to get into measuring and calculating redshifts, you can find the formula here later when you need it.

Part one concludes with discussions of different types of spectroscopes, from the humble prism to gratings and grisms, and the various ways they can be arranged to produce spectra.

Part two is really practical. "Obtaining and Analysing Spectra" is the down to earth practical advice on how to do it. Much of this is information is freely available on the web and from other books, but here it is all presented clearly, and concisely in a logical sequence. This part starts off discussing how to set up the spectroscope – full of practical tips.

Chapter 7 is all about "Spectroscopes in the Converging Beam" – that's StarAnalyser 100 and Rainbow Optics 200 type transmission gratings typically, and the next chapter is about reflection grating spectroscopes – how to set them up and use them, followed by descriptions of most of the commercial spectroscopes that an amateur may encounter. Chapter 9 discusses Cameras and CCD's with respect to spectroscopy, but really it's not so different to normal astrophotography. Chapters 10 and 11 round out part two of the book with "Processing Spectra" and "Amateur Spectroscope Projects".

"Processing Spectra" is really strong on how to use VSpec – the freeware that is the defacto standard for processing spectra. I've been using VSpec for quite a while now and still learned a few tricks from this chapter. To be critical though, the section on pre-processing was perhaps a little light on. IRIS is another freeware that is used for pre-processing the spectra, and it's a command line or menu/dialog driven program rather than a WYSIWYG GUI, so it does take a little bit to get used to driving now that we've all become lazy using windows! Once you know how to do something in IRIS though, its very easy and it does it exceptionally well. The IRIS component of preprocessing a transmission grating spectrum (like you get from a StarAnalyser) is minimal, but the prepocessing gets a bit more involved when you start using a slit spectrograph. That's what I'm starting to learn at the moment, so maybe that's why I'd personally like to see more step by step preprocessing stuff in IRIS, to complement the excellent guidance through VSpec.

"Amateur Spectroscope Projects" discusses the various types of projects you could use your spectroscope for and the suitability of various spectroscopes for each project. This good guidance to help you choose a spectroscope if you have a particular interest, or to avoid frustration by adapting your projects to suit your spectroscope.

The final part of the book is titled "Spectroscope Design and Construction". You may think that this only of interest if you are planning to design and build your own spectrograph, but that's not entirely true. A lot of this stuff is handy to know to modify your spectroscope, or just to understand how it works so you can use it more effectively. The section on Guiding is valuable reading for any spectroscopist.

Illustrations throughout the book are clear and clean and most, if not all, spectra are the product of amateurs and excellent examples of what can be achieved.

- The Appendices cover:
- Suppliers of Spectroscopes and Accessories
- Useful Spectroscopy Forums and Other Websites
- Selected Bibliography

Extras

The "Extras" is a nice touch. These are downloads that book purchasers can access from the Springer site including spreadsheets, the final illustration list, copies of VSpec and IRIS software and some spectroscopy presentations in Powerpoint and PDF form, and even a list of the webpage links from the book so you don't have to type in the URLs!

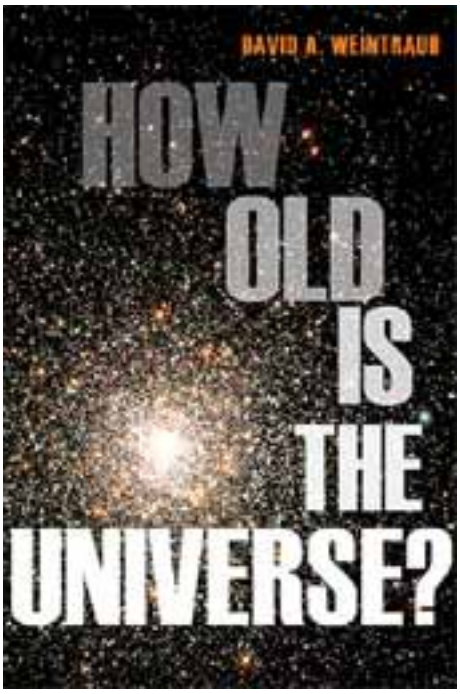
From the extras page on the Springer site, there is also an online copy of the book and facility to download a PDF copy. Presumeably, this is so you can also read it on your eBook reader, however, I had a problem on my first download attempt and the security prevented me from downloading it again. The error message it gave me the second time was that it was "available to subscribers only" so perhaps you need to buy chapters of the book for download.

If you are interested in spectroscopy, then I recommend this book as an excellent starter. All but the most experienced astro-spectroscopists will get something new out of this book, or at least find it handy to have such a reference source all in the one place.

Al Sheehan

HOW OLD IS THE UNIVERSE ?

David A. Weintraub **ISBN13: 978-0-691-147314 £20. 95 Princeton University Press**



From Bishop James Ussher's 17th Century analysis of biblical chronology to an interpretation of the power spectrum of the WMAP data for the Cosmic Microwave Background Radiation David Weintraub relates the unfolding effort to put an age to the Universe. The answer, making use of the WMAP data of some 13.7 billion years, is revealed in the title to chapter 1. so quoting it here is not to spoil the fun - the book is more about methodology than the numerical answer.

There are few aspects of modern day astrophysics which do not play their part in unravelling the answer to the central question and Weintraub discusses each of them in a concise, easily understood but nonetheless comprehensive fashion. The book therefore careers through many of the most significant and exciting astrophysical advances of the last century or so and from that point of view alone this is a worthwhile text. The emphasis in early chapters is that the Universe must be older than the objects which it contains so the attention is drawn quickly to a comprehensive consideration of stellar age and evolution. In this regard Weintraub's treatment of Hertzsprung - Russell (Colour - Magnitude) diagrams is both detailed and revealing as is his subsequent treatment of those key objects, the White Dwarfs. If these are the oldest stars which we see then the question evolves to 'When and how did these objects form, evolve and cool?' The author thus moves on to consider stellar birth, galactic evolution, the Cosmic Microwave background, Dark Matter, Dark Energy and Big Bang Cosmology. In his conclusion Weintraub emphasises that the answers, from a range of methods, must be consistent. The Universe really is 13.7 billion years old and the uncertainty is not much more than 100 million years.

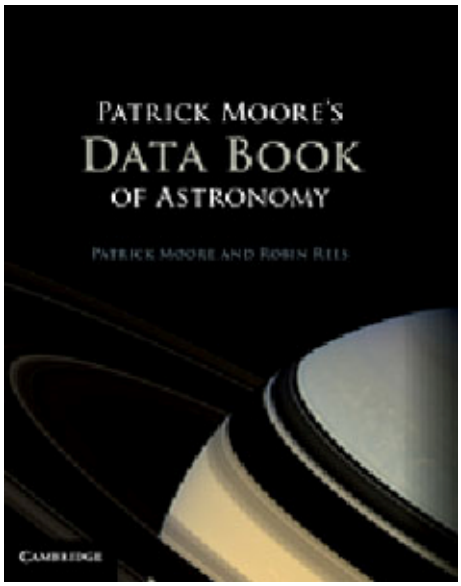
The book might be seen as consisting of two parts. The first part, which considers the central question – 'How old are the stars?' is a detailed review of relevant stellar physics. The language is fundamentally scientific but non mathematical and the conclusions drawn are supported by well presented graphical evidence and argument. The treatment is thorough but far from intimidating for a non specialist reader and the author draws on useful analogies for illustration and support. From the oldest stars to the oldest clusters of stars and thence to a detailed account of Edwin Hubble's use of Cepheid variables as standard candles. The gradual refinement of these methods to yield a Hubble age for the expanding Universe which over decades has inexorably come to be consistent with other measures is reviewed in some detail. Finally, the author ventures into the modern era where Dark Matter and Dark Energy dominate the large scale evolution of the cosmos. Using the standard interpretation of the visible, x-ray and gravitational lensing effects in the Bullet Cluster of galaxies the author discounts possible MOND alternatives in favour of the more widely accepted concordance model. New for this reader is a consideration of the evolution of this model since the recombination era and a resulting fine tuning of the expansion age of the universe. The treatment of the analysis of the WMAP Power spectrum data in terms of density fluctuation based on primordial sound waves was never going to be an easy read. This reader will try again.

This is an attractively presented and well written book. It tells an exciting story in an easily read style and if there are instances when the use of examples might be considered to get in the way, such as a house interior fully tiled with different sized tiles, this to illustrate spacial temperature variations in the Microwave background radiation, then these can be forgiven. The author takes pains at all times to emphasise the prime objective that calculated values for the age must be consistent. The overall result is a very satisfying read.

Brian Parsons.

Patrick Moore's DATA BOOK of Astronomy

by Patrick Moore and Robin Rees.
2nd Edition. ISBN 978-0-521-89935-2. HB £35.00 Cambridge University Press



A solid book in the format of the familiar red and black encyclopaedia series of some 575 pages. This volume has a new colour scheme however of black and grey.

Unsurprisingly the solar system is covered at length for example Jupiter has some 20 pages no less than 63 satellites are tabulated and the four Galilean satellites are covered in more detail, with some useful illustrations. All the planets receive proper attention and the minor members get good coverage too. The Sun gets a full chapter and includes the launch of the Solar Dynamics Observatory, the list of upcoming solar eclipses proved enlightening.

It is hard to escape the thought that this book is aimed at the advanced club member, as it seems to answer those questions used to plan an observing session and training course.

The stars chapters include Double Stars and Variable Stars, clusters, nebulae and galaxies. Tables of all of these abound and will be very useful to anyone requiring DATA!

As one would expect with any book from PM the constellations are well covered. The maps and tables allow a good set of observations to be accumulated. Some of the information has transferred from his earlier books but this compilation is pretty extensive.

The data collected in this text is very much up to date and any one who is interested in say the dates of the return of periodic comets need look no further.

Although this is essentially an information book it is packed with lively and instructive text, which we will all find useful. So there is no need to declare your flock of sheep redundant should you chose it for bedtime reading!

Brian Sheen
Roseland Observatory.

Irish Observers get a Lucky Glimpse of the Partial Eclipse

On the evening before, conditions for the 4th January, partial eclipse at sunrise looked promising, and I drove to a nearby hill to seek out the best location with excellent unobstructed views to the south eastern horizon. The site was Scrabo Golf Course outside Newtownards in County Down which has a superb elevated aspect overlooking Strangford Lough and at around 08:30 am the already partially eclipsed Sun would rise out of the waters of the Lough. The main observing group of the Irish Astronomical Association had agreed to rendezvous at an area of high ground to the north of Belfast at the Knockagh War Memorial – but for me this meant an early morning battle with the rush hour traffic into Belfast – to be avoided at all costs!

On the morning of the eclipse at around 6.45am I pulled back the bedroom curtains to see brilliant Venus shining magnificently, almost screaming out, in a dark blue south eastern sky – conditions looked hopeful. Half an hour later as I packed the gear in the car, my spirits dropped as I felt a few light drops of rain falling on my face from the now almost total cloud cover – although there were still patches of blue which could be seen in the dawn sky to the east. On the way I got a call from George Brannan who decided to abandon his planned trip to Knockagh and he opted to join me at Scrabo.

When we got to Scrabo car park it was still dark, but the sky was brightening steadily from the east, and bizarrely we were surrounded by about 40 golfers in the process of preparing for an early morning tee-off. They rattled and bantered as they kitted-up but completely ignored us, oblivious to the spectacle which was about to unfold.

The sky to the southeast held out some hope – it was crossed by layers of cloud punctuated by brighter areas where the cloud was thinner, then a single gap of blue, then more thick, seemingly impenetrable cloud. If only the Sun could be persuaded to rise up into the clear, blue band then we might catch a glimpse of the eclipse.

The telescopes and cameras were set up and we stared intently the cloudy south eastern sky which was brightening gloriously over Strangford Lough – a beautiful vista of yellow and orange shades, edged with shafts of golden sunlight reflecting from the Lough. Time passed quickly and the Sun brightened, brilliant yellow-gold behind the clouds but firmly stuck just above the horizon, refusing to approach the gap which was about 15 de-

grees above the horizon, but no more than the thickness of a couple of fingers at arm's length. Eight thirty came and went, 8.45 came and went and still the Sun refused to make its way into the clear patch ..... time was ebbing away and in my mind's eye I could see the Moon's black disk sliding relentlessly off the Sun's golden orb.

Eventually we got our wish and through filtered telescopes and binoculars I watched intently as the tiny circular arc of the top of the Sun rose into the cloudless gap. By a few minutes past nine the main portion of the

eclipsed Sun could clearly be seen through thin misty cloud with the disk crossed by streaks of darker cloud layers. The Sun had the appearance of a strange, gas-giant alien planet from a science fiction novel, complete with dark rings and with a tiny sunspot (AR1140) clearly on view close to the edge of the Moon's black disk. Within a few minutes the Sun had passed through the gap in the clouds and it moved into the thicker area with the remaining stages of the eclipse lost to view. We stared on hoping for a last parting glimpse but it was over. We didn't realise at the time, but we were probably the lucky few who had managed to catch a view from Ireland. Most of the Island was clouded out and our colleagues at Knockagh had a frustrating time with fog and black ice – and unfortunately they saw nothing. The reward for our patience was the few hastily taken images which were shown after the evening BBC TV

Equipment Review

Frederiksen Spectroscope

TE 313—D2 -32 10.05

marketed by: djb microtech ltd, Delfie House, 1 Delfie Drive, Greenock, Renfrewshire, Scotland, PA16 9EN www.djb.co.uk

It was early in the 19th century that the French philosopher August Comte claimed that the composition of the stars was one thing that was inherently unknowable.

Then a spectroscope was bolted onto the back of an astronomical telescope and the unknowable was knowable.

However it is a long way from the astronomical spectroscopes of the 19th cent to the 21st cent astronomy club training course. However help is at hand in the form of a small spectroscope

It is 10 cm long and 2.5 cm in diameter and is supplied in a robust box not unlike those used to protect telescope eyepieces.

It is a diffraction grating spectroscope of excellent quality, in a recent comparison it outperformed those supplied by a school physics dept. It has been tested against a tungsten filament electric bulb, a long life (Mercury) bulb, a yellow (Sodium) street light, the new white (Mercury) street light and a special neon bulb. In each case it work very well indeed, it was also evaluated against sodium and other coloured salts in the standard flame test.

I was unable to test the absorption by salt solutions in the workshop I was running.

Students were able to mark the emission lines onto small (10cm X 6 cm) cards with a continuous spectrum printed on them. This simple practical experiment allowed students to understand the relevance of knowing the position of emission lines.

The price of £56.00 represents excellent value for money.

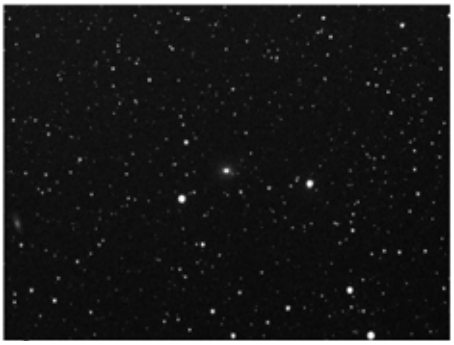
Brian Sheen
Roseland Observatory.

Supernova Searches—Close but not yet time for Champagne

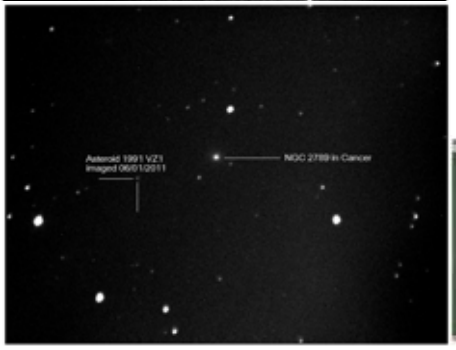
By Brendan Martin & Dave Thomson

The Liverpool Astronomical Society Supernova Search team led by Dave Thomson are continuing searching for supernova, we independently discovered one in May last year only to be pipped at the post, on the 8th of January this year we were pipped again by one day. Koichi Itagaki beat us by 24 hours, we had imaged the galaxy NGC2655 on the 6th but clouds meant no imaging on the 7th when the star went supernova. Below are images taken on the nights in question. The telescope was the newly commissioned 10" f1.2 in the runoff observatory.

... and the pre-discovery image



Also on 6th January 2011 we imaged some asteroids during our searches (a little bit of tracking error on first image)



NGC 2789 was the galaxy where we imaged our first supernova, we were two weeks to late on that one.

Dave Thomson has also done a lot of updating on the weather station. The weather station has sensors for:-

- Rain sensor 1
- Rain sensor 2 (Tipping bucket home made)
- Rain sensor 3 (Infra-red car windscreen sensor) Not yet installed
- Wind (multi directional industrial limit switch with wind vane)
- Daylight
- Lux level (LDR sensor)
- Cloud sensor (Webcam)

The weather station is mounted off a pole on the corner of the control room. Most of the weather station sensors are 'hard wired' and are interlocked to the dome door and run of roof.

The weather station does not solely rely upon software to close the dome door or run-off roof, although the Cloud sensor and LDR sensors are software only.

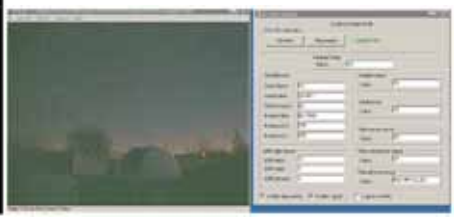
Each of the 'hard wired' sensors have repeat inputs to the Weather station monitoring software. This is written in Visual Basic 2008 Express.

The inputs are interfaced to the Weather station PC via a Vellerman K8055 USB I/O board. This same board has an output to a relay in series with the 'hard wired' sensors which will de-energise in BAD weather or on system failure.

Below is a screen dump of the Weather Station Form. Changes in the Weather Status is logged and there is a check box to enable/disable the relay output. This Form is used in conjunction with the Webcam for the Cloud sensor.

The Cloud sensor and LDR sensor have set points that can be tuned. All other sensors are digital On/Off.

Image below show both observatories open and observing on the 9th January 2011 with the weather still OK but close to dawn.



The following image shows the observatories closed. The Cloud sensor (works off reflected light) has tripped first with the LDR sensor only just reaching its set point.

If the Cloud sensor or LDR sensor fail, the

observatories will still close in bad weather. The cloud sensor and LDR sensor just add additional protection.

There are repeat inputs to each Observatories Observatory Auxiliary Control. The dome has an additional LED indicator panel for remote indication.

The image shows the rain station on its pole with the new (installed July 2010) Tipping bucket rain sensor. (needs a coat of paint and better bird spikes!)

The images below show the very simple 'Tipping bucket' rain sensor I have made. This is used as a 'backup' if the main Kemo rain sensor fails or does not respond quickly to a sudden down pour.

It is not as sensitive as the Kemo sensor, but is less likely to fail. The Kemo sensor is not that reliable and I have had to replace it every 6 months or so !!!

The tipping bucket uses a magnetic reed switch for activation of 'BAD' weather to the system and is in series with the 24V weather loop for all other sensors.

The upper mesh and small holes drilled in the base are an attempt to stop leaves and larger objects blocking the sensor. So far it has worked well.

UPDATE WINTER 2010: The sensor will ice up and fail to operate correctly. For a week it had iced up in the open state and both observatories where down!

Heater may be required.

Courtesy@ LAS Newsletter February 2011

Astronomy Apps for the iPhone

By Steve Southern

The Apple phenomenon continues showing no signs of a retreat with iPhone4, iPods, iPads and of course the Mac computers running Apple's own Unix operating system called OS/X Snow Leopard. If you're not a member of the Apple family of products then read on to find out what you're missing!

It started a long time ago in the '70's and Apple struggled with the growing dominance of Microsoft and the Windows IBM PC format of home computers for many years. But the last report I saw from 2010 showed Apple sneaking ahead of Microsoft in terms of company value and share price. Great news if you're Steve Jobs (Apple's owner). Apple market themselves as high quality, easy to use and desirable if expensive technology. I own an iPod Touch and I am delighted with it.

So what's so special about the Apple devices? Well they're pretty clever and neat pieces of technology.

Overall they are very well built, reliable and function extremely well. One of the things you can do with an iPad, iPhone or iPod is very easily and for very low cost download software from Apples' iTunes website. These are called "Apps" and there are many thousands of them. There are plenty of astronomy apps in there too. You can view maps of the Moon or most of Solar System planets. There are apps that interact with known websites that make it very easy, for example, to check for the ISS location, read up on all the Messier objects or view APOD images and many many other things. A lot of them are free. There are also Apps that I would call planetarium programs. They are your typical night sky programs to help guide you around the night sky. Some of the Apps make use of the GPS and compass features within the iPhone and will show the night sky you're pointing at. Some will even drive your goto scope. I've done a review of some of the most popular Astronomy Apps.

I've reviewed Redshift, Sky Safari (both full & Lite), Pocket Universe and Stellarium. There are a few others too that I'll comment on.

I have reviewed the quality of the night sky on screen display, the ease of use, the amount of information available, the functionality and the price. So in true Sky & Telescope fashion here are my observations after trialling these Software Apps. Always check compatibility with the iTunes store before downloading.

Stellarium

This is a great App for FREE (XL version for iPad is 59p). A planetarium program that does a great job showing the night sky. If you have the free PC version on your laptop then you'll know all about how good this App is.

- Compatible – iPhone and iPod Touch. For the iPad you need the XL version
- Night Sky quality – Very good night sky display. Easy to use but can seem slow compared to Redshift or Sky Safari. Can zoom in to show deep sky objects or planets and a good search option. Night time red mode. I did occasionally have some "bouncy" problems with the display jumping up and down but moving the image slightly stopped it.
- Information available and functionality – This is simply a planetarium program with limited additional information showed in the display when you search for an object. Can time shift to show different dates and times.
- Price – Amazing value for FREE (iPad XL version 59p)
- Score – 5 out of 10 (15.8Mb download size)

Sky Safari - Lite

Sky Safari used to be called Sky Voyager, it has recently been upgraded and renamed to Sky Safari. Created by Southern Stars (no relation to me!!). The Lite version is a cut down version of the full version I've also reviewed later in this article. This App gives a stunning image with a professional feel to it and is so intuitive to use. A top app for amateur astronomers.

- Compatible with iPhone, iPad and iPod touch
- Night sky quality – The planetarium image displayed in this app is excellent, the image moves smoothly. The app has a good night vision mode
- Ease of use – The options and settings are simple to find and easy to use. The menus are also easy to use and very obvious. So a very user friendly interface.
- Information available and Functionality – Sky Safari Lite shows you 120,000 stars, 220 deep sky objects and all the Solar System planets along with comets, asteroids and artificial satellites. It gives you 500 informative descriptions with many NASA and Hubble images to accompany them. If you have an iPhone (i.e. a device with GPS and a Compass) then the Accelerometer will show you the sky as you're pointing at it with your iPhone. There is an easy to use "time flow" feature that can be set for days, months, years or second and minutes to give you the motion of the night sky on your display.
- Price – At only £1.79 this is an incredible App and I highly recommend it.
- My Score – 8 out of 10 (Download size 37.5Mb)

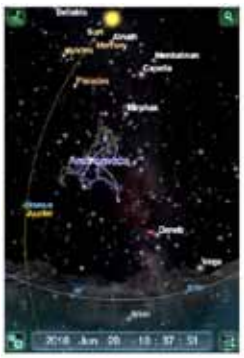
Pocket Universe

Created by Craic Design this is another very good App. Another really good App, it is well thought out and also uses the GPS and Compass Accelerometer of your iPhone so you can hold up your device at the night sky and see what's up there. This app doesn't quite match the smoothness and ease of use of Sky Safari but is still an excellent app.

- Compatible with iPhone, iPod touch & iPad
- Night Sky quality – Very clear display with night vision mode. Sometimes a little slow to respond
- Ease of use – The options and menus are simple to find. Settings are easy to find making it user friendly
- Information available and Functionality – Plenty of great features within this app including Tonights sky, Lunar phases along with Saturns moons and the Galilean Moons around Jupiter. As well of course the basic planetarium display. Night vision mode is included. Search for comets, asteroids and the ISS. Objects and events in there somewhere too. Plenty of information, this app also interacts with Wikipedia so an internet connection is required for more information. Displays 10,000 stars and deep sky objects. Quiz options included too and an option for using your iPhone camera which I didn't use (I have an iPod touch).
- Price - £1.79 is a great price for this really nice app.
- My score – 7 out of 10 (Download size 9.2Mb)

Redshift

Many of you will be familiar with the Windows PC versions of Redshift and Maris Technologies. This version has an impressive list of functions and features, great planetarium image and plenty of "Wow" factor with an impressive array of content. Definitely one of the top apps to purchase for your iPhone, iPod or iPad. I'm betting this looks fantastic on an iPad.



- Compatible with iPhone, iPad and iPod Touch
- Night sky quality – superb clear quality planetarium image. I particularly like the way you can zoom in on planets and deep sky objects and see a real image. Night vision mode too
- Ease of use – each App tackles ease of use and user interface differently. I found it a little clumsy at first but that was me and I very soon picked up on how easy it is to navigate the settings, options and menus. Plenty of options to keep you entertained. BTW – You soon find out how to switch off the annoying sound! Night sky red option too.
- Information available and functionality - You can go on trips to nearby objects too! The "Observatory" option is a great and simple way to "goto" many night sky objects. All in all plenty of functionality and easy to navigate. And with and over 100,000 stars gives you an idea of the detail within Redshift. Loads of quality images, information and features. Information is limited within the app itself so you'll need an internet connection to access Wikipedia for a lot of the information but a good interface makes it easy to access. In my opinion this app is excellent for learning and demonstrating the wonders of astronomy. Overall an excellent App with hours of enjoyment for whoever purchases it. There are lots of rave reviews about this app on the internet. You can even view a Youtube demo by going to the site this site http://www.youtube.com/watch?v=oz-V7RIZCtQ
- Price - £6.99 represents wonderful value and a quality App
- My score - 9 out of 10 (84.1Mb download size)

Sky Safari – full version

MACWORLD BEST OF SHOW 2010 WINNER. Had problems with the display bouncing all over the place and was absolutely useless at first. I contacted Southern Stars support who were very helpful and said a new release was imminent that would fix the display problems and sure enough it did and it was worth the couple of days wait. It's now trouble free and an absolutely brilliant App for the serious amateur astronomer.

- Compatible – iPhone, iPad & iPod touch
- Night Sky Quality – Easy to use excellent planetarium display which seems somehow smoother than the lite version. I particularly like the easy zoom in and out + and – at the two bottom corners of the display. Compass and Accelerometer can be switched on if you have it. Looks like the solar system planets can be zoomed in to display images and Moons whereas the deep sky objects are only chartlike displays. Double clicking on the deep sky item takes you to lots of info and many great images. Night sky red option too.
- Information available and functionality - What I've seen from this app oozes quality, the information at your fingertips is extremely impressive. 300,000 stars and 30,000 deep sky objects easily accessible (no internet required to access the info). Easy to access simply by double clicking on the screen or using the search function. The time flow function lets you select various dates and time with motion. There are lots of options in the settings. As with most of the Astro Apps those of you with an iPhone can use the motion sensors and compass feature to allow the App to show the portion of the sky you are pointing it at. If 300,000 stars is insufficient for your needs then the there is an optional expansion pack (£2.99) that will give you 2.5 million stars and over 300 colour deep sky images. Now here's the really 21st century bit, *Skyfi*. Skyfi allows you to control your goto telescope from your iPhone, iPod or iPad using a wifi network. I haven't used this amazing feature but it does appear to work very well with most goto scopes. The link has more info on skyfi: http://www.southernstars.com/products/skyfi/index.html
- Price - £8.99 and worth every penny (Expansion pack £2.99)
- My Score - 10 out of 10 (160Mb download size)

Others

Planets – Another good FREE planetarium App. Compatible with iPhone, iPod and iPad. Useful app with more functionality than Stellarium but limited zoom. 6 out of 10. 9.7Mb

Distant Stars Lite – Yet another great FREE planetarium app. Compatible with iPhone, iPod and there is an iPad version (£5.99). Good search function and zoom. If you like this one try out the full versions – they're not free though. 6 out of 10. 17.1Mb

Moon Phase - £1.19. iPhone, iPod & iPad compatible. Shows Moon phases, transits and has Lunar a calendar. 7.2Mb

Moon Globe – FREE. iPhone, iPod & iPad compatible. Spin the globe image or switch to telescope mode. Can show Moon phase, surface terrain detail, spacecraft landing sites and more. Great value app and free. 71.6Mb (Also try Mars globe).

Messier List – FREE. Another great free app for astronomers. Packed with images and information about all the Messier objects. 23.1Mb

Flyby - £1.79 – Compatible with iPhone, iPod & iPad. A "Heavens-above" on your iPhone. Give you details of ISS and satellite passes plus news and information. Recent update gives push notification. 0.3Mb

Particle Zoo – FREE. Compatible with iPhone, iPod & iPad. A list and explanation of all known sub-atomic particles. 4.1Mb

APOD – FREE Compatible with iPhone, iPod & iPad. Have you seen the NASA Astronomy Picture of the Day website? This is a nice front end App that's makes it easy to access the website from your iPhone. Needs an internet connection. 4.4Mb

Conclusions

What I can say is all the Apps in this article are good tools and some are stunning. It's clear with the planetarium programs you get what you pay for. Easily the best two are Redshift (£6.99) and Sky Safari (£8.99). For me Sky Safari get my vote as the best because of its functionality, features and add-on options. It is also very easy to use. But Redshift is also stunning and easy to use so it is down to what you want from your App. If you want great displays and features that show off our universe then Redshift is for you. If you want something more serious with lots of functionality then Sky Safari is the one. Sky Safari Lite is a low cost good cut down option at only £1.79 as is Pocket Universe. If you want a free App then Distant Stars Lite is the one I would choose but you may also want to try Stellarium (why not it 's free!). There are plenty of others in the App store that I didn't review so check them out too.

Of the other Apps, I use Flyby, Messier list and the Moon globe the most. All great value as they're free!

Courtesy: LAS Newsletter March 2011

A cool camera

For many years I have been recording the light from the stars in order to extract the spectral information, which tells us the make up of each of the stars. Almost all of this time I concentrated on the use of film, and whilst I understand film and its idiosyncracies, there is little doubt that the digital age is upon us and so I fely it was time to see what it was like aboard that particular band-wagon.

Having acquired a DSLR, I began digital imaging of stellar spectra but with initially disappointing results. After a little research I discovered that many astro-imagers were using DSLR cameras which had had their infra red blocking filter removed and I wondered if removing the IR blocking filter would improve the blue as well as the red end sensitivity of the ccd sensor? In theory it should.

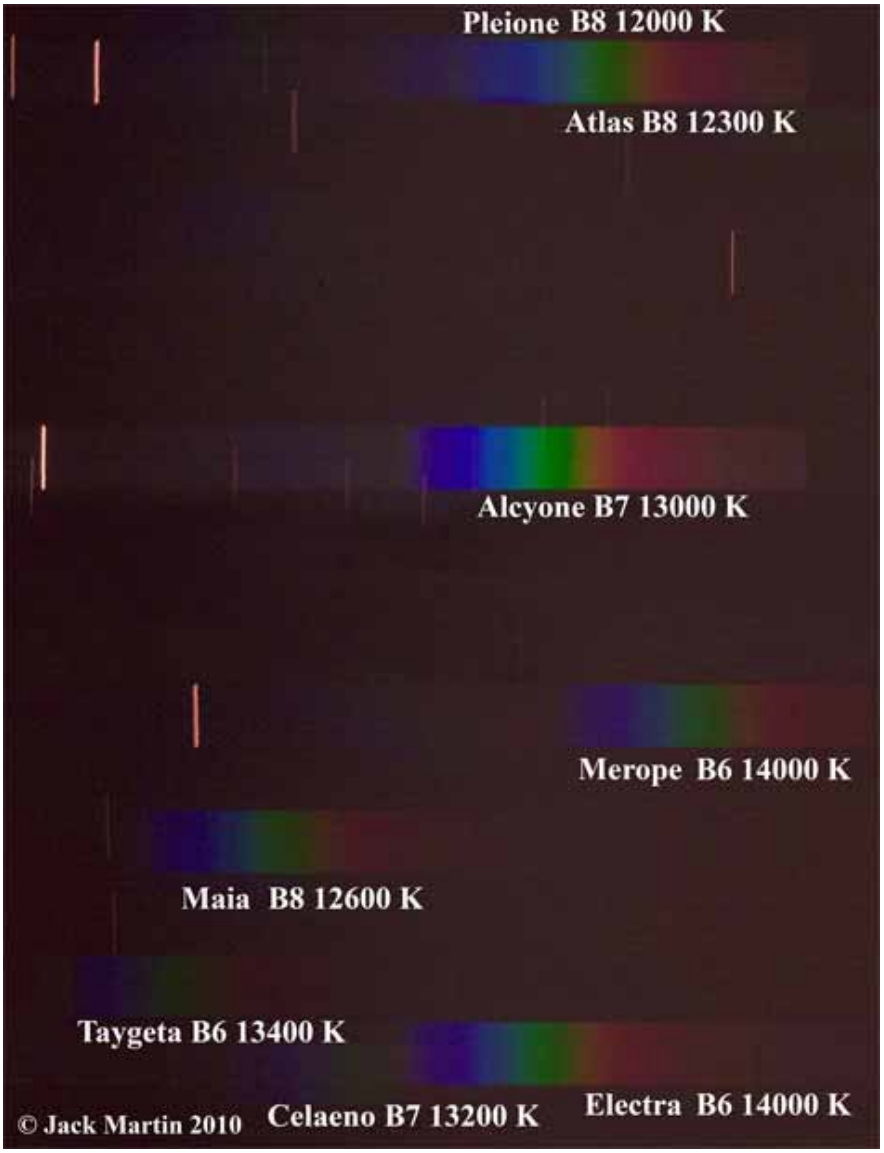
I purchased a Canon Rebel 300D with the IR blocking filter removed and took comparison spectra of Vega through a Canon EOS 400D (unmodified). I used a Rainbow Optics Star Spectroscope 200 lines/mm at the prime focus of my 0.3 m Newtonian reflector a drift time of 20 sec across the field of view at ISO 400 RAW image setting for each camera on 15/11/2010.

The answer to the question is a definite yes, removing the infra red blocking filter does improve the spectral sensitivity of the ccd sensor at both the blue and red end as seen from the results.

This has interesting implications for deep sky Astrophotography and I encourage people to have a go.

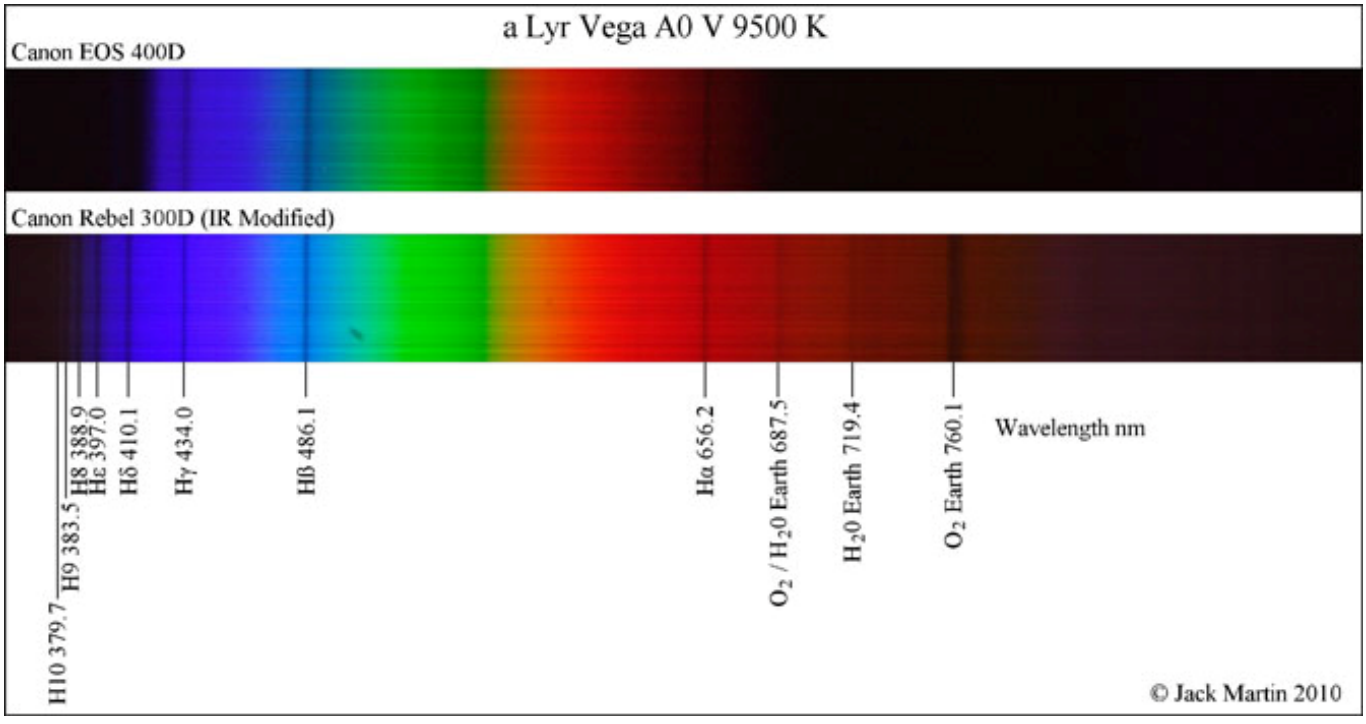
Jack Martin

Jack is the author of 'A Spectroscopic Atlas of Bright Stars' published by Springer. This book was reviewed in Issue 93, Spring 2010 of the FAS Newsletter.



M45 The Pleiades

This is a composite of 2 images taken on 25/12/2010 at the prime focus of my 0.3 m Newtonian reflector a Canon Rebel 300D IR modified through a Rainbow Optics Star Spectroscope 200 lines/mm a drift time of 15 sec across the field of view at 1600 ISO RAW image setting.



What Was the Star of Bethlehem? By Brian Mills, Wadhurst AS

Surely one of the biggest and most enduring astronomical mysteries is "What was the star of Bethlehem"? If we take the Biblical story literally then it can only be described as a miraculous event and will not stand up to scientific scrutiny.

Of the four gospels the only one to mention the star is that of St. Matthew although we ought to remember that it's very unlikely that he wrote it himself as it's now thought to date from AD85 to 90.

St. Luke tells the story of the nativity but there is no mention of the star, the Magi, Herod or the slaughter of young boys. Instead he talks about the manger and the shepherds who were told of the birth in a vision. The star is also mentioned briefly in the Protoevangelium of James - a book that was used in the early church but didn't make it into the New Testament. However theological scholars seem to be of the opinion that this is a low quality account written around 150AD and is mostly a re-telling of St. Mathew's gospel.

There is a suggestion that the reason the star is mentioned only in Matthew is that he enhanced his version to make it fit with earlier prophecies that certain groups would like to see fulfilled. There is also evidence to suggest that Mark's was the first written gospel (around AD70) and that Matthew and Luke used this to help write their own later accounts. Matthew makes reference to the prophecy of Balaam which appears in Numbers 24:17 (often called the "Star Prophecy") and says:-

"I shall see him, but not now: I shall behold him, but not nigh: There shall come a star out of Jacob, and a sceptre shall rise out of Israel ....."

This was seen as a prophecy that a Messiah would come and that a star would be the sign of his birth.

There are three types of event that we can attribute the star to:-

1: A Miracle

As we've already said if it was a miracle then we're wasting our time looking.

2: A Legend

This would be entirely a work of fiction possibly to give credence to an earlier prophecy.

3: An Astronomical Event

Possibly it was a conjunction, a nova, a supernova, an occultation or even a comet.

One thing that hinders analysis of the facts is that translations and interpretations of the original texts vary considerably. For example if we look at Matthew 2:2 he says - "For we have seen His star in the East and have come to worship Him". A later translations suggests it ought to read - "For we have seen His star at its rising and have come to worship Him". But David Hughes, a scholar who has spent considerable time studying the star and its background, says that the original text has a very specific meaning and so should be read as - "For we have seen His star at its heliacal rising and have come to worship Him". So what do we mean by heliacal rising?

The Sun appears to move eastwards by about 1º per day when compared to the background stars. So at some point the Sun will appear to have just passed a star by enough for it to be visible in the dawn sky immediately before the Sun rises. The very first time it is seen in this way is called its heliacal rising, and these heliacal risings were used as a calendar in the east with Sirius being a prime example because its heliacal rising signalled that the flood season of the Nile was imminent.

If we assume that the Star was seen by the Magi at its heliacal rising (in other words roughly in the east) then the journey to Jerusalem would have taken them almost due west meaning the star was behind them. This isn't a problem because there is no mention of the star guiding them from their home (Babylonia or Persia) but just on the final stage from Jerusalem to Bethlehem.

If the Magi came from Babylonia then the journey ahead of them would be 500 or 600 miles. If they came from Persia then it's roughly half as much again. Whichever it was, a reasonable assessment is that it could have taken 2 months or more from the star being sighted until they reached Jerusalem. It has been suggested that the Magi may have already started out on their journey to Jerusalem, before the star was seen. Matthew tells us that after they arrived in Jerusalem Herod spoke with his scribes and then with the Magi themselves. He says Herod was "troubled" - not surprising when he has just found out a new King of the Jews has been born and his rule could be under threat. There is a suggestion that Herod hadn't seen the star, although this may have been simply due to the fact that no one told him because they feared him.

We said that the sun appears to move eastwards by about one degree daily, but also because of the Earth's journey around the Sun we are presented with a slightly different view of the stars each night. As an example, if you go out tonight (late December) at 9.00 p.m. and note the position of the star Procyon in Canis Minor it will be above the eastern horizon. If you look in late March (in 3 months time) at 9.00 p.m. it will be just past south. This movement would also have been true of the star of Bethlehem if it were an astronomical object. It may have appeared in the east but by the time the Magi reached Jerusalem it could well now be closer to the south, and Bethlehem is south of Jerusalem. "And lo the Star, they saw in the east, went before them".

Of course one fundamental question is "When was Jesus born?" We know BC means Before Christ and AD means Ano Domino (in Latin "in the year of our Lord") so can we assume that as the date is AD 2011, Jesus was born 2,011 years ago - sadly it's not that simple. The Roman calendar had been in use for some time and used the year in which Rome was founded as their starting point. The year consisted of 10 months with leap months being inserted until Caesar altered this by adding two extra months and leap years. Pope Gregory adjusted it in 1582 by removing ten days because the leap year had caused slight over adjustment. He also changed the way leap years were implemented.

(Continued on page 14)

(Continued from page 13)

However, we must also consider that when the monk Dionysius tried to calculate the year of the nativity he made several errors as the astronomer Mark Kidger points out. He appears to have ignored the year "0" and also four years when Caesar ruled under a different name.

There is also other information that helps us pin down the year. Firstly we know that Herod died in 4BC and that coins minted by his successor in that year have been found. Secondly Herod had all boys of 2 years and under killed, so Jesus was probably considerably younger than two to allow a big margin of error. We also know a census was ordered in 8BC although its purpose isn't clear. It would surely have taken some time for this instruction to reach places like Jerusalem and outlying villages. Taking all this into account the most likely year of the nativity is 5BC.

Having established the approximate year of Jesus' birth we can turn our attention to the Magi - who were they and where were they from? There is an assumption that there were three of them (the Bible does not state numbers or names) because three gifts were given. The most widely accepted description of them is that they were "wise men" of a priestly caste who interpreted the stars and journeyed to Jerusalem as envoys, with their most likely country of origin being either Babylonia or Persia. Babylonia must be favourite because it was steeped in Jewish tradition and because of its long history of astronomical observations, some of which still exist today on pieces of tablet. Conversely Persia has almost no records of observing the skies although their religion does also mention the coming of a Messiah.

We can now look at what the star itself might have been. In order to be a candidate the event must have occurred in the east around the date of the nativity. It must also have been unusual enough to send the Magi on their journey but must have been long lasting enough to still be visible once they had reached Jerusalem. Venus has always been a favourite although we know the Babylonians knew of it and recorded its movements for more than a thousand years before the nativity. Occultations have been suggested although many of them would have previously been observed and they don't really "fit the bill". A comet may be a better option although the description in Matthew is of a star and not a "broom star" as comets were then known. Halley's comet is no longer a contender because its period has been calculated to show it would have returned in 12BC.

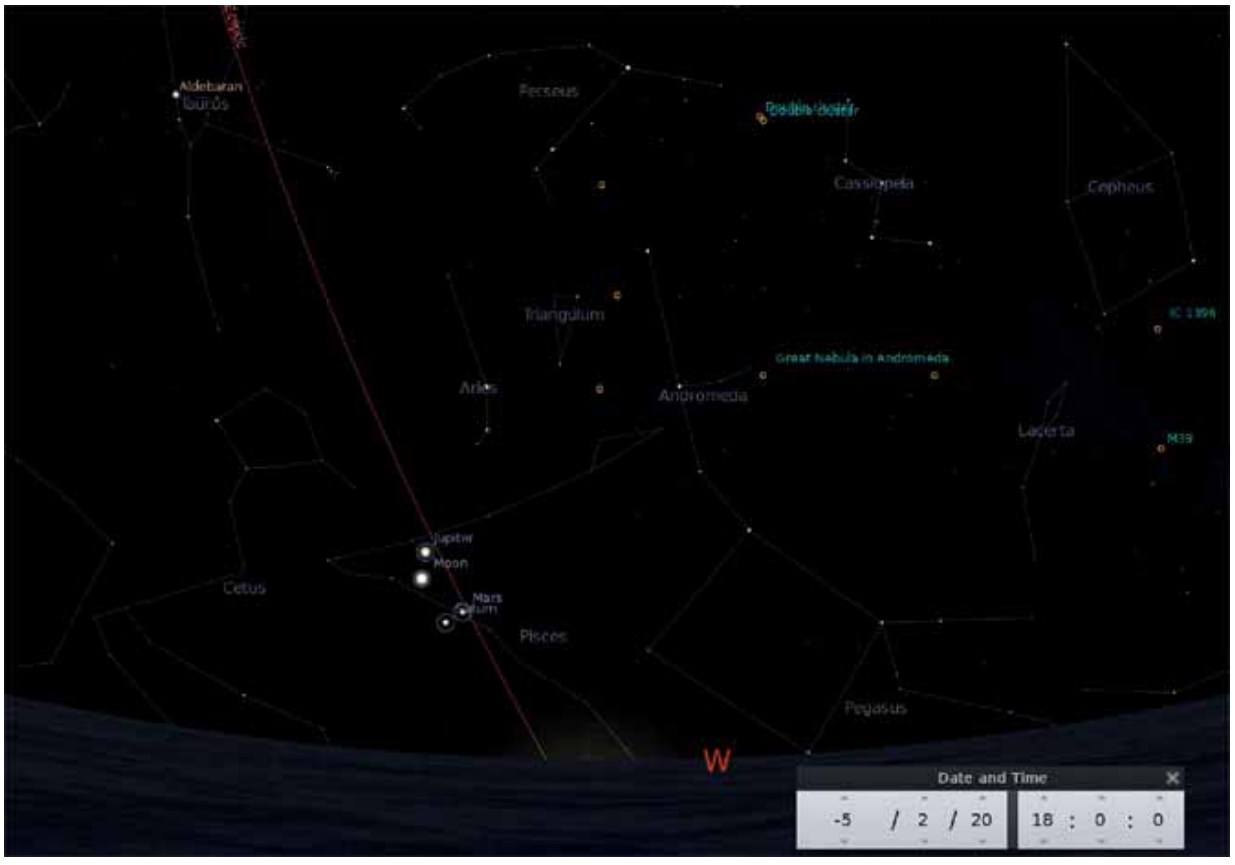
Could it have been a planetary conjunction? It is possible as something of this kind in the right constellation would be taken as a portent of a royal event although recent calculations show that no such conjunction occurred where two planets appeared so close as to appear as one object. Would a nova or supernova be a possibility? No supernovae are recorded anywhere close to the correct period although the Chinese do mention a nova in 5BC. The meteor theory still has its followers although suggesting that two fireballs occurred at just the right times may be a little far fetched. Also they don't fulfil the Biblical description at all. However, there is an interesting theory put forward by Mark Kidger that utilises elements from a variety of events to suggest a workable hypothesis. He suggests that a series of events occurred that led the Magi to believe that something truly monumental was about to happen and then a singular event that was the final sign.

His theory is that the Magi observed the rare spectacle of a triple conjunction of Jupiter and Saturn in Pisces (a constellation associated with the Jews) in 7BC. The following year they saw Jupiter and Saturn joined by Mars (also in Pisces), and then a double occultation of Jupiter by the Moon. Then in 5BC they would have seen a pairing of the Moon and Jupiter and a second pairing of Saturn and Mars. All these things would have been analysed by the Magi and an astrological meaning deduced. The final event that sent them westwards was the appearance of a nova on the borders of Aquila and Capricornus - an area of sky in the east at dawn. A new star would have told them that a royal birth had occurred and they would have set out for Jerusalem - the capital of the Jewish world.

There is a possible problem with explaining astronomically how a star can "stand over" a particular place, although the simplest (but not necessarily the most plausible) suggestion is that it was a reference to it culminating (reaching its highest point above the horizon) before sinking towards the west to set.

Whether this latest suggestion is correct of course we cannot say. It does however address all the issues required to put it in the correct time frame and takes into account more fully the part the Magi could have played. As far as a definitive answer is concerned - the jury is still out.

Courtesy: SAGAS Newsletter



A loft Window Observatory by Peter Bolwell, East Sussex AS

A Novel Approach to Observing

Choosing a telescope is one of the best parts of taking up astronomy – flicking through the catalogues, pouring over the reviews in the magazines, maybe trying out one or two at ESAS observing evenings – and finally you make your choice. With joyful anticipation you get your telescope unpacked, assembled, and ready for action. So now comes the next question, to which perhaps you gave very much less consideration: where exactly will you be using it?

Depending where you live, this may be quite a tricky one. It certainly was for us, at the bottom of our close with houses and trees all around us. We have actually cut down several trees that were in our garden, but of course we can't do much about the trees in the neighbours' gardens, far less the houses! Setting up the telescope up in the garden – front or back - would have been quite useless. We could bundle the thing into the car and drive up to Fairlight or somewhere like that, but that would mean that every chance opportunity to do a bit of observing becomes something of an expedition – even more so if, as in our case, we are talking about a sturdy 8 inch catadioptric rather than a modest collapsible refractor.

The alternative is to do one's observing from home, but higher up – i.e. through an upstairs window. We all know the problems with this of course – heat radiating from the house, light pollution from the surrounding residential area, and a very restricted field of view of course, depending on the size of your window. Nevertheless on balancing out the pros and cons we felt that, while we can always pack the telescope up and take it out for a trip if we want to, it would be useful and convenient to have an "observing station" at home as well.

To gain the greatest advantage of altitude and to maximise the field of view, not to mention avoiding the need to be continually moving furniture about, we thought it would be nice to set up the telescope in the loft and look through a skylight – preferably two skylights in fact, facing in opposite directions. A great idea in theory, only we didn't actually have any skylights – not even one. Not being the kind to let mere facts stand in the way of a good theory, we started to do the whole catalogue-flicking, magazine-pouring thing over again, this time looking at windows rather than telescopes. They are of course generally intended just to let in light and air and to afford a bit of a view, and are not really designed so much to accommodate the practicalities of poking a telescope through the aperture and waggling it about to look at objects in the sky. However after much thought – and careful counting of pennies – we found what we needed.

Basically it is a sophisticated sort of a Velux window, of a type we had never actually seen or even heard of until we started investigating. It comes in two halves, divided horizontally across the middle, and the fun part about it is that not only does the top half open out, but so does the bottom half – creating what is, in effect, a small viewing platform so that the telescope can stand further out from the roof line and get a much wider view from side to side. The major disadvantage of the design is that the top part of the window at its normal full extension only opens to an approximately horizontal position, more or less parallel with the ground, so that the open window itself then obstructs the view straight up into the sky or at high declinations. All is not lost however, since the window is designed so that it can also tilt backwards until it is pointing vertically straight up and down, affording an open vista before you (albeit a rather restricted space behind). Theoretically this particular feature was really meant to make the glass surface more accessible for cleaning, but never mind – it works!

So now we have our two skylights, one to the front and one to the rear, and a miniature observatory permanently installed in our loft with the telescope and also a moderately large pair of binoculars on a tripod ready for action whenever we get a clear night. Of course the "seeing" does suffer to some extent from the thermals coming off the house and from light pollution from the town centre nearby, as we expected, but still we are very pleased with the overall result. Earlier this year in fact we managed to get a good view of Mercury, low in the sky after sunset, which from our location at the bottom of the hill would have been impossible from ground level. All we need now is for the cloud to clear away once in a while, and with any luck I just might achieve every astronomer's dream, and be the first to spot the invasion fleet coming!

Courtesy: SAGASoffLine

Will heat from the house rising through the windows cause problems with turbulence ?

Will floor vibrations cause problems at high magnifications ?

Watch this space!!! or read SAGASoffline

Enhanced Colour Lunar Image *by Robin Durant*

Robin took this image using his New 10" Dobsonian Skywatcher 250 Multiflex with a Canon 450D. The image consists of 20 frames taken at 1/300th second at ISO 100. They were stacked in Registax which was difficult due to the very large size of the files (4920x 2856 pixels) but I felt that I needed them to be this size to get a good resolution and to bring out the natural colour. It took about 3/4 hour to stack the frames !

Robin made a slight adjustment to the Registax Wavelets, second row down and saved it. I then opened the saved file in Adobe CS3. The image did not need any processing so he opened "Hue & Saturation" and moved the saturation slide slowly to the right and the colour just emerged.

Robin believes the colour shown on the image shows the varying elements that the moon has.

If the saturation increase does not work, you can try "Auto Color" first then Saturation after.

Courtesy: SAGAS Newsletter

Robins 10" Skywatcher 250 Multiflex Dobsonian

NASA image showing lunar mineral distribution

For more information on Robin Durant's Astronomy visit his web site at: http://www.robin-durant.com

Shropshire AS visit Keele Observatory

On the evening of Thursday 3rd March, a number of Society members visited Keele Observatory, where Keele Astrophysicist Dr Jacco van Loon led the evening and provided a very satisfying observing session and a fascinating Talk about the observatory and its history.

Keele University was founded as the University College of North Staffordshire in 1949 and received its Charter as the University of Keele in 1962. Keele Hall was re-built in 1860, the original dating from 1580.

Keele Observatory was erected in 1962 as well, with the Dome coming from Oxford. Its proper name was

the William Boulton Observatory (after the local steel company) and was not opened officially until 1975, by Princess Margaret.

The main telescope at the very beginning was one built by Grubb

in 1874. The Grubb refractor came from Oxford; its objective is 12", (31cm) across.

Other instruments include the 24" Newton/Cassegrain/Coude Thornton telescope; an old 55-degree Schmidt camera which can be used to photograph meteors; and a 4cm Coronado solar telescope which has an H-alpha filter.

Keele Earth and Space Observatory was refurbished recently with a development grant of 250,000 from

the Wolfson Foundation, and it was reopened officially on 2nd February 2010 by Lord Martin Rees, Professor at Cambridge, Astronomer Royal and President of the Royal Society.

In addition to observing locally, Keele researchers are involved in many projects all over the world. For

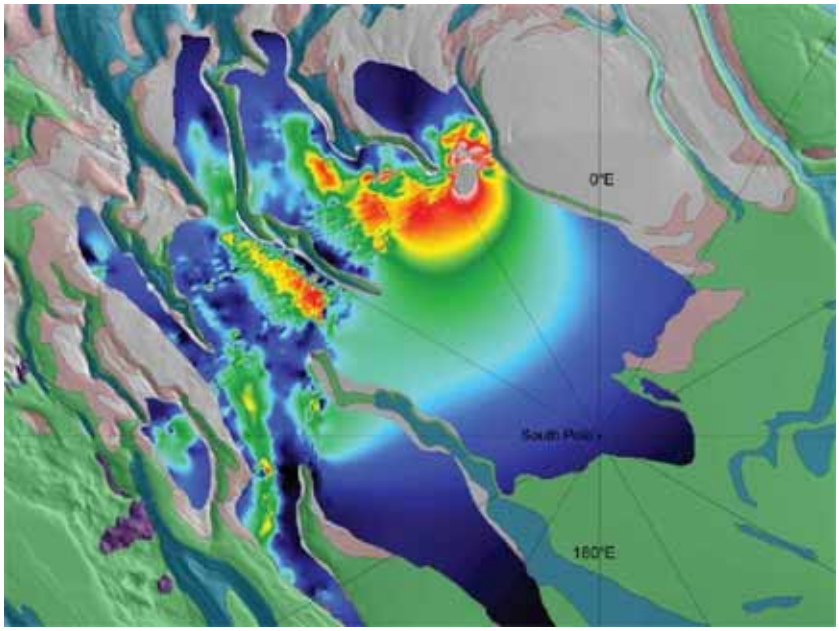
example, Keele's involvement with the Super-WASP exoplanet consortium resulted in an announcement on 13th April 2010 that nine new planets had been discovered. Keele astronomers often use European Southern Observatory's Very Large Telescope, and Keele is a partner in the largest (11m) optical telescope, SALT in South Africa.

Keele is open to the public as well as students, every Tuesday between 20:00hrs and 22:30hrs and Saturday between 14:00hrs to 16:30hrs for Solar observing.

Further details at: www.astro.keele.ac.uk/~obs

Courtesy: Hermes

Huge Dry Ice Deposit on Mars: NASA Orbiter Reveals Big Changes in Red Planet's Atmosphere



A newly found, buried deposit of frozen carbon dioxide - dry ice - near the south pole of Mars contains about 30 times more carbon dioxide than previously estimated to be frozen near the pole. (Credit: NASA/JPL-Caltech/Sapienza University of Rome/ Southwest Research Institute)

NASA's Mars Reconnaissance Orbiter has discovered the total amount of atmosphere on Mars changes dramatically as the tilt of the planet's axis varies. This process can affect the stability of liquid water, if it exists on the Martian surface, and increase the frequency and severity of Martian dust storms.

Researchers using the orbiter's ground-penetrating radar identified a large, buried deposit of frozen carbon dioxide, or dry ice, at the Red Planet's south pole. The scientists suspect that much of this carbon dioxide enters the planet's atmosphere and swells the atmosphere's mass when Mars' tilt increases. The findings are published in the journal *Science*.

The newly found deposit has a volume similar to Lake Superior's nearly 3,000 cubic miles (about 12,000 cubic kilometers). The deposit holds up to 80 percent as much carbon dioxide as today's Martian atmosphere. Collapse pits caused by dry ice sublimation and other clues suggest the deposit is in a dissipating phase, adding gas to the atmosphere each year. Mars' atmosphere is about 95 percent carbon dioxide, in contrast to Earth's much thicker atmosphere, which is less than .04 percent carbon dioxide.

"We already knew there is a small perennial cap of carbon-dioxide ice on top of the water ice there, but this buried deposit has about 30 times more dry ice than previously estimated," said Roger Phillips of Southwest Research Institute in Boulder, Colo. Phillips is deputy team leader for the Mars Reconnaissance Orbiter's Shallow Radar instrument and lead author of the report.

"We identified the deposit as dry ice by determining the radar signature fit the radio-wave transmission characteristics of frozen carbon dioxide far better than the characteristics of frozen water," said Roberto Seu of Sapienza University of Rome, team leader for the Shallow Radar and a co-author of the new report. Additional evidence came from correlating the deposit to visible sublimation features typical of dry ice.

"When you include this buried deposit, Martian carbon dioxide right now is roughly half frozen and half in the atmosphere, but at other times it can be nearly all frozen or nearly all in the atmosphere," Phillips said.

An occasional increase in the atmosphere would strengthen winds, lofting more dust and leading to more frequent and more intense dust storms. Another result is an expanded area on the planet's surface where liquid water could persist without boiling. Modeling based on known variation in the tilt of Mars' axis suggests several-fold changes in the total mass of the planet's atmosphere can happen on time frames of 100,000 years or less.

The changes in atmospheric density caused by the carbon-dioxide increase also would amplify some effects of the changes caused by the tilt. Researchers plugged the mass of the buried carbon-dioxide deposit into climate models for the period when Mars' tilt and orbital properties maximize the amount of summer sunshine hitting the south pole. They found at such times, global, year-round average air pressure is approximately 75 percent greater than the current level.

"A tilted Mars with a thicker carbon-dioxide atmosphere causes a greenhouse effect that tries to warm the Martian surface, while thicker and longer-lived polar ice caps try to cool it," said co-author Robert Haberle, a planetary scientist at NASA's Ames Research Center in Moffett Field, Calif. "Our simulations show the polar caps cool more than the greenhouse warms. Unlike Earth, which has a thick, moist atmosphere that produces a strong greenhouse effect, Mars' atmosphere is too thin and dry to produce as strong a greenhouse effect as Earth's, even when you double its carbon-dioxide content."

The Shallow Radar, one of the Mars Reconnaissance Orbiter's six instruments, was provided by the Italian Space Agency, and its operations are led by the Department of Information Engineering, Electronics and Telecommunications at Sapienza University of Rome. NASA's Jet Propulsion Laboratory, a division of the California Institute of Technology in Pasadena, manages the Mars Reconnaissance Orbiter project for NASA's Science Mission Directorate at the agency's headquarters in Washington. Lockheed Martin Space Systems in Denver built the spacecraft.

For more information about the Mars Reconnaissance Orbiter mission, visit http://www.nasa.gov/mro

Courtesy: *ScienceDaily*

Alien Planet Nearly Dense as Lead

Astronomers have pinned down some details of an exotic nearby alien planet that's almost as dense as lead.

The exoplanet, called 55 Cancri e, is 60 percent larger in diameter than Earth but eight times as massive, researchers revealed Friday (April 29). That makes the alien world the densest solid planet known -- twice as dense as Earth.

Astronomers previously thought 55 Cancri e took about 2.8 days to orbit its parent star. But the new study reveals that the exoplanet is so close to its host star that it completes a stellar lap in less than 18 hours.

"You could set dates on this world by your wristwatch, not a calendar," study co-author Jaymie Matthews, of the University of British Columbia, said in a statement.

Updating views of 55 Cancri e

The super-dense alien world is part of a multiplanet solar system about 40 light-years from Earth, in the constellation Cancer (The Crab). Its sunlike parent star, 55 Cancri, is bright enough to be seen from Earth by the unaided eye, researchers said.

Since 1997, astronomers have discovered five planets circling 55 Cancri (including 55 Canrci e in 2004). All five alien worlds were detected using the so-called radial velocity -- or Doppler -- method, which looks for tiny wobbles in a star's movement caused by the gravitational tugs of orbiting planets.

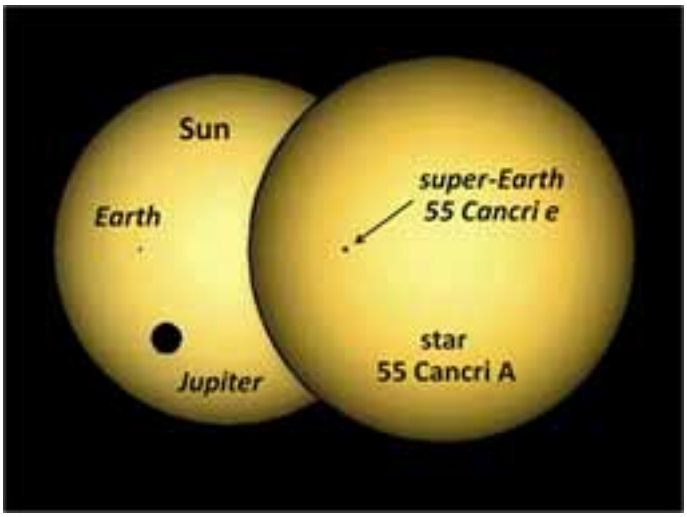
Initially, astronomers thought 55 Cancri e had an orbital period of about 2.8 days. But last year, two researchers -- Harvard grad student Rebekah Dawson and Daniel Fabrycky of the University of California, Santa Cruz -- re-analyzed the data. They suggested that the alien planet might actually zip around its host star much faster than that.

This wide-angle photograph of the night sky shows the location of 55 Cancri, a star where astronomers have found five planets, including a hot, dense super-Earth.
CREDIT: Till Credner, AlltheSky.com

So Dawson and Fabrycky joined up with a few others to observe 55 Cancri e more closely. The team trained Canada's MOST (Microvariability & Oscillations of STars) space telescope on the planet's star, then watched for the tiny brightness dips caused when 55 Cancri e passed in front of -- or transited -- it from the telescope's perspective.

This is the same technique used by NASA's prolific Kepler space observatory, which has found 1,235 alien planet candidates since its March 2009 launch.

The team found that these transits occur like clockwork every



A simulation of the silhouette of planet 55 Cancri e transiting its parent star, compared to the Earth and Jupiter transiting our sun, as seen from outside the solar system. The star 55 Cancri A is nearly a twin of the sun.
CREDIT: Jason Rowe, NASA Ames and SETI Institute and Prof. Jaymie Matthews, UBC

17 hours and 41 minutes, just as Dawson and Fabrycky had predicted. The starlight is dimmed by only 0.02 percent during each transit, telling the astronomers that the planet's diameter is about 13,049 miles (21,000 kilometers) -- only 60 percent or so larger than Earth.

Using this information, the researchers were able to calculate 55 Cancri e's density.

"It's wonderful to be able to point to a naked-eye star and know the mass and radius of one of its planets, especially a distinctive one like this," said study lead author Josh Winn of MIT.

The research was released online Friday at the website arXiv.org, and it has been submitted for publication in The Astrophysical Journal Letters.

A scorching-hot world

Because 55 Cancri e is so close to its parent star, it wouldn't be a very pleasant place to live. Temperatures on its surface could be as high as 4,892 degrees Fahrenheit (2,700 degrees Celsius), researchers said.

"Because of the infernal heat, it's unlikely that 55 Cancri e has an atmosphere," Winn said. "So this is not the type of place where exobiologists would look for life."

If you could somehow survive the heat, however, the view from the planet's surface would be exotic and spectacular.

"On this world -- the densest solid planet found anywhere so far, in the solar system or beyond -- you would weigh three times heavier than you do on Earth," Matthews said. "By day, the sun would look 60 times bigger and shine 3,600 times brighter in the sky."

But the appeal of 55 Cancri e is not limited to such gee-whiz factoids. Because it's so close to Earth, the planet and its solar system should inspire all sorts of future work, researchers said.

"The brightness of the host star makes many types of sensitive measurements possible, so 55 Cancri e is the perfect laboratory to test theories of planet formation, evolution and survival," Winn said.

Courtesy: SPACE.com

China's First Space Station: A New Foothold in Earth Orbit

Leonard David, SPACE.com's Space Insider Columnist

China is developing its first full-fledged space station, called Tiangong (Heavenly Palace). Early tests of China's skills at rendezvous and docking, shown in this artist's illustration, are set to begin in 2011. CREDIT: China Manned Space Engineering Office

China's state-run news outlets report that preparations of the country's first space station module, called Tiangong-1, are in full swing for a launch in the second half of this year and will be followed by an unpiloted spacecraft.

The spacecraft twosome, the station module and China's Shenzhou 8 vehicle, will mark the country's first round of orbital rendezvous and docking tests – viewed as a springboard to larger space adventures. A Long March 2F rocket is the booster of choice for the individual launches, according to reports by China's Xinhua news agency.

According to state media reports, the Tiangong-1 space station module is outfitted with a docking port on its front and rear ends. It will tip the scales at roughly 8 1/2 tons and purportedly will have a two-year lifetime in Earth orbit.

Next year, China's Shenzhou 9 and Shenzhou 10 missions, each carrying astronauts, are expected to link up with the station module, according to current plan.

By honing their skills at rendezvous and docking, Chinese space officials see the target practice as a step forward in assembling a far heftier space facility, now slated to be completed around 2020, according to Yang Liwei, deputy head of China's Manned Space Engineering Office. Yang was China's first person to orbit the Earth, in 2003.

China currently has a 21-member astronaut corps that includes two women and is undergoing training for future docking and rendezvous milestones. The two women are pilots drawn from the People's Liberation Army Air Force.

Take a look at how China's first space station, called Tiangong ("Heavenly Palace") will be assembled in orbit in this SPACE.com infographic.
CREDIT: Karl Tate/SPACE.com

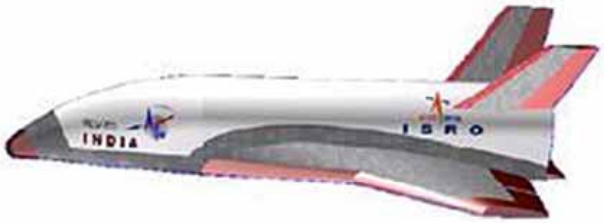
India designing reusable spacecraft

Director of Vikram Sarabhai Space Centre (VSSC), Thiruvananthapuram, P S Veeraraghavan on Wednesday said India`s space scientists are designing a reusable space craft, which is likely to be launched in 2030. The Indian SpaceResearch Organisation (ISRO) is currently working on Human Spacelift Project or the man mission in 2015 and Chandrayan-II in 2013, he said.

"The winged Reusable Launch Vehicle Technology Demonstrator (RLV-TD) has already been configured. It will give India an edge in space science as no country except the US has yet launched a reusable satellite launch vehicle," he added.

On the man mission to space, Veeraraghavan said, "ISRO is working on it but we are yet to get the final nod from the government." He was speaking on the occasion of 13th national technology day function organized by NALCO on Wednesday.

"Scientists are working on some critical areas of Chandrayan-II, which is ready for launch in 2013. It will consist of the spacecraft and a landing platform with the moon rover. The project is in the developing stage. In the Indo-Russian joint venture the lander will be from Russia and the rover will be a done by India. The rover will land on the moon and map a three-dimensional atlas of the moon and analyse the chemical and mineral composition of the lunar surface," he said.



Besides, Astrosat-an astronomy satellite to study the movements of celestial bodies, has already been popular among astronomy circle. However, the senior scientist was cagey about use of remote sensing in military missions and anti-Maoist operations.

by Staff Writers—Bhubaneswar, India (PTI)

Courtesy: Space-Travel.com

Dawn - first visual contact with Vesta

The camera system on board the Dawn spacecraft has acquired its first image of the massive asteroid Vesta. Although the mission's first target is still about 975,000 kilometres away, appearing as just a large white dot, "we now have visual contact with our objective," said Ralf Jaumann of the German Aerospace Center (DLR).

In August 2011, the camera will photograph the asteroid from an orbit with a planned survey altitude of 2700 kilometres; the data will then be processed to develop a three-dimensional model.

It has taken the NASA spacecraft over 43 months, during which it has travelled 2.6 billion kilometres, to come within imaging range of the irregularly shaped asteroid. The image acquired on 3 May 2011 shows the asteroid, which has a diameter of about 530 kilometres, as a white dot against a background of stars. Dawn will use its framing cameras over the next three months to navigate the approach and orbital capture by Vesta.

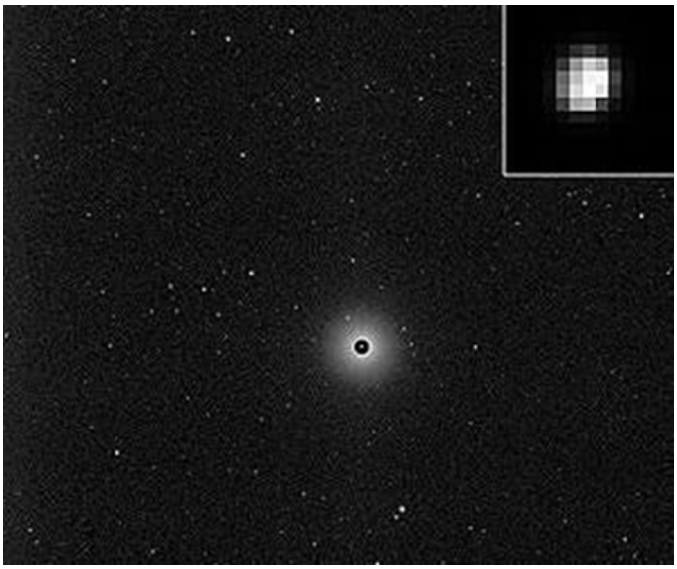
"We are no longer flying without sight of our target," said Jaumann, head of the Planetary Geology Department at DLR's Institute of Planetary Researchin Berlin. The camera system has now successfully demonstrated the first of its two functions by providing navigational data. "It is now clear that the camera system is working flawlessly and can fulfil its purpose as a navigation instrument."

The images obtained with the framing cameras will now be used to determine the exact relative trajectory of the spacecraft, and significantly improve its guidance and control to Vesta. According to current calculations, on 16 July 2011, Vesta will capture Dawn into orbit. The spacecraft will study the asteroid for roughly a year.

An asteroid in three dimensions

Beginning in August, the framing cameras will begin to perform their second function; the German camera system will analyse the surface of Vesta before Dawn continues its journey to visit the asteroid Ceres. Excitement is growing among planetary scientists as the spacecraft approaches Vesta. "We can't wait to begin exploring," says an enthusiastic Carol Raymond, a researcher at NASA's Jet Propulsion Laboratory and Deputy Principal Investigator for the Dawn mission.

Although the appearance of the asteroid's surface is as yet unknown, it is thought likely that it has a solid crust similar to that of the Moon. The camera technologies have been exercised on the Rosetta, Mars Express and Venus Express missions. DLR's planetary scientists will process the data obtained with the cameras as Dawn orbits Vesta at different altitudes.



This image, processed to show the true size of Vesta, shows the first glimpse of the giant asteroid Vesta in front of a spectacular background of stars. It was obtained by the framing camera aboard NASA's Dawn spacecraft on 3 May 2011, from a distance of about 1.2 million kilometres. Vesta is so bright that it outshines its starry background, so the framing camera team programmed a long exposure time to make the stars visible. The resulting exaggerated size of Vesta was corrected by superimposing a short exposure image of the target asteroid, showing its true size. Vesta is the small, bright pearl in the middle of the image. Vesta is 530 kilometres in diameter, and the second most massive object in the asteroid belt. But, as the inset shows, Vesta is approximately five pixels across in size in Dawn's early approach images. Credit: NASA/JPL-Caltech/UCLA/MPS/DLR/IDA

The resulting terrain model will answer questions about Vesta's birth, geological history and battering by other asteroids.

The Dawn mission

The Dawn mission to Vesta and Ceres is managed by NASA's Jet Propulsion Laboratory (JPL) in Pasadena, which is a division of the California Institute of Technology, for NASA's Science Mission Directorate in Washington DC. The University of California, Los Angeles, is responsible for overall Dawn mission science.

The camera system on the spacecraft was developed and built under the leadership of the Max Planck Institute for Solar System Research in Katlenburg-Lindau, Germany, with significant contributions from the German Aerospace Center (DLR) Institute of Planetary Research in Berlin and the Institute of Computer and Communication Network Engineering in Braunschweig. The Framing Camera project is funded by the Max Planck Society, DLR, and NASA/JPL.

by Staff Writers Bonn, Germany (SPX)
Courtesy@ Space.com

The Sabatier System: Producing Water on the Space Station

NASA astronaut Doug Wheelock, Expedition 25 commander, works to install the new Sabatier system that will extract more water out of the International Space Station atmosphere. (NASA)

Drinkable water is one of the primary and most important assets for human survival. So when preparing for a journey, whether to sea or to space, planners must take this vital resource into consideration. Stowage space during such voyages always comes at a premium. It is no different for the International Space Station and the resupply vehicles that dock there.

A great example of a solution to minimize size and weight in life support is the recently launched Sabatier system. Originally developed by Nobel Prize-winning French chemist Paul Sabatier in the early 1900s, this process uses a catalyst that reacts with carbon dioxide and hydrogen -- both byproducts of current life-

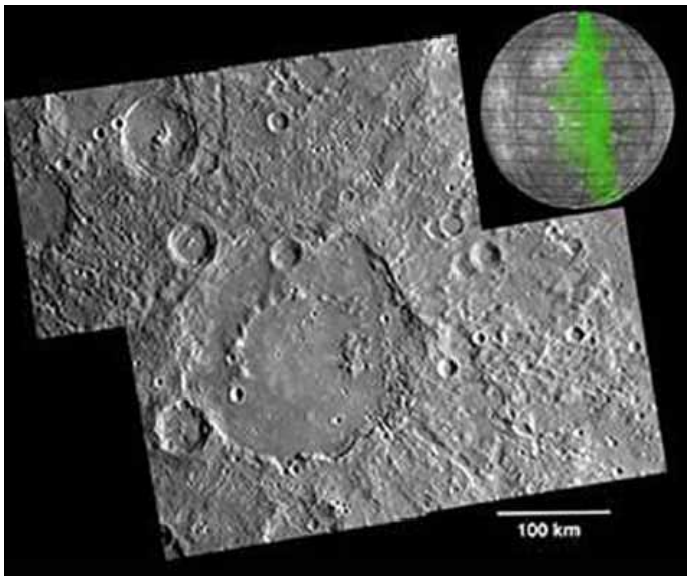
(Continued on page 23)

Science Highlights from Mercury's Orbit

As the first spacecraft to orbit the planet Mercury, MESSENGER has the opportunity to make many observations of the Solar System's innermost planet that had not previously been possible. Each of MESSENGER's eight science investigations has a one-year data collection plan that has been carefully designed to meet the goal of maximizing the science return for the mission.

MESSENGER's Mercury Dual Imaging System (MDIS) is composed of two cameras, a wide-angle camera (WAC) and a narrow-angle camera (NAC). MDIS is scheduled to acquire more than 75,000 WAC and NAC images during the one-year orbital mission in support of MESSENGER's science goals.

A range of imaging campaigns achieves a balance between globally mapping the entire surface of Mercury and obtaining targeted higher-resolution images in support of specific science goals. Together, MDIS's imaging campaigns will provide a new view of Mercury and will address one of the mission's main science questions: What is the geologic history of Mercury?



A portion of the surface morphology base map. The mosaic is centered at 22.63 degrees S, 219.71 degrees E, and has a resolution of 216 m/pixel. The large crater in the center is Valmiki (210 km diameter). Inset globe: example of planned base map image coverage during a typical week, showing how mosaics of large regions of the surface are built up from numerous individual images.

Surface Morphology Base Map

During the first 176 days of the orbital mission, equal to one solar day on Mercury, MDIS will acquire images to produce a high-resolution base map for surface morphology (morphology is the term given to the shape and texture of the surface). This map will cover more than 90% of Mercury's surface at an average resolution of 250 m/pixel (0.16 miles/pixel or 820 feet/pixel) or better.

At this resolution, features about 1 km in horizontal scale are recognizable in the images. Images acquired for the surface morphology base map have off-vertical solar illumination and visible shadows so as to reveal clearly the topographic form of geologic features. Because of MESSENGER's highly elliptical orbit, the spacecraft passes close to the surface at high northern latitudes but is far above the southern hemisphere, so both the NAC and the WAC are being used to construct the global base map.

For the southern hemisphere, images are obtained with the NAC, which has a 1.5 degrees field of view and can acquire images at seven times greater resolution than the WAC. For the northern hemisphere, when the spacecraft is closer to and moving faster over the surface, the WAC is used, because its 10.5 degrees field of view enables good image coverage. Images from both the NAC and the WAC will be mosaicked together to produce the global map. Shown in Figure 1 is an example mosaic of four images acquired as part of the surface morphology campaign.

Color Base Map

In addition to the surface morphology base map, MDIS is currently acquiring a color base map during the mission's first 176 days. The color base map is composed of WAC images taken through eight different narrow-band color filters and will cover more than 90% of Mercury's surface at an average resolution of 1 km/pixel (0.6 miles/pixel) or better. In contrast to the imaging conditions best suited for seeing surface topography, the highest-quality color images of Mercury's surface are obtained when both the spacecraft and the Sun are overhead and shadows are limited.

The eight different color filters of the WAC that are used to create the color base map have central wavelengths of 430, 480, 560, 630, 750, 830, 900, and 1000 nm. The images acquired through these narrow-band filters are combined to create color images that accentuate color differences on Mercury's surface.

Stereo Base Map

After the surface morphology base map is acquired during the first Mercury solar day, a second, complementary near-global map, called the stereo base map, will be acquired during the second Mercury solar day of MESSENGER's one-year orbital mission. The stereo base map will be used in combination with the surface morphology base map to create high-resolution stereo views of Mercury's surface at an average resolution of 250 m/pixel (0.16 miles/pixel or 820 feet/pixel) or better.

As with the surface morphology base map, images are acquired under non-vertical solar illumination, so that shadows accentuate the topography of the surface. In addition, the stereo basemap images are acquired under viewing angles that differ from those for the morphology base map by about 20 degrees , allowing stereo information about the surface to be determined.

As the mission is currently in the first Mercury solar day, no images have yet been acquired in support of the stereo base map. However, different viewing conditions during MESSENGER's second and third Mercury flybys allowed stereo information to be obtained for a portion of Mercury's surface at an image resolution of 500 m/pixel.

South Polar Monitoring

In addition to the three global base maps, there is an MDIS imaging campaign to monitor the south polar region of Mercury. By imaging the south polar region once every four MESSENGER orbits (once every two Earth days) as illumination conditions change, features that were in shadow on earlier orbits can be discerned and any permanently shadowed areas can be identified over one Mercury solar day.

Identifying areas of permanent shadow are of interest to understand the unusual materials at Mercury's poles and whether these highly radar-reflective materials consist of water ice. During MESSENGER's one-year mission, the WAC is used to monitor the polar region south of 70 degrees S at 1.5 km/pixel for the first Mercury solar day. On the second Mercury solar day, the NAC will be used for imaging the polar region south of 85 degrees S at 300 m/pixel.

Limb Imaging

Once per week, MDIS captures images of Mercury's limb (the edge of the sunlit planet with space), with an emphasis on imaging the southern hemisphere limb. The spacecraft was high above Mercury's south polar region when capturing this image. However, even when the spacecraft is at its highest altitude above Mercury, a single WAC image cannot capture the entire limb of Mercury.

(Continued on page 23)

(Continued from page 22)

Consequently, two images are taken and mosaiced together to image Mercury's entire limb. These limb images will provide information about Mercury's shape and will complement measurements of topography made by the Mercury Laser Altimeter (MLA) of Mercury's northern hemisphere.

Targeted Observation

MDIS also acquires targeted images of small areas on Mercury's surface at resolutions much higher than those of the morphology, stereo, or color base maps. It is not possible to cover all of Mercury's surface at such high resolutions during MESSENGER's one-year primary mission, but several areas of high scientific interest are generally imaged in this mode each week.

Additionally, as new features of particular science interest are imaged from orbit, targets are added to a database list and will be imaged if possible at higher resolution by MDIS, or with multiple instruments, the next time that area of Mercury is in view from the spacecraft.

Calibrations

In addition to the science imaging campaigns described above, MDIS also acquires a few images each week in support of calibration of the instrument. Some of these images are of star fields, to verify the pointing of the camera and to assess any changes in instrument characteristics during the mission. These star images resemble those acquired in support of the vulcanoid search effort, carried out during MESSENGER's journey prior to orbit insertion.

Other calibration images include repeated imaging of the same portion of Mercury's surface under different lighting and viewing geometries. These image sets provide information about the photometric corrections that must be applied to compare images acquired under a range of lighting and viewing conditions.

related report

100 Orbits and Counting

MESSENGER has begun its 100th orbit around Mercury. Since its insertion into orbit about the innermost planet on March 17, the spacecraft has executed nearly 2 million commands.

The data gathered so far include more than 70 million magnetic field measurements, 300,000 visible and infrared spectra of the surface, 16,000 images, and 12,000 X-ray and 9,000 gamma-ray spectra probing the elemental composition of Mercury's uppermost crust.

"As the primary orbital phase of the MESSENGER mission unfolds, we are building up the first comprehensive view of the innermost planet," states MESSENGER Principal Investigator Sean Solomon, of the Carnegie Institution of Washington.

"The surface is unraveling before our eyes in great detail, and the planet's topography and gravity and magnetic fields are being steadily filled in. As the Sun becomes increasingly active, Mercury's extraordinarily dynamic exosphere and magnetosphere continue to display novel phenomena."

MESSENGER continues its science-mapping phase in orbit around Mercury. All spacecraft systems remain safe and healthy, and all science instruments are on and continue to collect data according to the baseline observation plan.

"Over the next several weeks, MESSENGER's subsystems and instruments will experience their hottest temperatures yet as the spacecraft crosses between the planet's surface and our Sun at high noon close to the planet, preceded by hour-long eclipses near local midnight with only the spacecraft battery to keep the spacecraft alive in the dark of Mercury's night," notes MESSENGER Project Scientist Ralph McNutt.

"All of this was planned in great detail more than seven years ago, as was the orbit insertion burn that went so flawlessly," he adds. "Theory is one thing and reality another, and the sense of thrill leading to 'firsts' is always followed by a sense of relief, especially in the challenging environment of interplanetary space, far from home."

With less than one-sixth of its primary orbital mission completed, MESSENGER is already rewriting our books on what is known (and unknown) regarding the innermost planet, McNutt says. "By exploring our near - and far - neighbors in our solar system, we touch new knowledge, new understanding, and new wonderment about not only our own origins and place but of the other worlds circling the stars we see in our night sky."

by Staff Writers Laurel MD (SPX)

Courtesy: Space.com

(Continued from page 21)

support systems onboard the space station -- to produce water and methane. This interaction closes the loop in the oxygen and water regeneration cycle. In other words, it provides a way to produce water without the need to transport it from Earth.

The fundamental technology for this particular system has been in development for the past 20 years. The overall schedule for hardware production, however, was under two years. This accelerated timeline was a significant challenge for the complex Sabatier, which contains a furnace, a multistage compressor, and a condenser/phase-separation system. The fact that recycling system feeds for Sabatier were already available on the station helped to simplify some of the design tasks by reducing the unknowns.

According to Jason Crusan, chief technologist for space operations at NASA Headquarters in Washington, the previous development and solid interfaces allowed NASA to try out a new way of acquiring services for the station with Sabatier. "Being able to demonstrate innovative new methods to acquire technical capabilities is one of the key cornerstones the space station can serve for future missions and approaches to those missions," Crusan explained.

Using developing technologies and productive systems enables the station to squeeze every drop from the resources that must launch from Earth. In addition to improving the efficiency of the station's resupply capabilities, Sabatier also frees up storage space. This helps to maximize the area available for science facilities and engineering equipment. The knowledge gained from such systems also advances the collective understanding of technologies to advance spaceflight and help solve similar problems on Earth.

The Sabatier system has long been a part of the space station plan, but the retirement of NASA's space shuttles elevated the need for new resources to provide water. For a decade, shuttles have provided water for the station as a byproduct of the fuel cells they use to generate electricity. Sabatier supplements the capability of resupply vehicles to provide water to the station, without becoming a sole source for this critical station resource.

Currently in operation on the station, Sabatier is the final piece of the regenerative environmental control and life-support system. This hardware was successfully activated in October 2010 and interacts directly with the Oxygen Generation System, which provides hydrogen, sharing a vent line.

Prior to Sabatier, the Oxygen Generation System vented excess carbon dioxide and hydrogen overboard. Rather than wasting these valuable chemicals, Sabatier enables their reuse to generate additional water for the station. With room and resources at a premium in space, this is a significant contribution to the space station's supply chain.

by Jessica Nimon
International Space Station Program Science Office
NASA's Johnson Space Center

Courtesy: www.NASA.gov

Flipping Hot Jupiters

More than 500 extrasolar planets - planets that orbit stars other than the sun - have been discovered since 1995. But only in the last few years have astronomers observed that in some of these systems the star is spinning one way and the planet, a "hot Jupiter," is orbiting the star in the opposite direction.

"That's really weird, and it's even weirder because the planet is so close to the star," said Frederic A. Rasio, a theoretical astrophysicist at Northwestern University. "How can one be spinning one way and the other orbiting exactly the other way? It's crazy. It so obviously violates our most basic picture of planet and star formation."

Figuring out how these huge planets got so close to their stars led Rasio and his research team to also explain their flipped orbits. Using large-scale computer simulations, they are the first to model how a hot Jupiter's orbit can flip and go in the direction opposite to the star's spin.

Gravitational perturbations by a much more distant planet result in the hot Jupiter having both a "wrong way" and a very close orbit. (A hot Jupiter is a huge Jupiter-like planet in very close proximity to the central star.)

"Once you get more than one planet, the planets perturb each other gravitationally," Rasio said. "This becomes interesting because that means whatever orbit they were formed on isn't necessarily the orbit they will stay on forever. These mutual perturbations can change the orbits, as we see in these extrasolar systems."

Details of the study will be published by the journal Nature.

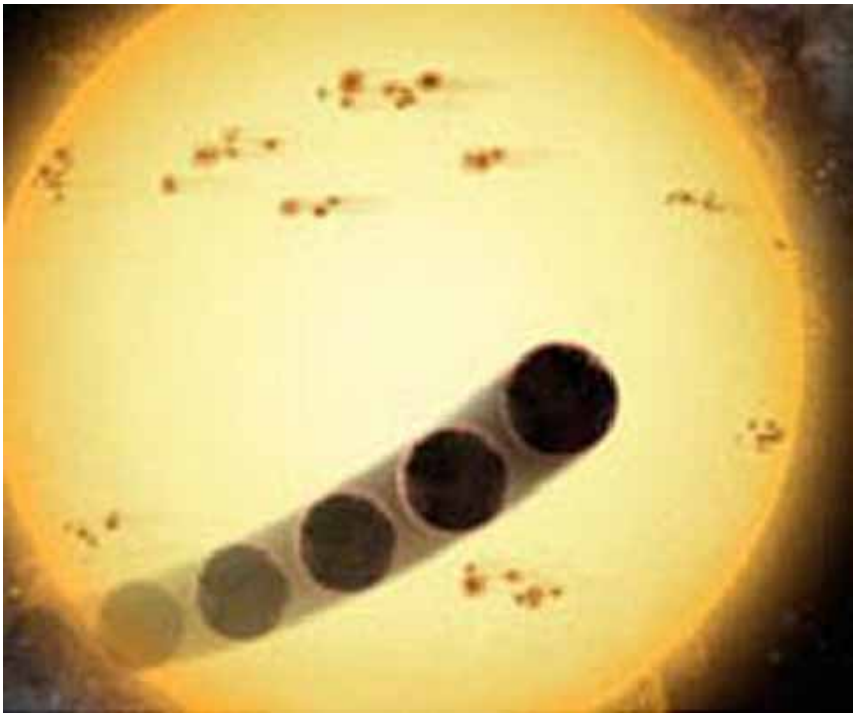
In explaining the peculiar configuration of an extrasolar system, the researchers also have added to our general understanding of planetary system formation and evolution and reflected on what their findings mean for the solar system.

"We had thought our solar system was typical in the universe, but from day one everything has looked weird in the extrasolar planetary systems," Rasio said.

"That makes us the odd ball really. Learning about these other systems provides a context for how special our system is. We certainly seem to live in a special place."

Rasio, a professor of physics and astronomy in Northwestern's Weinberg College of Arts and Sciences is the senior author of the paper. The first author is Smadar Naoz, a postdoctoral fellow at Northwestern and a Gruber Fellow.

The physics the research team used to solve the problem is basically orbital mechanics, Rasio said, the same kind of physics NASA uses to send satellites around the solar system.



A retrograde hot Jupiter: the transiting giant planet orbits very close to the star and in a direction opposite to the stellar rotation.

"It was a beautiful problem," said Naoz, "because the answer was there for us for so long. It's the same physics, but no one noticed it could explain hot Jupiters and flipped orbits."

"Doing the calculations was not obvious or easy," Rasio said, "Some of the approximations used by others in the past were really not quite right. We were doing it right for the first time in 50 years, thanks in large part to the persistence of Smadar."

"It takes a smart, young person who first can do the calculations on paper and develop a full mathematical model and then turn it into a computer program that solves the equations," Rasio added. "This is the only way we can produce real numbers to compare to the actual measurements taken by astronomers."

In their model, the researchers assume a star similar to the sun, and a system with two planets. The inner planet is a gas giant similar to Jupiter, and initially it is far from the star, where Jupiter-type planets are thought to form. The outer planet is also fairly large and is farther from the star than the first planet. It interacts with the inner planet, perturbing it and shaking up the system.

The effects on the inner planet are weak but build up over a very long period of time, resulting in two significant changes in the system: the inner gas giant orbits very close to the star and its orbit is in the opposite direction of the central star's spin. The changes occur, according to the model, because the two orbits are exchanging angular momentum, and the inner one loses energy via strong tides.

The gravitational coupling between the two planets causes the inner planet to go into an eccentric, needle-shaped orbit. It has to lose a lot of angular momentum, which it does by dumping it onto the outer planet. The inner planet's orbit gradually shrinks because energy is dissipated through tides, pulling in close to the star and producing a hot Jupiter. In the process, the orbit of the planet can flip.

Only about a quarter of astronomers' observations of these hot Jupiter systems show flipped orbits. The Northwestern model needs to be able to produce both flipped and non-flipped orbits, and it does, Rasio said.

The National Science Foundation, Northwestern's Center for Interdisciplinary Exploration and Research in Astrophysics (CIERA) and the Peter and Patricia Gruber Foundation supported the research.

The title of the paper is "Hot Jupiters From Secular Planet-Planet Interactions." In addition to Rasio and Naoz, other authors of the paper are Will M. Farr, a CIERA postdoctoral fellow; Yoram Lithwick, an assistant professor of physics and astronomy; and Jean Teyssandier, a visiting pre-doctoral fellow, all from Northwestern

by Megan Fellman, Evanston IL (SPX).

Courtesy: Space.com

MPs criticise severe cuts to astronomy and particle physics funding

Report from science and technology committee says UK astronomy will have 50% less funding by 2014/15 than in 2005

The William Herschel Telescope on La Palma in the Canary Islands, one of the facilities the UK is due to withdraw from. Photograph: Nik Szymanek/WHT

MPs have warned that major cuts in research budgets and withdrawal from several major scientific facilities will endanger the UK's international standing in astronomy and particle physics and its ability to inspire the next generation of scientists.

In the report of its inquiry into the funding of particle physics and astronomy, the House of Commons science and technology committee said that while scientific research was left relatively unscathed in last year's government spending cuts, historical cuts planned for research meant that astronomy would have 50% less money overall by 2014/15 than it did in 2005. This is set against the background of increased investment by international competitors.

Andrew Miller MP, chair of the science and technology committee, said he was concerned at the "smoke and mirrors exercise on how the funding cuts have been presented over a period of time. The cuts are very severe compared with a few years ago. That undoubtedly is going to have an impact on our standing. We've already heard some [international] partners saying that we can't trust the Brits because they won't keep up with the long-term funding of projects."

The Science and Technology Facilities Council (STFC), which is responsible for research grants and membership of international facilities in astronomy, particle physics and nuclear physics, has had a long-term plan to cut back its subscriptions to telescope facilities around the world. These include gradual withdrawals in the coming years from the Gemini observatory and the Joint Astronomy Centre in Hawaii, the William Herschel Telescope and the Liverpool Telescope on La Palma in the Canary Islands. This would leave UK astronomers without any access to ground-based facilties in the northern hemisphere.

The withdrawal from the Liverpool Telescope in particular has impacts on the National Schools Observatory, which provides access to telescopes for school pupils.

"It stands out like a sore thumb from everything we've looked at, how important the astronomy is as a switch-on for kids studying science in the longer term," said Miller. "What on Earth are we doing pulling out of optical and infrared astronomy in the northern hemisphere? There may be scientific arguments that justify that but, in terms of strategic arguments about engaging with the next generation, they don't seem to have been considered."

Brian Cox, a particle physicist at Cern and the University of Manchester, said that the problems identified by the MPs were nothing to do with the recent budget settlement, which he said was not bad. "The fact that we got flat cash into the research councils [in the recent comprehensive spending review] is a recognition of the fact that it's important, even in a recession, to spend money on research because it pays dividends in the future."

Instead he points to the formation of the STFC in 2007 as the start of the problems. This was the result of a merger between two older research councils and was given insufficient resources to carry out its job. "[It] has been a complete disaster ... The UK was considered to be one of the best places in the world for research into the physics of the early universe and astronomy and particle physics. The UK was punching way above its weight and it was working very well. For some reason, some people decided to demolish that and form a new council with a difficult remit and not enough money."

Miller said that, ever since the merger, there had been a systematic "hacking off of capital budgets over time. We need to recognise that this is serious and it needs addressing, not because of esoteric interest in the sky at night but because astronomy is fundamental to producing next-generation scientists and it is also an area where we have a massive reputation which we shouldn't put at risk."

A spokesperson for the Department for Business said: "Our world-class science and research base is inherently valuable, as well as critical to promoting economic growth. Despite enormous pressure on public spending, the £4.6bn per annum funding for science and research programmes has been protected in cash terms and ring-fenced against future pressures during the spending review period. The Haldane principle dictates that the government cannot intervene in individual funding decisions."

A spokesperson for the STFC said it welcomed the report and shared the science and technology committee's concern to "ensure that particle and nuclear physics and astronomy in the UK remain world class". It noted in particular the Committee's support for an expanded programme of outreach and public engagement. "Particle and nuclear physics and astronomy, with space science and the other disciplines we support, play a crucial role in inspiring younger people to become involved in science, technology, engineering and mathematics. STFC will now examine the report's recommendations in detail and respond in due course with our sponsoring department."

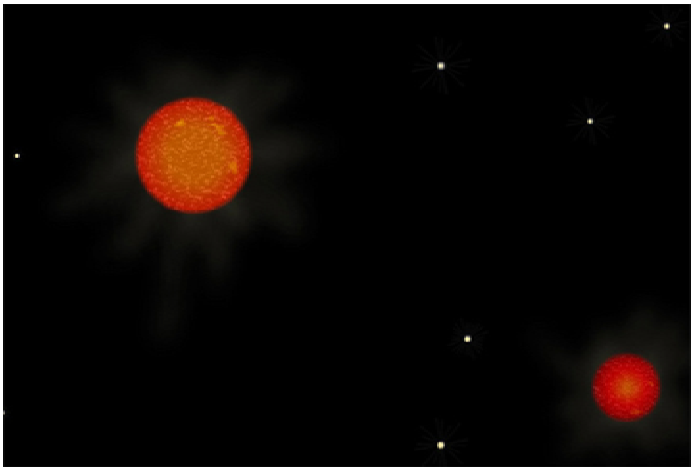
Imran Khan, director of the Campaign for Science and Engineering, said: "This report makes it pretty clear that investing in science is a long-term business – we're looking at decades, not years. It really highlights why the UK needs a long-term strategy for science and engineering that looks beyond artificial political timescales. Our future as a high-tech nation depends on it."

Alok Jha, science correspondent, The Guardian

Courtesy: The Guardian

Astronomy Without A Telescope – SLoWPoKES

by STEVE NERLICH



The Sloan Low-mass Wide Pairs of Kinematically Equivalent Stars (SLoWPoKES) catalogue was recently announced, containing 1,342 common proper motion pairs (i.e. binaries) – which are all low mass stars in the mid-K and mid-M stellar classes – in other words, orange and red dwarves.

These low mass pairs are all at least 500 astronomical units distance from each other – at which point the mutual gravitation between the two objects gets pretty tenuous – or so Newton would have it. Such a context provides a test-bed for something that lies in the realms of 'fringe science' – that is, Modified Newtonian Dynamics, or MoND.

The origin of MoND theory is generally attributed to a paper by Milgrom in 1981, which proposed MoND as an alternative way to account for the dynamics of disk galaxies and galactic clusters. Such structures can't obviously hold together, with the rotational velocities they possess, without the addition of 'invisible mass' – or what these days we call dark matter.

MoND seeks to challenge a fundamental assumption built into both Newton's and Einstein's theories of gravity – where the gravitational force (or the space-time curvature) exerted by a massive object recedes by the inverse square of the distance from it. Both theories assume this relationship is universal – it doesn't matter what the mass is or what the distance is, this relationship should always hold.

In a roundabout way, MoND proposes a modification to Newton's Second Law of Motion – where Force equals mass times acceleration (F=ma) – although in this context, a is actually representing gravitational force (which is expressed as an acceleration).

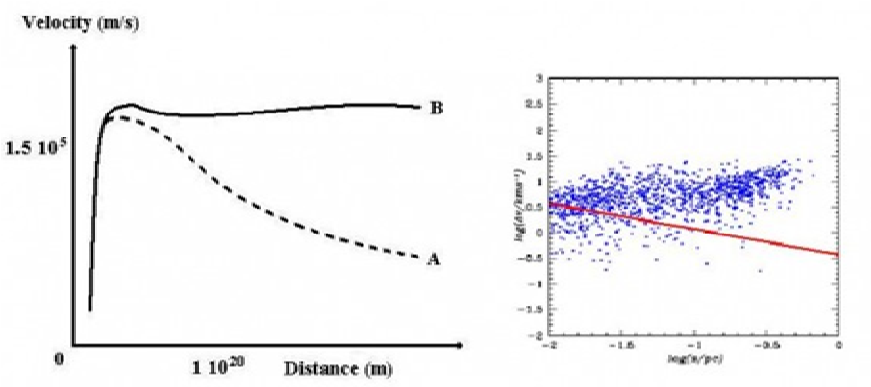
If a expresses gravitational force, then F expresses the principle of weight. So for example, you can easily exert a sufficient force to lift a brick off the surface of the Earth, but it's unlikely that you will be able to lift a brick, with the same mass, off the surface of a neutron star.

Anyhow, the idea of MoND is that by allowing F=ma to have a non-linear relationship at low values of a, a very tenuous gravitational force acting across a great distance might still be able to hold something in a loose orbit around a galaxy, despite the principle of a linearF=ma relationship predicting that this shouldn't happen.

MoND is fringe science, an extraordinary claim requiring extraordinary evidence, since if Newton's or Einstein's theories of gravity cannot be assumed to universal, a whole bunch of other physical, astrophysical and cosmological principles start to unravel.

Also, MoND doesn't really account for other observational evidence of dark matter – notably the gravitational lensing seen in different galaxies and galactic clusters – a degree of lensing that exceeds what is expected from the amount of visible mass that they contain.

In any case, Hernandez et al have presented a data analysis drawn from the SLoWPoKES database of widely spread low-mass binaries, suggestive that MoND might actually work at scales of around 7000 astronomical units. Now, since this hasn't yet been picked up by Nature, Sci. Am. or anyone else of note – and since some hack writer at Universe Today is just giving it a 'balanced' review here, it may be premature to consider that a major paradigm of physics has been overturned.



Left image: *The unusual flat curve (B) of velocities of objects in disk galaxies versus what would be expected by a naive application of Kepler's Third Law (A).* ***Right image:*** *A scatter plot of selected binaries from the SLoWPoKE catalogue (blue) plotted against the trend expected by Kepler's Third Law (red). Credit: Hernandez et al. (**Author's note** - Kepler's Third Law of Planetary Motion fits the context of the solar system where 99% of the mass is contained in the Sun. Its applicability to the motion of stars in a galactic disk, with a much more even mass distribution, is uncertain)*

Nonetheless, the concept of 'missing mass' and dark matter has been kicked around for close on 90 years now – with no-one seemingly any closer to determining what the heck this stuff is. On this basis, it is reasonable to at least entertain some alternate views.

Courtesy: Universe Today