FAS Newsletter

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

40th FAS Convention & AGM to be held at Birmingham University

The 2014 FAS Convention will take place on October 11th 2014 at the University of Birmingham. The convention will start at 9.30am, with the AGM taking place at 2.00pm.

To celebrate the 40th Anniversary of the FAS, the Convention will take place at the new Bramall Music Hall at the University of Birmingham. A stunning venue which can hold up to 450 people, this year's FAS Convention is not one to miss! There will be a series of talks by invited speakers as well as a variety of trade stands.

The Bramall Music Building is located in the centre of the University of Birmingham campus, in the Aston Webb building.

The venue is easily accessible via car or train. The University of Birmingham has its own train station ('University') which is a short walk from the venue. Alternatively it has easy car access with car parks located around the University or disabled parking right outside the venue. Detailed maps will be provided when a ticket for the event has been bought.

As far as catering goes –at the venue there is a Costa Coffe and within 5 minutes on campus there is a Spar and a Subway. Local pubs and restaurants are 10+ minute walk away.

Tickets will be charged at £5 for FAS members and £7 for non-members.

Bramall Music Building,
University of Birmingham, Edgbaston,
Birmingham B15 2TT.

President
Gary Gawthrope
19 Campion Drive, Swinton,
S Yorkshire. S64 8QZ
01709 584116
president@fedastro.org.uk

Treasurer
Peter Cooke
Haven Cottage, Frithville,
Boston, Lincs, PE22 7DS
01205 750868
treasurer@fedastro.org.uk

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Secretary
Shaun O'Dell
147 Queen St, Swinton,
Mexborough, S Yorkshire.
S64 6NG
07714 093723
secretary@fedastro.org.uk

Newsletter Editor
Frank Johns
38 Chester Road, Newquay,
Cornwall. TR7 2RH
01637 878020
newsletter@fedastro.org.uk

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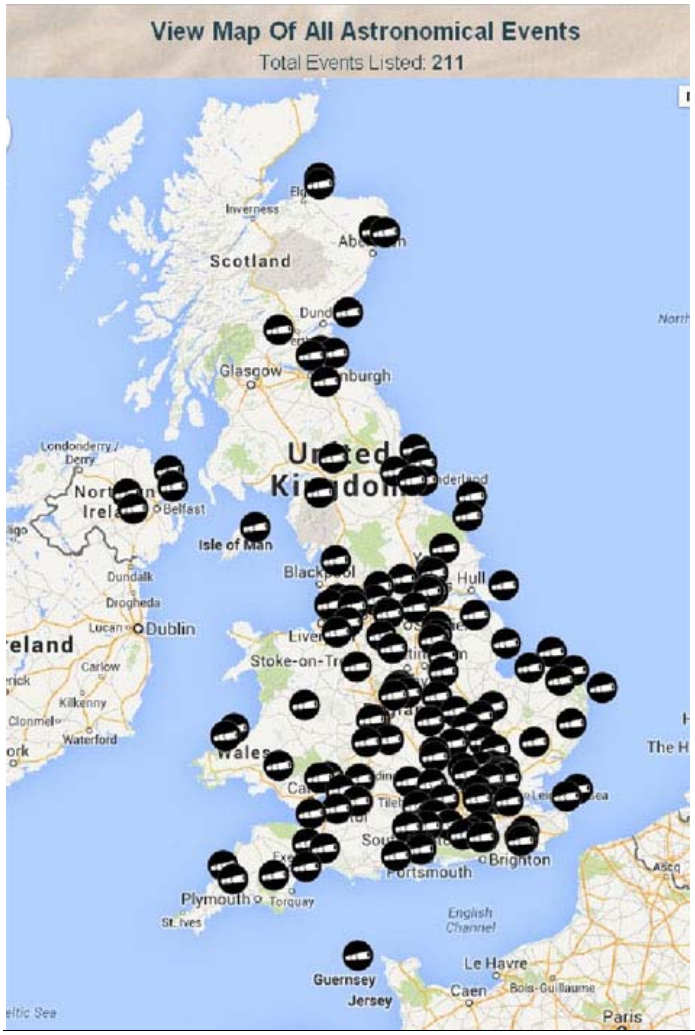
National Astronomy Week 2014

By Jove, what a success! Stargazing Live was always going to be a hard act to follow but National Astronomy Week 2014 certainly succeeded with Target Jupiter, indeed it capitalised upon its more famous trail-blazer. Over 200 events were held nationwide, between 1st and 8th March, the vast majority of which were observational evenings organised for the general public whose appetite for stargazing has most certainly been whetted by the amount of prime time TV exposure that astronomy is now getting. As would be expected most sessions were organised by FAS member societies who are experienced in running events of this sort, but it is good to see such a wide range of other bodies getting involved; astronomy shops, observatories, museums, schools, colleges, nature reserves, local councils, the U3A, the National Trust and others besides.

Publicity was excellent, local FAS societies did a splendid job in promoting NAW events including to local radio and newspapers. At a national level NAW was mentioned by the SGL team, website and calendar, and also on the BBC's One Show. Both *BBC Sky at Night Magazine* and *Astronomy Now* strongly featured the event, with the latter being one of our sponsors and providing a stand at AstroFest and timetabling a talk on NAW by Dr Robert Massey, the Steering Group Chair.

Perhaps the most visible face of the Steering Group was the excellent NAW website. Here could be found a map and searchable list of events, lesson plans for schools (created by the former FAS webmaster Dr Sam George), an "Ask the Expert" page, downloadable posters and fact sheets plus excellent videos about Jupiter. By the way, these resources are still freely available - should you want them just go to www.astronomyweek.org.uk




John Axtell in action at an NAW event for U3A

Funding was generously provided to event organisers from two sources, namely the FAS Council and the STFC's Dark Sky Discovery team; 13 FAS societies and 16 other event organisers each benefitting to the tune of £50.

So when will the next one be? As was reported in my article in Newsletter No 103 these National Astronomy Weeks have usually been held every five or six years, timed to coincide with a time of astronomical significance, either observational or historical. Following this line of thinking it has been suggested that late Feb/early March 2020 would be appropriate with Venus as the main theme. However, given the current swell of enthusiasm for all things astronomic, it has also been suggested that the next NAW should be earlier – perhaps Spring 2017 with the focus on The Moon. At present it's yet to be decided, so by all means send in your suggestions to the FAS Council, but do watch out for the decision in due course.

John Axtell FRAS

Recent FAS Council member and FAS Rep to NAW Steering Committee.

There are quite a number of reports of both ***Stargazing LIVE*** and ***NAW*** events in this edition—with more in the electronic version. Make sure you get a copy from your society.

Editor

PRESIDENT'S SPOT

I hope that you had a good Stargazing Live and National Astronomy Week. These are wonderful opportunities for societies to promote astronomy to the general public – you may even get a few new members from these events.

For those societies that ran events in Stargazing Live and NAW we'd love to hear from you, maybe consider a short article for the newsletter. The organisers and funders of these events also like feedback – this supporting material helps them apply for funding for future events.

Now that the winter observing season is over most of us look forward to a nice quiet summer, especially from the point of view of interacting with the public. But if your society has a solar telescope (either white light or Hydrogen alpha) then how about contacting local fetes or country parks & ask if you can bring your telescope & show the public a close up view of our nearest star. My own society is running 3 solar observing events at the local RSPB reserve (a venue we use for both Stargazing-Live and NAW), this has become a very successful partnership over the past years and provides a great venue for interacting with the public.

Don't forget to put the Convention Date in your diary for 11th October 2014 at the University of Birmingham. We're arranging a great day out including an interesting set of speakers. Of course the traders will also be present – trying to separate you from you're your hard earned money! The Convention page on the FAS website will be updated with further details as they are confirmed.

That's all for now.

Gary Gawthrope

Stargazing LIVE - Isle of Man

The Isle of Man Astronomical Society held a three night Stargazing Live Event on Tuesday 7th, Wednesday 8th and Thursday 9th January 2014 at Onchan Park, Onchan, Isle of Man.

This event was partnered with the BBC "Things to Do" in support of The Stargazing Live program on BBC 2. Here is my report on how it went:

Tuesday 7th Jan was about 100% cloud cover when we left for the meeting. On arrival at Onchan Park a few gaps appeared in the cloud at about 90% cover; the cloud was forecast to reduce a bit later on. To our surprise about 60 members of the public arrived including several children. They were rewarded with quite good views of Jupiter and the moon through telescopes and binoculars.

Wednesday night was 100% clouded out and raining, we had previously announced on radio that the evenings stargazing was cancelled. A few of our team went along in case any public turned up. Surprisingly about a dozen people arrived but were told that it was off and they should return on Thursday night. During Wednesday our awaited Stargazing Calendars arrived and these exceeded our expectations; they are excellent.

Thursday night was the one which was forecast to be clear for stargazing by our local met office at Ronaldsway, so all stops were pulled out to get this announced on our own local radio stations: Manx radio, 3FM and Energy FM. On Thursday night the sky was crystal clear, we had a tremendous amount of people who came to see the night sky through the Society members telescopes and binoculars. On arrival people were greeted by one of our very knowledgeable members (previously Chairman of the IOM Astronomical Society), Mr Mike Kelly who gave a visual naked eye tour of the night sky, pointing out the names of constellations, stars and various objects to be seen. Members of the society brought their telescopes and tripod mounted binoculars ranging from a large Dobsonian, 10" Newtonian, and a 6" Maksutovs and several refractors of various sizes on driven or manual mounts and large binoculars of various sizes on tripods. We had one telescope with a video camera on board showing live images of the Moon. I estimate that we must have had 500 people at least. There was a steady stream of people arriving and leaving over the period of about two and a half hours. The area in which we had sited the telescopes was packed and had, at a rough count, held about 250 people for most of evening. The stargazing calendars were given out and we gave away almost 400. Not everyone took a calendar and some just took one per couple, so I think it safe to say we had 500 or more people. There were many comments of amazement and lots of "Wows" at what could be seen. Jupiter, Orion Nebular, the Moon, Castor, the Pleiades and many other sights.

In answer to the question as to whether being partnered to the BBC event created more interest; I would say yes, I think being partnered to BBC things to do stargazing live did increase the turnout. Our posters showed that it was connected to Stargazing Live and the excellent TV coverage increases the interest in the subject..

I would like to thank all the members of our society who brought their instruments and say how incredibly kind and patient everyone was in showing and explaining the objects to all our visitors from small children to adults of all ages.

We are also grateful to the co-operation of Onchan District Commissioners for allowing use of Onchan Park and in particular Andrea Dentith for organising the arrangements in the Park and arranging for all the street lighting in the immediate area to be turned off.

Thanks must also go to the two young ladies, Breeshey and Kirree from St John's ambulance, who volunteered to attend as first aid cover.

All in all a very successful and rewarding event.

Thanks to all the Stargazing Live team for their support and for supplying the calendars.

Thanks must also go to Mark Henthorne for co-organising the event with me: his help, advice and knowledge were invaluable.

Regards,

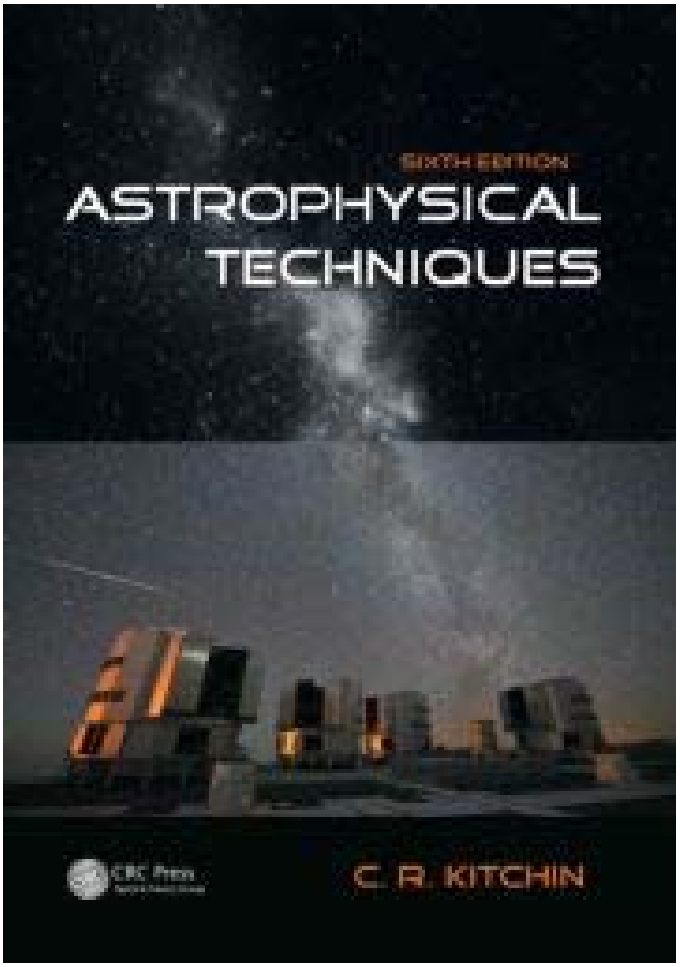
James Martin

Secretary—IOM Astronomical Society

BOOK REVIEWS

ASTROPHYSICAL TECHNIQUES

- Sixth Edition - by C.R.KITCHIN
CRC Press ISBN-13:978-1-4665-1115-6
(Hardback) £37.55



C.R.Kitchin's book on Astrophysical Techniques, first published in 1984 and now in it's Sixth Edition, provides a comprehensive, coherent and updated account of the instruments and detectors used in twenty first century astrophysical observation and measurement. This new edition omits some now dated methods and associated instrumentation and substitutes these with first time accounts of those new techniques which have emerged to replace or complement astrophysical methodology over the 30-year lifespan of the series. Many of the new devices and techniques discussed in this book will have become widely used by amateur enthusiasts as well as by professional astronomers. The book is directed primarily at an undergraduate readership but it will be equally useful for amateur astronomers who may wish to keep abreast of modern instrumentation and its application and who increasingly make use of some of the devices and methods discussed. The professional astrophysicist will no doubt also find it useful to update their knowledge in areas outside of their principal research interests and experience. The mathematical content is largely accessible to the reader with a good grounding in advanced level algebra and calculus coupled with a background in technology and physics. The author expresses an understanding that the modern day internet user will wish to supplement the content of this book by accessing websites which provide further and perhaps more detailed information on specific techniques and instrumentation. The book is structured in such a way as to complement this practice although there are few website references given the availability of effective search engines. The book is not just a list and the author is keen to emphasise the unifying approach which is to be found within the content of the five chapters and in the arrangement of the subject matter within them.

The first and by far the longest chapter (at 217 pages) deals with Detectors. These range from the human eye through photographic, CCD, infrared, radio, microwave, x-ray and gamma-ray detectors to cosmic ray, neutrino, gravitational radiation and dark matter detectors. There is a brief historical review of telescope design and development and similarly brief but useful discussions of optical design, resolution, specific imaging techniques and noise reduction processes. In this and in subsequent chapters the author discusses likely future developments. Chapters two, three and four deal with Imaging, Photometry and Spectroscopy. Chapter two includes essential material on photographic as well as electronic methods of imaging and provides brief details of interferometric techniques in the visible and radio regions of the spectrum. Chapter three continues the discussion of photographic and electronic (CCD) methods within the context of Photometry. There is a useful discussion of filters leading to a section on colour indices. Chapter four reviews the theory and use of both prism and diffraction grating spectrometers with detailed sections also on Fabry-Perot and Michelson Interferometry. Chapter five is titled 'Other Techniques' and covers Astrometry, Polarimetry, Solar Studies, and Magnetometry and concludes with a brief account of Digital Sky Surveys and Virtual Observatories.

At appropriate points in each chapter there are a selection of Exercises with answers provided in an appendix. Other appendices provide notes on the use of The Julian Calendar, a comprehensive list of acronyms, a glossary of CCD devices and a bibliography of useful journals, catalogues and textbooks. The list of acronyms is particularly useful for the casual reader since many of those listed will not be widely known and some, such as UCLES (University College London Echelle Spectrograph), are unfamiliar abbreviations which are astronomy or even spectroscopy specific. In the context of this book UCLES does not represent a Local Examination Syndicate ! The book concludes with a comprehensive index.

This is a useful and well presented update to an established series which will attract a wide and varied readership. It is unlikely perhaps that users will read the book chapter by sequential chapter. More likely it will find alternative but equally valuable use as a reference text in the same manner as it's earlier editions.

Brian Parsons.

Le Verrier – Magnificent and Detestable Astronomer.

James Lequeux (in French). Translated by Bernard Sheehan and edited by Dr William Sheehan Hardback £117.00 ISBN 978-1-4614-5564-6 ebook £93.50 ISBN 978-1-4614-5565-3

James Lequeux is employed at the Paris Observatory and has authored a number of books on deep space astronomy. Lequeux carried out the research and published the original book in French. It was translated by Bernard Sheehan (William Sheehan's brother) into American English. The original French version was briefly reviewed by Clive Davenhall in the Bulletin of the Society for the History of Astronomy Issue 20 for the summer of 2010 (P70)

William Sheehan is an American living in Minnesota a neuroscientist by profession, a keen astronomer and a well-known author of books relating to the solar system. William is also an enthusiastic member of the team investigating the discovery of Neptune story. He led the team's presentation in Seattle to the AAS conference in 2011. He is very keen that scholars are able to explore all aspects of the Neptune discovery story. Although William is a well-known writer of astronomy books and expert on the discovery of Neptune his name does not appear on the cover.

For a number of years now scholars have tried to study the archives held in the Paris without success. The outcome is that Le Verrier era is poorly represented in the history of European astronomy. Indeed much of what we know about Urbain Le Verrier is restricted to the page in the Hutchinson Dictionary of Scientific Biography.

William Sheehan's initial contribution, the new preface, clarifies some of the myths that have grown up around Le Verrier in the absence of a definitive account. It must not be passed over as of little worth. Reading it does provide useful insights into the role played by the Paris Observatory and the Board of Longitudes. The conflict between the two is a thread throughout the book. A number of other assumptions consequent upon a lack of a definitive history can also be laid to rest

Le Verrier (1811 – 1877) is most famous for predicting the position of Neptune from its perturbation of the orbit of Uranus. It was subsequently discovered close to its predicted position by Galle and d'Arrest in Berlin on the evening of the 23rd of September 1846. On the English side of the Channel the story is usually twinned with the unsuccessful attempt to find the planet at Cambridge University.

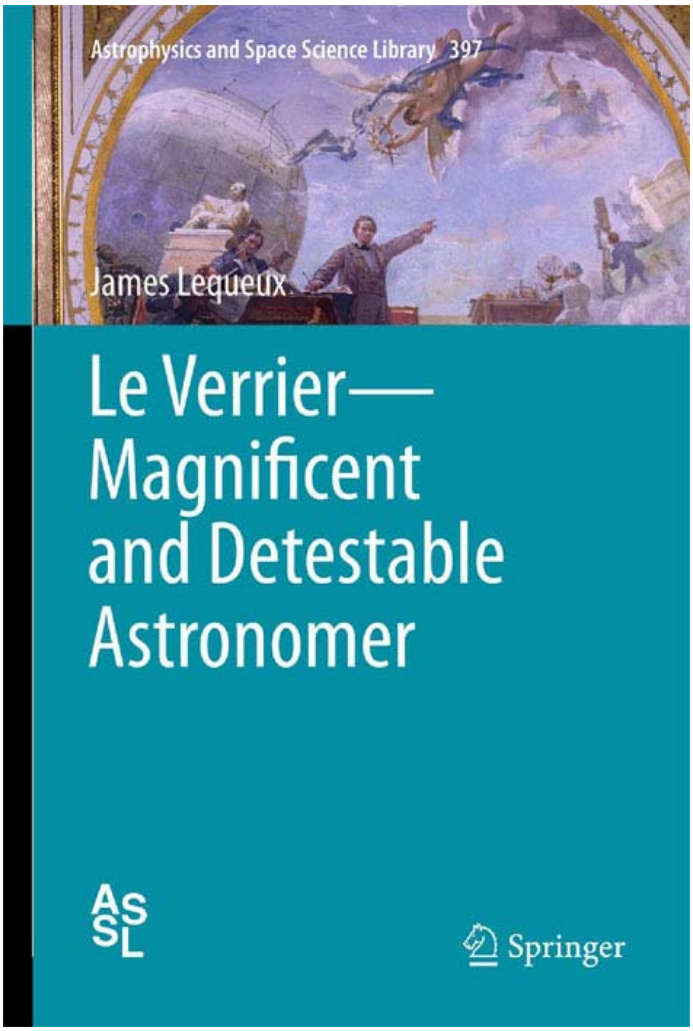
Urbain Jean-Joseph Le Verrier was born on the 11 March 1811 in Saint-Lo. (It is reassuring to see that the correct spelling Le Verrier rather than Leverrier is used throughout) His early years, were not spectacular for in 1830 he failed the entrance exam to the Ecole Polytechnique. In 1831 he came only second in a national competition but this was enough to secure his place in the prestigious Polytechnique. Also he finished his course in eighth place, not good for someone whose prowess would prove to be world class in only a few years. He then applied for a post as a chemist in the Polytechnique and was passed over. However he was successful in securing a post as an astronomer, he was already tracking Francois Arago! It is wholly possible that his early failures contributed to his detestable behaviour in later life.

The first part of Le Verrier's astronomical life was mainly concerned with the discovery of Neptune in 1846, arguably the most important astronomical discovery of the century. A study of the papers to be found in the UK reveals that a number of holes in the overall narrative. The information in Lequeux's book goes a long way towards filling them. His brilliant feat of mathematical analysis placed the position of the new planet very close to its actual position in the night sky.

There is also a whiff of a new scandal – a hint that the breakdown of the friendship between Arago and Le Verrier was due to an affair between Le Verrier's wife and Arago! The book adds so much to the overall Neptune Saga that no new paper on the subject will be complete without reference to this text. It is very difficult to do justice to the impact on the Neptune story in a book review, covering as it does some 340 pages of informative text.

Subsequent chapters cover Le Verrier's reign as Director of the Paris Observatory, his dismissal and his later reinstatement.

After he took over from Arago as Director of the Paris Observatory



his character started to shine forth. The first of his major problems surfaced - a complete lack of inter personal skills. He fell out with all and sundry and finally got thrown out as Director in 1870. This area is covered in good detail together with a profile of his successor Delaunay who managed to drown himself in a boating accident in 1872.

As has been hinted at by a number of authors the Paris Observatory was encumbered with many useless instruments. A new 38cm scope was described as "utterly useless" by Otto Struve. In addition its location in the middle of Paris meant that the seeing conditions were poor and getting worse. Never the less Le Verrier managed to bring about great improvements to the Observatory and brought it up to a good standard.

Then of course there was political turmoil in France at the time. The citizens were always "manning the barricades". In 1848 Arago found himself president of the committee that ruled France. A number of programmes of astronomical work were disrupted; many letters and data were lost.

This state of affairs laid France open to attack by its neighbour Germany (Prussia) and Paris came under siege.

Le Verrier's contribution extended beyond pure astronomy. He refined the position of various towns by measuring their longitudes with great care. Following the shipwreck of half the French fleet in the Black Sea he was able to put into practice a much improved system of meteorology.

An extremely valuable part of this text comes towards the end – Appendix A is a time line of Le Verrier's life set beside important scientific and political events. This is followed by an excellent Bibliog-

(Continued on page 6)

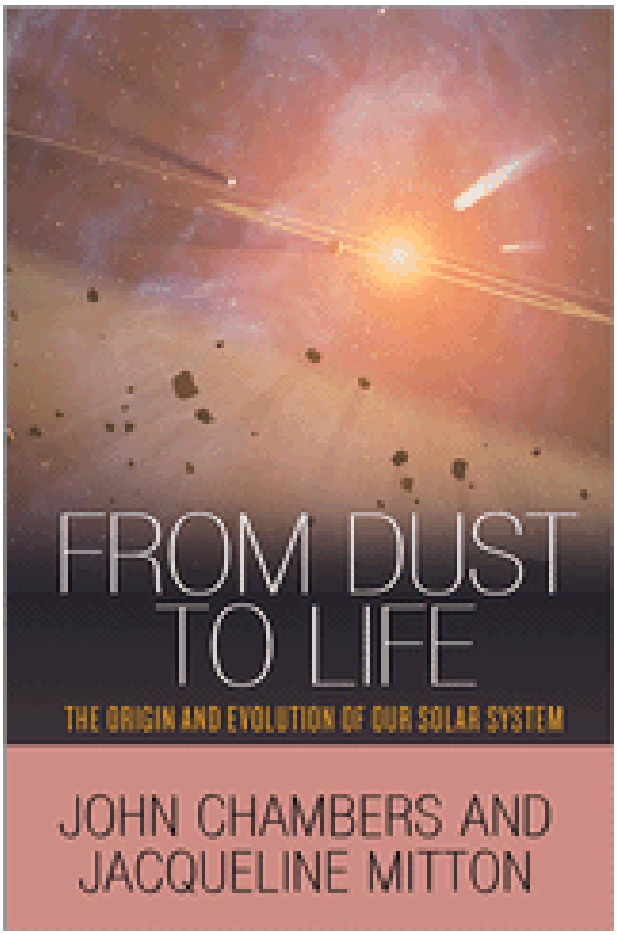
FROM DUST TO LIFE - The origin and evolution of our Solar System

John Chambers and Jaqueline Mitton Princeton University Press ISBN 9781400848355 £19.95

John Chambers is a planetary scientist and Jacqueline Mitton is a writer on astronomy. Together in this 300 page book they explore in a sequential way the origins of our local neighbourhood, the Solar System. They describe how the many varied objects that make up our solar system all came from a common origin billions of years ago and how over centuries scientists and philosophers have endeavoured to study and reveal the truth of the structure, age and formation of the Sun and its huge family revolving around it. In 15 chapters, using the history of astronomical discoveries including the latest information from recent and current space missions and observations, the authors give us a detailed but very readable and authoritative version of our current understanding of the solar system.

Chambers and Mitton look at how the evolution of the universe enabled the Sun to form and the subsequent birth of the planets, comets, moons and asteroids from the nebulous dust and gas spinning around it. They investigate and explain why each planet's structure is unique and why it is rocky or gaseous and examine the reasons why the Earth is a perfect place for life to begin and flourish. These include the position of Earth's orbit (Goldilocks Zone), its size, the availability of carbon, water, nitrogen and other essential materials which together allows "life as we know it" to exist. The authors discuss the recent discoveries of other varied and surprising planetary systems and how ours relates to them giving rise to more questions and theories on system evolution.

The writers wrote this book after a fascination with the past and how the rest of the solar system determined how we are here today. Their goal is to describe the origins and key moments in the history of the system and how scientists have gradually pieced together the complex detailed jigsaw of the structure, interactions and timescales using the most exciting and evermore inventive and complex tools. The book is not a specialist scientific tome on the solar system but is written for the general reader with some basic understanding of science and using non-jargon words. Where some unfamiliar words have to be used they are helpfully explained in a glossary at the end of the book. The graphics, photos and tables used in the book are very clear, relevant and useful to illustrate some of the more abstract or difficult concepts discussed. Each chapter is clearly titled, e.g. "Cosmic Archaeology", "A Star is Born", "What Happened to the Asteroid Belt?". Likewise the subsections of each chapter are also well titled, e.g. "The Missing Planet", "An Abundance of Elements", "The Tree of Life".



This book takes the reader on a guided tour from the long-distant past to the present of our solar system giving lots of intriguing information and descriptions of how we now think it all began and developed. The authors' use of the most up to date knowledge gleaned from the most sophisticated experiments and space machines that man has devised keeps us at the cutting edge of how we see our place in the great scheme of our Solar System. Highly recommended.

Glynn Bennallick

(Continued from page 5)

raphy which provides leads for English readers to explore other aspects of French science in addition to providing background material to the Le Verrier story.

Is this text the complete story – actually no - a certain amount of his time was spent in England , meeting Couch Adams twice – once post Neptune and second much later to receive the Gold Medal of the Royal Astronomical Society, from Adams as President of the RAS. These visits, although short in duration, were important as Adams was able to work around Le Verrier's difficult personality and go some way to smoothing over the rift between French and British astronomy. Anyone wishing to write about Le Verrier's place in 19th cent science will still have to research beyond the covers of this book. Until now our view of Le Verrier was large but lacking in detail – pixelated in effect.

One slight problem I have with the book is that William Sheehan, himself an expert in 19th cent astronomy has augmented the book, seamlessly, well almost. It would have been better, in my view, if his contribution had been noted as such.

One very strong feature of this book are the images, most of the principals are illustrated together with many instruments, documents and buildings, as a standalone collection it would be very useful to any student of 19th century science. Unfortunately this collection is not indexed, although it is possible to find what you are looking for with a little diligence.

Of course the majority of the book comes directly from French archives, making this the definitive English language biography of Le Verrier. It makes an indispensable addition to our knowledge of astronomy of that turbulent era. Unsurprisingly it is well written and a real page turner. It must find a place in any Library dedicated to the history of science.

Advance of the perihelion of Mercury. In 1859 Le Verrier came across an anomaly in the movement of Mercury. Planets orbit in ellipses rather than circles and the position of the perihelion can be determined. This is due to the pull of the other planets in the solar system and can be quantified. When all these effects were taken into account there remained an unacceptable error. Either Newton's theories were inadequate or there was another undiscovered planet orbiting even closer to the Sun. False sightings of a round sunspot lead to Le Verrier announcing that Vulcan had joined the solar system! In truth he was not confident of this assertion and Vulcan was never seen again but the information was used to establish Einstein's Theory of General Relativity. The advance of the perihelion of Mercury calculated from the theory of relativity is 43" per century, in almost exact agreement with that observed by astronomers.

Brian Sheen

NAW - King's Lynn

An event organised by the King's Lynn & District Astronomy Society as part of the nationwide National Astronomy Week, was hailed as an unmitigated success by the Society's Chairman Mr Richard Last.

" We achieved our aims which were to engage the Public with the wonders of the night sky and to excite the imaginations of the young."

With well in excess of 100 members of the Public attending including her worship the Mayor of the Borough Council of King's Lynn and West Norfolk, turning out in support, and through Society Members telescopes, which varied in size from Starter to Advanced - Adults and children gazed upon astronomical phenomena including, the death of a Star in M 82 (The Cigar Galaxy - which hit the News Headlines recently), M42 - The Orion Nebula, Jupiter and the four accompanying Galilean Moons (the closest Jupiter will be for the next 84 years) and the Moon.

After succumbing to the cold, visitors came inside the Hall to seek warmth and refreshment saw, displays and details of a scaled Solar System (with satellites orbiting their host Planet), Computer Displays using the latest Astronomical Software and a Video presentation of the Solar System with the salient facts.

Whilst the Parents welcomed the chance to sit down for a rest - the Children busied themselves taking part in the various competitions laid on from, Colouring Competition, Space Quiz and Name that Constellation Competition.

The Winners received their Certificates and Prizes from the King's Lynn & District Chairman - Mr Richard Last, seen pictured with the winners.

For more information on the King's Lynn & District Astronomy Society, please go to www.westnorfolkastro.co.uk or telephone Richard on 07791 388431

From Left:

Under 8's	Colouring Competition	Winner Samuel Milner	(6)
Name the Constellation	Competition	Winner Sophie Jones	(5)
6 - 8 Year Olds	Space Quiz	Winner Harry Mason	(6)
8 - 14 Year Old	Space Quiz	Winner Amelia Farmer	(12)

NAW - Liverpool AS

The LAS held Yet another successful Wirral Star Party On Saturday, March 1st, as part of National Astronomy Week. We had an attendance of 125, with cloud and rain at the beginning of the evening, but it soon cleared to give all our visitors excellent views of Jupiter and it's Moons. And lots of deep sky objects. Talks inside given by Ken Clark, and Geoff Regan, were on the subjects of "Jupiter king of the planets", "Spaceflight", and "Our Solar System". We held an advice clinic and advice on telescope and binoculars, and how to use star maps session inside the centre.

We would like to thank the Wirral Ranger Services who provided the Wirral Country Park Visitor Centre free of charge.

The attached images - with Thanks to Alan Dennett and Jim Stacey from LAS.

We will do it all again on Saturday, November 1st 2014.

Gerard Gilligan
Hon Secretary, Liverpool AS

Stargazing LIVE - St Columb Major

The 2014 Stargazing Live staged by Kernow Astronomers at St Columb Major Academy proved to be a well attended and successful event. The turnout was no doubt aided by Sky at Night magazine listing this event as 'Pick of the Month'.

In addition to the descriptive and photographic displays, this time a series of short talks were given. These proved very popular and will be expanded upon in future years.

Unlike last year, when we were graced with clear skies, the 'cloud lady' did not look kindly on us by providing heavy cloud and a little rain. So a couple of scopes were set up in the hall and pointed at distant images of the planets and the Moon. The children took great delight in such observing. They were also enthusiastic participants in the scope making area. Mike Thompson, armed with a large number of lenses, plastic tubes and much sticky tape, gave instructions to the children who created various telescopes—so learning a little about how and why telescopes work.

Club members were kept busy all evening answering the many questions from both young and old.

Visitors studying the various exhibition panels and equipment

Brian Parsons explaining the workings of one of the two Orrery on display—which had been made by Stewart Poyner—to the right of the image

Thanks must go to the school for allowing us the use of the premises and to the PTA for being 'on parade' providing refreshments to all and sundry.

All are looking forward to an even better event in 2015.

Glynn Bennallick

Find the planet !

Scope making

Stargazing LIVE - Liverpool

Once again the LAS had a very busy January hosting 'Stargazing Live' events and again we where invited along to Jodrell Bank for the live shows on the Tuesday and Wednesday. These are some photos from the events.

At Jodrell Bank

Tuesday at Court Hey Park—Images by Jim Stacey

—Images by Jim Stacey

Stargazing LIVE - Macclesfield AS

Jubilee Moon by Sally Stubbs.

There she rose, the magnificent yellow moon, a crown jewel in the indigo sky, lilac clouds that whispered like feathers across her face….. I sat silent and still watching the changing scenery, listening to a distant Jubilee party that rolled on the wind like waves to a shore. A train, a siren, the night filled with sounds from a world outside the one where I sat. For me it was a silent place, one where time moved slowly and the ancient light of a hundred stars mapped the night sky. Lost in that moment several hours passed and the night ventured towards dawn….

People often ask what is the attraction to astronomy. Stars are just points of light in the night sky…..? Astronomy is so much more… it is the appreciation of ancient light mapping the night sky… Telling this history of our space and time… And the night sky is always changing. The constellations move with the seasons and there are also those rare phenomena such as comets, asteroids, novae, and meteor showers, which are occasional and spectacular. There are also unusual positioning of objects in the solar system which are beautiful. For example, it is possible to watch the transit of a planet across the surface of the sun or a transit of a moon across Jupiter. A Lunar occultation of Saturn. The sky is nature on a monumental scale, filled with colour, light, shadows, movement and change.

One way to enjoy astronomy is through a local society. Established in 1990 by Chris Rose, Macclesfield Astronomy Society began as an amateur society within Jodrell Bank meeting once a month to encourage astronomy in our community. Today we have over 160 members of all ages and include a good mix of both males and females, from professional astrophysicists to complete beginners. Our society is members are friendly and we encourage people at ask every question as no question is a silly question.

As a society our long-term aims are to provide a focal point for contact between local astronomers and also to make astronomy accessible to everyone. We provide weekly meetings, public events, outreach to schools supporting the national curriculum, outreach to the elderly, outreach to the NHS for rehabilitation and free astronomy education for members.

There are four official Tuesday meetings held by Macclesfield Astronomical Society each month. Our Workshop (Heritage Centre, Macclesfield) is held on the first Tuesday of every month. This is where our members showcase their passion for astronomy in a variety of short presentations. Our Social Evening (Blacksmiths Arms, Henbury) is held on the second Tuesday of every month. This is our chance to get together and build camaraderie which makes astronomy special. Our Lecture (Village Hall, Goostrey) is held on the third Tuesday of every month. Our speakers are usually well regarded academics or experts in the world of astronomy. Our Astronomy class (Holmes Chapel Comprehensive School) is held on the fourth Tuesday of every month. Topics range from equipment to observing and astronomical theory. If the sky is clear we utilise the time to observe with telescopes and binoculars.

We also hold weekend observing sessions and a regular weekend field trip for members as well as attend and host various public events across Cheshire.

Long time member Paul Cannon says "As a member of Maccclesfield Astronomical Society for the last six years I have been impressed by its ability to reach out to all age groups providing something for everyone interested in astronomy. I have watched the membership increase as the society has actively promoted practical astronomy through star parties, monthly workshops and lectures. I personally like to make a contribution to the society through the monthly workshops by giving talks on the latest astronomical events peppered with images and sketches I have managed to complete that month. My favourite outreach events are the Ranger's at Tegg's Nose where I either give a talk or provide a telescope and encourage member's of the public to view the wonder's of the night sky. The Oohs and Aahs make it all worthwhile."

We have had many highlights over the years but specifically looking at these past three months we have been very privileged to join in with several prestigious events in our region…

We filmed a segment for the BBC NWT News about day time astronomy which screened on the BBC news on the 7th January. We were very proud that this feature was used on the main news to introduce the Stargazing Live 'season' for 2014 from Jodrell Bank.

20 of our members attended Jodrell Bank on 7th January and formed a part of the studio audience for "Stargazing Live: Back to Earth" shown live on BBC 2. Members were thrilled not only to be in the audience but after the show to have a chance to meet with Brian Cox, Chris Lintott and Dara O'Briain for autographs and chat. It was a fantastic experience!

We attended Project Wild Thing screening for the Cheshire East Council on Saturday 15th January, which was a film to encourage people back into nature. Lovely exhibition, which made it into local papers too.

On 20th February we held a Half Term Astronomy

Extravaganza at Macc Town Football Club attended by over 120 children with their parents where we had an introductory talk by Megan Argo (Physicist at Jodrell Bank and who herself started astronomy as a junior members of the society in 1990). We had activities, games and a PC Laptop lab exploring the virtual sky and most excitingly we had clear skies and showed the families Jupiter and the Galilean Moons! 97% said it was an excellent unique event for children. We hope to host another one soon.

On 8th March 2014 in conjunction with National Astronomy Week's Jupiter Celebrations we held a public star part in collaboration with Cheshire East Counsel at Tegg's Nose Country Park. Once again it was clear skies! We had three Jupiter themed talks, outdoor observing and a raffle prize.

We launched our new modern eye catching website on Saturday 4th January to start the new year and retired our 10 year old site! This beautiful site was designed by a very gifted designer and our former Chairman Andrew Greenwood. Andrew was at the helm of MaccAstro for 10 years as its Chairman.

It's been a phenomenal start to the year but we have more wonderful events planned…

From Friday 5th September to Sunday 7th September we are very proud to be hosting the British Astronomical Society weekend extravaganza. The event will have distinguished speakers from the BAA, exhibitions, trade stands and activities.

We also welcome visitors to our Tuesday night events throughout the year. It is free to come and no booking is necessary. If you do decide to come more frequently you may like to join as an official member. Our public events held on weekends usually attract people from all over the North West. A ticket system is in place and a fee is usually payable. Our Chairman Steve Warbis said that "There are many different ways of enjoying astronomy, and our society tries to cater for everyone's interest in some way in the things that we do, whether you may be a beginner or a veteran astronomer, an armchair 'bookworm' or an outdoors astronomer, and whether with a scientific interest or just a spirited enthusiasm. We would be keen for anyone to come along to try one of our sessions and see what they feel."

For details of our society and upcoming events please visit our website www.maccastro.com

Macclesfield Astronomical Society

NAW - Carnewas—Cornwall

As part of NAW and in association with the National Trust, Kernow Astronomers ran one of its popular ***Sun 'n Stars*** events at Carnewas—overlooking Bedruthan Steps. This location, with its super western horizon, has been designated a Dark Sky Discovery Site.

The scopes were set up about 2 hours before sunset allowing views of the setting Sun. There was a crescent Moon to observe during the gloaming until the skies were dark enough to see Jupiter and the rest of the night sky objects.

About 100 members of the public braved the cold wind that got stronger as the evening progressed.

After a very successful session we packed up our kit and adjourned to the nearby Inn at Bedruthan, where the landlord took pity on us and handed around complementary mugs of piping hot mugs of freshly made minestrone soup. Most welcome.

The nest Sun 'n Stars to take place Saturday 31st May at the same location.

Phil Brotherwood

The Liverpool AS Trip To Ennerdale Low Gillerthwaite Field Centre - January 2014 By Noel Rimmer

Well, where to start? Nine members attended and after an adventurous journey being the fault of my Sat Nav, we arrived with help from Mark Paine at the field centre around 7.30pm. I have a few new members of the Captain Noel's lemming club after a detour over the Honister Pass! We were welcomed warmly by Walter, Helen and Malcolm and were given our rooms.

As soon as we could, we set up and started observing for approximately 2 hours with very good seeing! Later Malcolm was out with us and he said that the sky was metered at 22.5, using a sky quality meter.

Back in the centre we made full use of the facilities – warm, open fire, full kitchen, their canteen and the honesty bar and comfortable beds.

The next day, Saturday the 1St was total clouded over with rain so no solar observing was done, at this point shopping at Keswick was the best option.

In the evening we met up with Stuart from the Kendal Society and Alan Brown and with the Field centre that evening doing a 'Dark Sky Discovery Night', there was a talk with Alan Brown from the STFC (Science & Technology Facilities Council) and with Stuart Atkinson from the Eddinton Astronomical Society (Kendal) with a talk on astrophotography.

We then experienced the 'StarLab' which is a large, inflatable planetarium which held around twenty people. Staged in the unusual setting of the eighteenth century barn, visitors saw a rotating, digital illustration of our universe and our place in it. After that we had the *Pièce de résistance* - the field centre had made all of us a hearty meal with home made soup, bread and cakes which was very welcome and delicious.

The day we all left, the last job was the traditional L.A.S photo shoot. Walter and Malcolm were very keen on us making another visit and I can highly recommend it. All attendees enjoyed a good weekend.

The L.A.S has made I think a very good friend with the Ennerdale Low Gillerthwaite Field Centre.

Telescope Tips By Colin Murray

A simple and cheap way to illuminate a polar finder

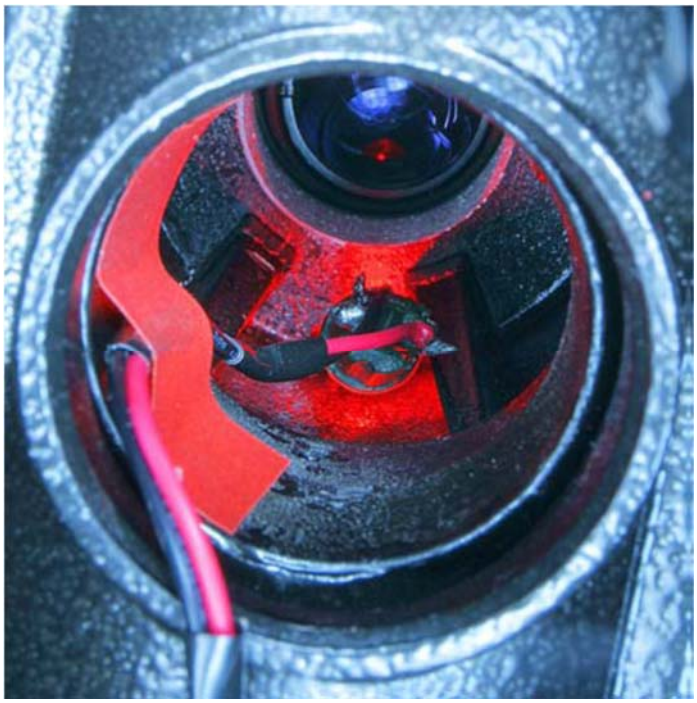
Because of the difficulties I had with not being able to see the markings on the polar finder in the dark, I felt it needed to be illuminated. So I thought about it for a while and thought about how I could do it. A couple of months had passed without me doing anything about it, it wasn't really a problem because my Goto telescope has its own polar alignment routine which does away with the need for a polar finder but being able to use the polar finder cuts down on time spent aligning the telescope to the pole. So -

I went to Maplins and bought some red LED's, I have a mains operated voltage converter which I hook the lights up to just on a temporary basis and just placed the light inside the top of the polar finder but found it to be far too faint, the only way I could get the red light to show up was to have it right on top of the lens, not what I really wanted, I think it's better if the light is tucked away out of the field of view and have the whole area illuminated. So I searched on the Internet for red bulbs without much success, what I did get among the searches was Christmas tree lights which seemed irrelevant at the time, but that then gave me an idea to try a Christmas tree light, so I took out one of the spare red bulbs from my Christmas tree lights and hooked it up to the voltage converter, because the bulb was rated at 6V I could switch the converter to 4.5V and not overload the bulb.

The next stage was to put the bulb inside the polar finder and to put it to the side out of the field of view and view the night sky with it, I could easily see the markings on the polar scope and the light didn't overwhelm the stars.

So off again to Maplins and get a battery holder and clip to attach to the battery holder. I then soldered the bulb to the end of the wire, that was a bit fiddly because I was on my own but it will be easier if you have a second person to hold the bulb while you hold the soldering iron in one hand and the solder in the other. The good thing about these bulbs is that you don't need to worry about getting the polarity the right way round; the bulb will work whichever way round you put it.

The most expensive item there are the rechargeable batteries, the battery holder was £1.29 and the clip on the left (without the bulb) was £1.34 both from Maplins. If you don't have a soldering iron then you will have to factor that in to the cost, but the purchase of a soldering iron will be an investment.



Then it's just a case of connecting the clip which has the effect of turning the light on.

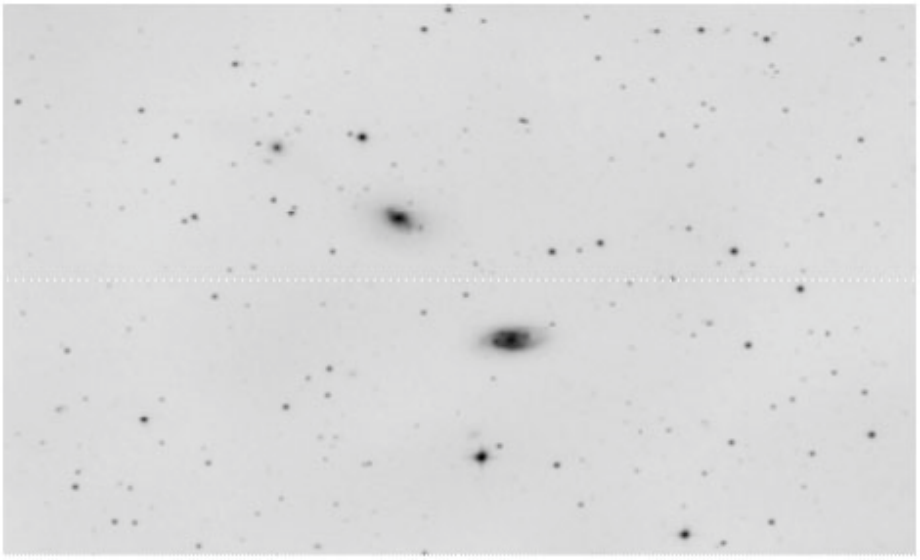
I found the easiest way to attach the battery holder to the mount was to just simply tape it on using insulating tape, I only need it on there while I'm using the polar finder to align the scope with the pole, once that's complete then I can take it off.

By placing the bulb to the side inside the mount the red light isn't too bright, I can see both the markings on the polar finder and the stars quite easily.

Courtesy: LAS Newsletter

Galaxy Identification Using Aladin

By Rob Johnson

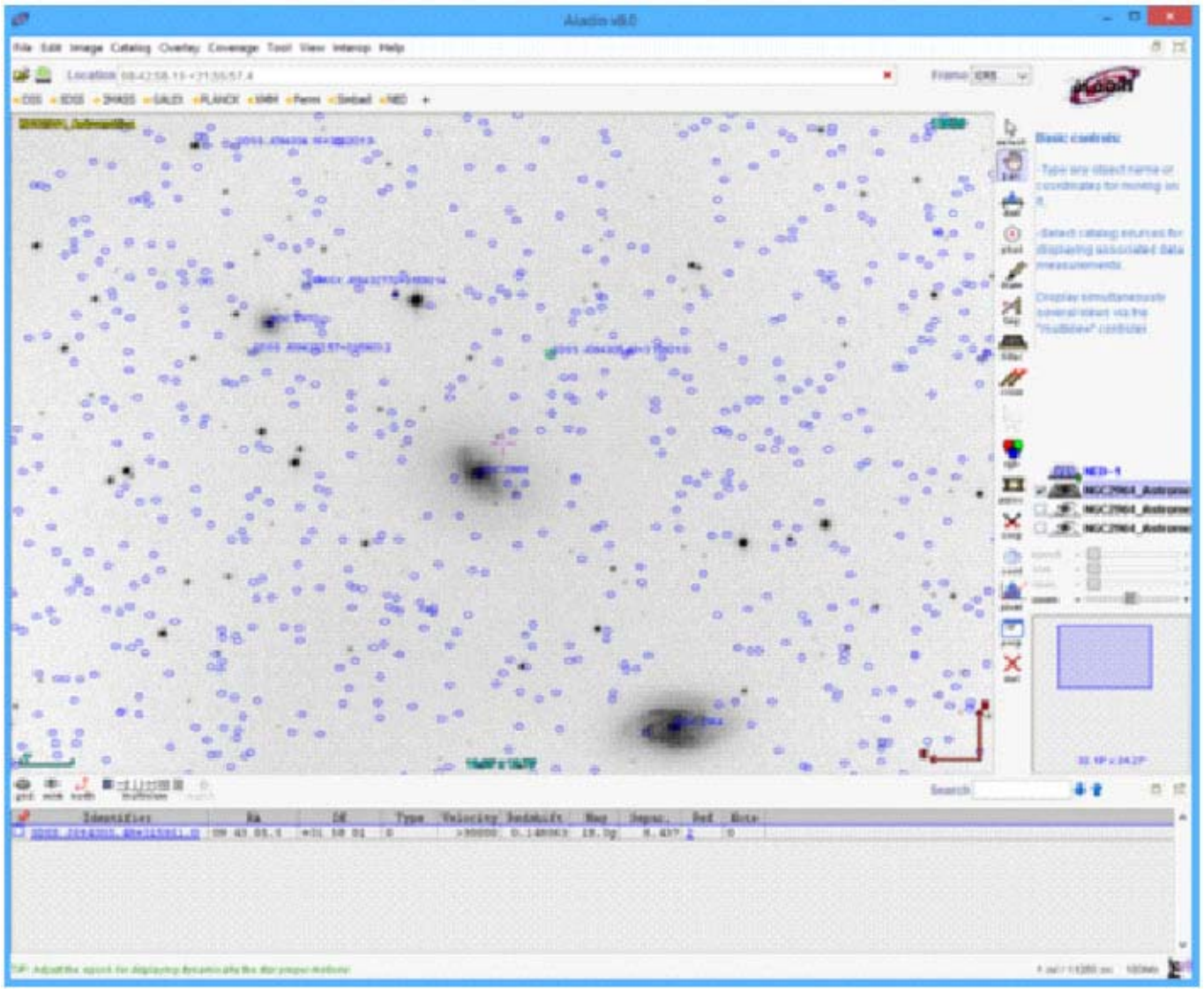


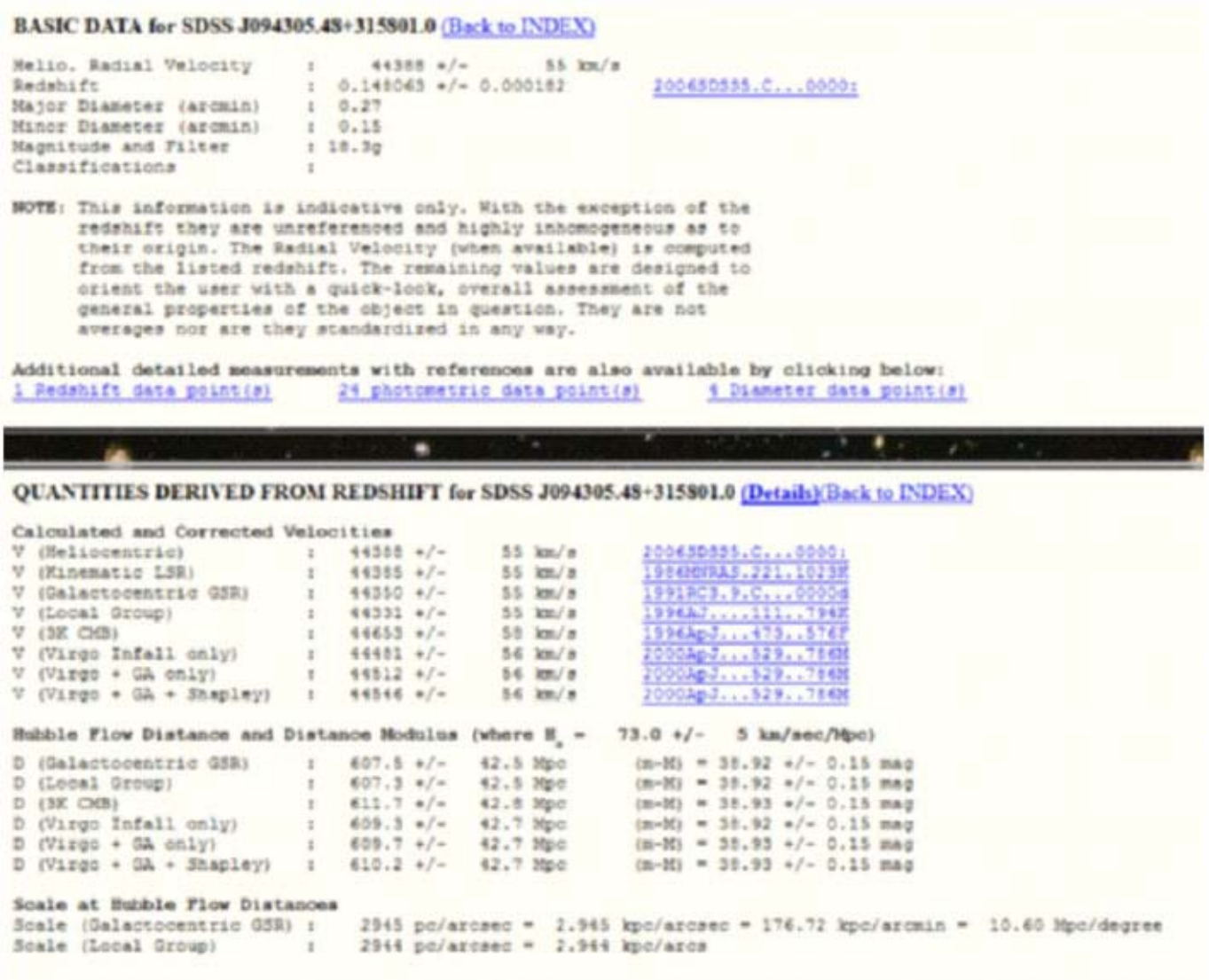
Whether you take an image through your own telescope or use an image from the internet it can be frustrating not to know the identification of some of the lesser objects in the field. In addition, if you have taken the image yourself it can be very informative to see what magnitude you have reached.

The problem with identification of stars or galaxies is that popular planetarium programs usually only use databases that reach magnitude 15 or so. That may seem very faint but with a 250mm diameter telescope and a CCD camera, magnitude 15 can be reached with an exposure of a few seconds! Enter Aladin, this piece of free software can access professional survey databases that go well beyond magnitude 20 and enable identification of faint stars and galaxies in your image.

I took this image of NGC2964 and NGC2968 a few weeks ago mainly for testing the tracking accuracy of my 14" reflector, it is a stack of 1 and 2 minute exposures totalling 70 minutes and in the field you can see at least 10 or 20 faint fuzzy blobs – images of distant galaxies, the image is inverted to be able to see them better.

To identify the faint galaxies first download Aladin from the University of Strasbourg website (2) and launch the application. The basics of how to use Aladin are available from within the program with handy interactive help, a





BASIC DATA for SDSS J094305.48+315801.0 (Back to INDEX)

```
Helio. Radial Velocity     :     44388 +/-       55 km/s
Redshift                   :  0.148065 +/- 0.000182        2006MNRAS.370..339S
Major Diameter (arcmin)    :  0.27
Minor Diameter (arcmin)    :  0.15
Magnitude and Filter       : 18.3g
Classifications            :
```

NOTE: This information is indicative only. With the exception of the redshift they are unreferenced and highly inhomogeneous as to their origin. The Radial Velocity (when available) is computed from the listed redshift. The remaining values are designed to orient the user with a quick-look, overall assessment of the general properties of the object in question. They are not averages nor are they standardized in any way.

Additional detailed measurements with references are also available by clicking below:
1 Redshift data point(s) 24 photometric data point(s) 4 Diameter data point(s)

QUANTITIES DERIVED FROM REDSHIFT for SDSS J094305.48+315801.0 (Details)(Back to INDEX)

Calculated and Corrected Velocities

```
V (Heliocentric)           :    44388 +/-      55 km/s      2006MNRAS.370..339S
V (Kinematic LSR)          :    44385 +/-      55 km/s      1998MNRAS.301..1039F
V (Galactocentric GSR)     :    44350 +/-      55 km/s      1991RC3.9.C...0000d
V (Local Group)            :    44331 +/-      55 km/s      1996AJ....111..794F
V (3K CMB)                 :    44653 +/-      58 km/s      1996ApJ...473..576F
V (Virgo Infall only)      :    44481 +/-      56 km/s      2000ApJ...529..786S
V (Virgo + GA only)        :    44512 +/-      56 km/s      2000ApJ...529..786S
V (Virgo + GA + Shapley)   :    44546 +/-      56 km/s      2000ApJ...529..786S
```

Hubble Flow Distance and Distance Modulus (where H_o = 73.0 +/- 5 km/sec/Mpc)

```
D (Galactocentric GSR)     :   607.5 +/-   42.5 Mpc     (m-M) = 38.92 +/- 0.15 mag
D (Local Group)            :   607.3 +/-   42.5 Mpc     (m-M) = 38.92 +/- 0.15 mag
D (3K CMB)                 :   611.7 +/-   42.8 Mpc     (m-M) = 38.93 +/- 0.15 mag
D (Virgo Infall only)      :   609.3 +/-   42.7 Mpc     (m-M) = 38.92 +/- 0.15 mag
D (Virgo + GA only)        :   609.7 +/-   42.7 Mpc     (m-M) = 38.93 +/- 0.15 mag
D (Virgo + GA + Shapley)   :   610.2 +/-   42.7 Mpc     (m-M) = 38.93 +/- 0.15 mag
```

Scale at Hubble Flow Distances

```
Scale (Galactocentric GSR) :    2945 pc/arcsec =  2.945 kpc/arcsec = 176.72 kpc/arcmin =  10.60 Mpc/degree
Scale (Local Group)        :    2944 pc/arcsec =  2.944 kpc/arcs
```

complete 91 page manual can also be downloaded via the program.

The first thing you need to do is to plate solve your image, this can be done from within Aladin or with a number of other programs, I like to use Astrometrica (3) which has a free trial version available. All plate solving does is to find where in the sky your image corresponds to in terms of RA and DEC and writes this information to the FITS file(1) header, Aladin then knows how to align the data from the catalogues with our image.

The screenshot below shows Aladin with my image overlaid by data from the *NASA/IPAC Extragalactic Database (NED), identifying the many galaxies in the field as blue ovals, data from many other sources an be overlaid including images. The overlay can be toggled on and off with a mouse click to help see which galaxies are recorded in your image, not all the ovals will align with a fuzzy blob in your image – some galaxies in this database reach magnitude 23,* the faintest galaxy on my image was about magnitude 19.3.

Each database can be filtered, here I chose just to show galaxies. Control of the overlays displayed is made by the menu at bottom right, called the 'stack', multiple databases can be shown at once.* In this screenshot I have highlighted a few faint galaxies and labelled them, this can be done by right-clicking on the galaxy symbol in the image and selecting 'label'. When you use the select tool (top right menu) to click on a galaxy, brief information about that galaxy appears in the window below with a link to many more details from the database webpage. I have chosen the galaxy near the centre of the view above catalogued as *SDSS J094305.48 +315801.0.

This particular galaxy in my image is magnitude 18.3 and has a red shift of z=0.148, this corresponds to an incredible recessional velocity of 44,388km/s and a distance of just over 2,000 million light years. When you look at the number of faint galaxies in this small field it is hard to imagine the number scattered across the whole sky.

I have just given a brief overview of what is possible using Aladin, it has many more features to enable you to explore your images and gain a little more scientific insight into what you have imaged.

(1) ***FITS or Flexible Image Transport System is an image format widely used by professional and amateur astronomers using CCD cameras. The file header can store many details of how and when the image was taken.***

(2) **http://aladin.u-strasbg.fr/**

(3) **http://www.astrometrica.at/**

Courtesy: LAS Newsletter

Leighton Observatory Open Day March 2014 by Hayley Parr

I arrived at this event around 3pm, nice drive, no disasters. Disappointingly, Galileo had already left because he was poorly, I haven't seen him for a while and was looking forward to a catch up! Get well soon!

Although this event was cloudy at first we persevered waiting for Mr. Sun to show his face. He didn't disappoint.

Curious members of the public approached to ask what on Earth we were looking at in the middle of the day. Their faces, a delight when the response, "The Sun" came. I appointed myself 'dog holder' while they went into the forest of solar scopes. I should have thought twice on this decision, as one of them was the size of a horse and twice as determined (there were biscuits knocking about).

Night time descended and we had an early view of the moon. Its was at this point I decided to climb the ladder up to the 30″ reflecting telescope eye piece.

I played it cool but I was petrified, as I gingerly ascended my awkward body up the ladder a little boy shouted "FFFFFFAAAAALLLLL!!!" so cheers to that kid!

However I made it and I don't think Buzz Aldrin himself had a better lunar view! Breath taking!

Some stunning views of Jupiter (the theme of this yea'rs National Astronomy week) were to be had.

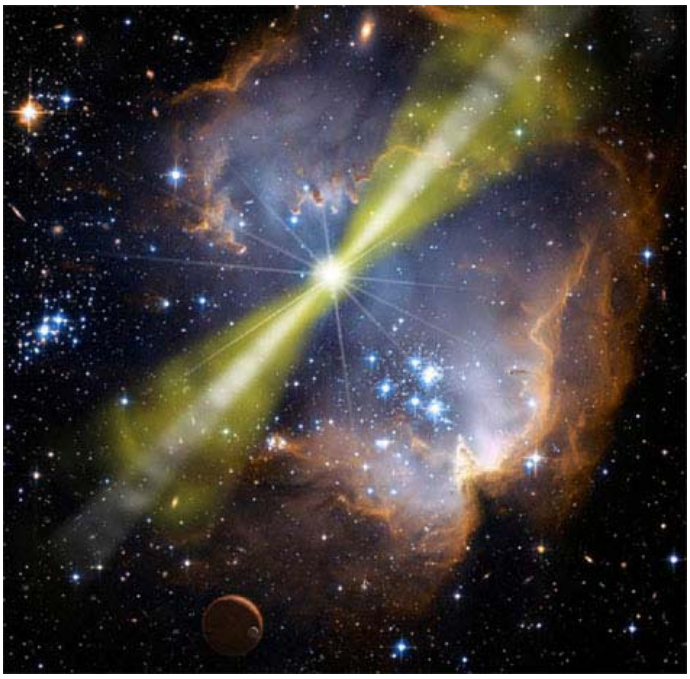
However the absolute HIGHLIGHT of this event for me is when Brian went to the chippy!

Big Dobs at Leighton Observatory Open Day

Courtesy: LAS Newsletter

Surprise Gamma-Ray Burst Behaves Differently Than Expected

by Shannon Hall on May 6, 2014



This artist's impression shows a gamma-ray burst with two intense beams of relativistic matter emitted by the black hole. Image Credit: NASA/Swift/Mary Pat Hrybyk-Keith and John Jones

Roughly once a day the sky is lit up by a mysterious torrent of energy. These events — known as gamma-ray bursts — represent the most powerful explosions in the cosmos, sending out as much energy in a fraction of a second as our Sun will give off during its entire lifespan.

Yet no one has ever witnessed a gamma-ray burst directly. Instead astronomers are left to study their fading light.

New research from an international team of astronomers has discovered a puzzling feature within one Gamma-ray burst, suggesting that these objects may behave differently than previously thought.

These powerful explosions are thought to be triggered when dying stars collapse into jet-spewing black holes. While this stage only lasts a few minutes, its afterglow — slowly fading emission that can be seen at all wavelengths (including visible light) — will last for a few days to weeks. It is from this afterglow that astronomers meticulously try to understand these enigmatic explosions.

The afterglow emission is formed when the jets collide with the material surrounding the dying star. They cause a shockwave, moving at high velocities, in which electrons are being accelerated to tremendous energies. However, this acceleration process is still poorly understood. The key is in detecting the afterglow's polarization — the fraction of light waves that move with a preferred plane of vibration.

"Different theories for electron acceleration and light emission within the afterglow all predict different levels of linear polarization, but theories all agreed that there should be no circular polarization in visible light," said lead author Klaas Wiersema in a press release.

"This is where we came in: we decided to test this by carefully measuring both the linear and circular polarization of one afterglow, of GRB 121024A, detected by the Swift satellite."

And to their surprise, the team detected circular polarization, meaning that the light waves are moving together in a uniform, spiral motion as they travel. The gamma-ray burst was 1000 times more polarized than expected. "It is a very nice example of observations ruling out most of the existing theoretical predictions," said Wiersema.

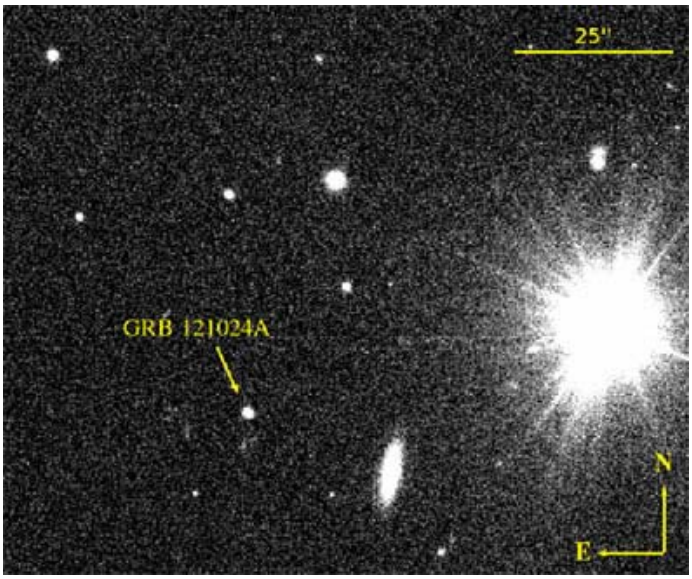
The detection shows that current theories need to be re-examined. Scientists expected any circular polarization to be washed out. The radiation of so many electrons travelings billions of light-years would erase any signal. But the new discovery suggests that there could be some sort of order in the way these electrons travel.

Of course the possibility remains that this particular afterglow was simply an oddball and not all afterglows behave like this.

Nonetheless "extreme shocks like the ones in GRB afterglows are great natural laboratories to push our understanding of physics beyond the ranges that can be explored in laboratories," said Wiersema.

The paper has been published in Nature.

Courtesy: universetoday.com



Gamma-ray burst 121024A, as seen on the day of the burst by ESO's Very Large Telescope in Chile. Only a week later the source had faded completely. Image Credit: Dr Klaas Wiersema, University of Leicester, UK and Dr Peter Curran, ICRAR.

25-foot asteroid comes within 186,000 miles of Earth

Pasadena, Calif. (UPI) May 5, 2013

A 25-foot asteroid passed between Earth and the moon over the weekend, coming within 186,000 miles of Earth's surface. On average, the moon's orbit is 238,855 miles from Earth.

Dubbed 2014 HL129 by astronomers, the bus-sized asteroid was only discovered several days before by scientists at the Steward Observatory, which sits atop Mt. Lemmon in Arizona's Catalina Mountains. The above video from Space.com, shows the orbit of HL129.

The near miss of an asteroid flying anonymously through space (until just a few days ago) is sure to bring further attention to NASA's Asteroid Grand Challenge, a series of contest aimed at bringing amateur scientists and astronomers into the asteroid-hunting fold.

"Asteroid hunting is an activity everyone can get involved with," NASA claimed in a promotional video earlier this year. "Whether it's writing computer code, building hardware, making observations through a telescope. Survival is its own reward. It's up to each of us to protect our planet from asteroids."

Artist's impression

Courtesy: spacedaily.com

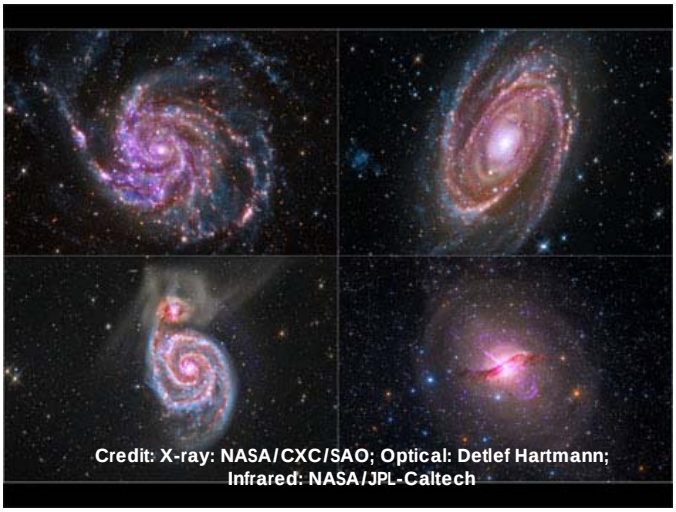
Professional and amateur astronomers join forces Apr 24, 2014

(Phys.org) —Long before the term "citizen science" was coined, the field of astronomy has benefited from countless men and women who study the sky in their spare time. These amateur astronomers devote hours exploring the cosmos through a variety of telescopes that they acquire, maintain, and improve on their own. Some of these amateur astronomers specialize in capturing what is seen through their telescopes in images and are astrophotographers.

What happens when the work of amateur astronomers and astrophotographers is combined with the data from some of the world's most sophisticated space telescopes? Collaborations between professional and amateur astronomers reveal the possibilities and are intended to raise interest and awareness among the community of the wealth of data publicly available in NASA's various mission archives. This effort is particularly appropriate for this month because April marks Global Astronomy Month, the world's largest global celebration of astronomy

The images in this quartet of galaxies represent a sample of composites created with X-ray data from NASA's Chandra X-ray Observatory, infrared data from the Spitzer Space Telescope, and optical data collected by an amateur astronomer. In these images, the X-rays from Chandra are shown in pink, infrared emission from Spitzer is red, and the optical data are in red, green, and blue. The two astrophotographers who donated their images for these four images—Detlef Hartmann and Rolf Olsen—used their personal telescopes of 17.5 inches and 10 inches in diameter respectively. More details on how these images were made can be found in this blog post.

Starting in the upper left and moving clockwise, the galaxies are M101 (the "Pinwheel Galaxy"), M81, Centaurus A, and M51 (the "Whirlpool Galaxy"). M101 is a spiral galaxy like our Milky Way, but about 70% bigger. It is located about 21 million light years from Earth. M81 is a spiral galaxy about 12 million light years away that is both relatively large in the sky and bright, making it a



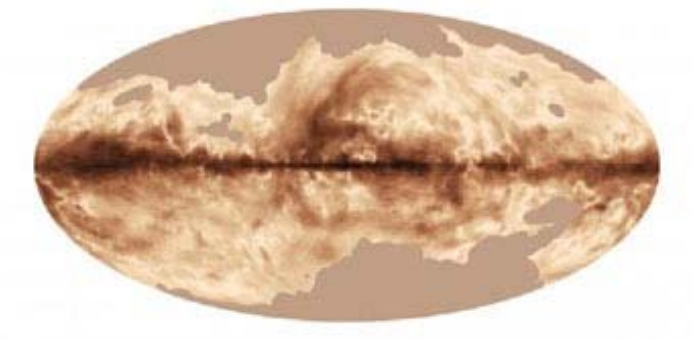
Credit: X-ray: NASA/CXC/SAO; Optical: Detlef Hartmann; Infrared: NASA/JPL-Caltech

frequent target for both amateur and professional astronomers. Centaurus A is the fifth brightest galaxy in the sky—making it an ideal target for amateur astronomers—and is famous for the dust lane across its middle and a giant jet blasting away from the supermassive black hole at its center. Finally, M51 is another spiral galaxy, about 30 million light years away, that is in the process of merging with a smaller galaxy seen to its upper left.

For many amateur astronomers and astrophotographers, a main goal of their efforts is to observe and share the wonders of the Universe. However, the long exposures of these objects may help to reveal phenomena that may otherwise be missed in the relatively short snapshots taken by major telescopes, which are tightly scheduled and often oversubscribed by professional astronomers. Therefore, projects like this Astro Pro-Am collaboration might prove useful not only for producing spectacular images, but also contributing to the knowledge of what is happening in each of these cosmic vistas.

Credit: phys.org

Researchers image the Milky Way's magnetic fingerprint



The magnetic field of our Milky Way Galaxy as seen by ESA's Planck satellite. This image was compiled from the first all-sky observations of polarised light emitted by interstellar dust in the Milky Way. The magnetic field is displayed using a visualisation technique called line integral convolution (LIC). Credit: ESA and the Planck Collaboration

(Phys.org) —Our Galaxy's magnetic field is revealed in a new image from ESA's Planck satellite. This image was compiled from the first all-sky observations of 'polarised' light emitted by interstellar dust in the Milky Way.

Light is a very familiar form of energy and yet some of its properties are all but hidden to everyday human experience. One of these – polarisation – carries a wealth of information about what happened along a light ray's path, and can be exploited by astronomers.

Light can be described as a series of waves of electric and magnetic fields that vibrate in directions that are at right angles to each other and to their direction of travel.

Usually, these fields can vibrate at all orientations. However, if they happen to vibrate preferentially in certain directions, we say the light is 'polarised'. This can happen, for example, when light bounces off a reflective surface like a mirror or the sea. Special filters can be used to absorb this polarised light, which is how polarised sunglasses eliminate glare.

In space, the light emitted by stars, gas and dust can also be polarised in various ways. By measuring the amount of polarisation in this light, astronomers can study the physical processes that caused the polarisation.

In particular, polarisation may reveal the existence and properties of magnetic fields in the medium light has travelled through.

The map presented here was obtained using detectors on Planck that acted as the astronomical equivalent of polarised sunglasses. Swirls, loops and arches in this new image trace the structure of the magnetic field in our home galaxy, the Milky Way.

In addition to its hundreds of billions of stars, our Galaxy is filled with a mixture of gas and dust, the raw material from which stars are born. Even though the tiny dust grains are very cold, they do emit light but at very long wavelengths – from the infrared to the microwave domain. If the grains are not symmetrical, more of that light comes out vibrating parallel to the longest axis of the grain, making the light polarised.

If the orientations of a whole cloud of dust grains were random, no net polarisation would be seen. However, cosmic dust grains are almost always spinning rapidly, tens of millions of times per second, due to collisions with photons and rapidly moving atoms.

Then, because interstellar clouds in the Milky Way are threaded by magnetic fields, the spinning dust grains become aligned preferentially with their long axis perpendicular to the direction of the magnetic field. As a result, there is a net polarisation in the emitted light, which can then be measured.

In this way, astronomers can use polarised light from dust grains to study the structure of the Galactic magnetic field and, in particular, the orientation of the field lines projected on the plane of the sky.

In the new Planck image, darker regions correspond to stronger polarised emission, and the striations indicate the direction of the magnetic field projected on the plane of the sky. Since the magnetic field of the Milky Way has a 3D structure, the net orientation is difficult to interpret if the field lines are highly disorganised along the line of sight, like looking through a tangled ball of string and trying to perceive some net alignment.

However, the Planck image shows that there is large-scale organisation in some parts of the Galactic magnetic field.

The dark band running horizontally across the centre corresponds to the Galactic Plane. Here, the polarisation reveals a regular pattern on large angular scales, which is due to the magnetic field lines being predominantly parallel to the plane of the Milky Way.

The data also reveal variations of the polarisation direction within nearby clouds of gas and dust. This can be seen in the tangled features above and below the plane, where the local magnetic field is particularly disorganised.

Planck's Galactic polarisation data are analysed in a series of four papers just submitted to the journal *Astronomy & Astrophysics*, but studying the magnetic field of the Milky Way is not the only reason why Planck scientists are interested in these data. Hidden behind the foreground emission from our Galaxy is the primordial signal from the Cosmic Microwave Background (CMB), the most ancient light in the Universe.

The brightness of the CMB has already been mapped by Planck in unprecedented detail and scientists are now scrutinising the data to measure the polarisation of this light. This is one of the main goals of the Planck mission, because it could provide evidence for gravitational waves generated in the Universe immediately after its birth.

In March 2014, scientists from the BICEP2 collaboration claimed the first detection of such a signal in data collected using a ground-based telescope observing a patch of the sky at a single microwave frequency. Critically, the claim relies on the assumption that foreground polarised emissions are almost negligible in this region.

Later this year, scientists from the Planck collaboration will release data based on Planck's observations of polarised light covering the entire sky at seven different frequencies. The multiple frequency data should allow astronomers to separate with great confidence any possible foreground contamination from the tenuous primordial polarised signal.

This will enable a much more detailed investigation of the early history of the cosmos, from the accelerated expansion when the Universe was much less than one second old to the period when the first stars were born, several hundred million years later.

Courtesy: phys.org

Galaxy's biggest telescope harnesses most precise measurement of spinning star

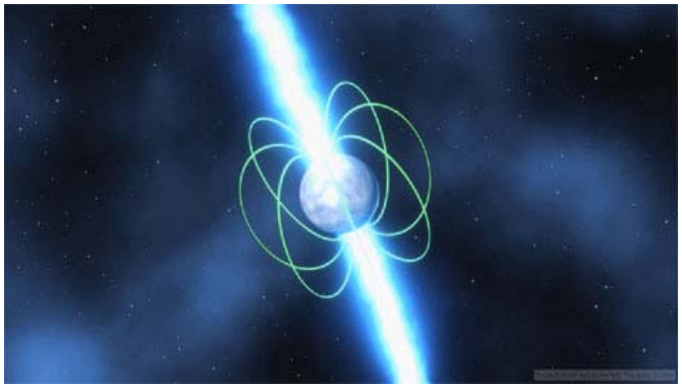
sciencedaily.com

An international team of astronomers has made a measurement of a distant neutron star that is one million times more precise than the previous world's best.

The researchers were able to use the interstellar medium, the 'empty' space between stars and galaxies that is made up of sparsely spread charged particles, as a giant lens to magnify and look closely at the radio wave emission from a small rotating neutron star.

This technique yielded the highest resolution measurement ever achieved, equivalent to being able to see the double-helix structure of our genes from the Moon!

"Compared to other objects in space, neutron stars are tiny -- only tens of kilometres in diameter -- so we need extremely high resolution to observe them and understand their physics," Dr Jean-Pierre Macquart from the Curtin University node of the International Centre for Radio Astronomy Research (ICRAR) in Perth said.



The densely packed matter of a pulsar spins at incredible speeds, and emits radio waves that can be observed from Earth, but how neutron stars emit these waves is still a mystery.
Credit: Swinburne Astronomy Productions/CAASTRO

Dr Macquart, a member of the ARC Centre of Excellence for All-sky Astrophysics (CAASTRO), said neutron stars were particularly interesting objects to study, as some of them -- called pulsars -- gave off pulsed radio waves whose beams swept across telescopes at regular intervals.

"More than 45 years since astronomers discovered pulsars, we still don't understand the mechanism by which they emit radio wave pulses," he said.

The researchers found they could use the distortions of these pulse signals as they passed through the turbulent interstellar medium to reconstruct a close in view of the pulsar from thousands of individual sub-images of the pulsar.

"The best we could previously do was pointing a large number of radio telescopes across the world at the same pulsar, using the distance between the telescopes on Earth to get good resolution," Dr Macquart said.

The previous record using combined views from many telescopes was an angular resolution of 50 microarcseconds, but the team -- led by Professor Ue-Li Pen of the Canadian Institute of Theoretical Astrophysics and a CAASTRO Partner Investigator -- has now proven their 'interstellar lens' can get down to 50 picoarcseconds, or a million times more detail, resolving areas of less than 5km in the emission region.

"Our new method can take this technology to the next level and finally get to the bottom of some hotly debated theories about pulsar emission," Professor Pen said.

Testing their technique on pulsar B0834+06, the researchers found the neutron star's emission region was much smaller than previously assumed and possibly much closer to the star's surface -- which might be the most crucial element in understanding the origin of the radio wave emission.

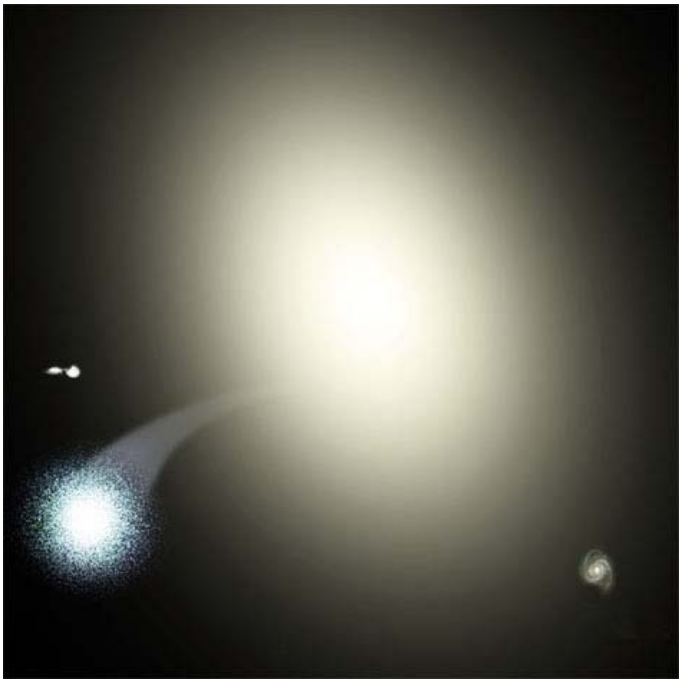
"What's more, this new technique also opens up the possibilities for precise distance measurements to pulsars that orbit a companion star and 'image' their extremely small orbits -- which is ultimately a new and highly sensitive test of Einstein's theory of General Relativity," Professor Pen said.

Story Source:

The above story is based on materials provided by International Centre for Radio Astronomy Research (ICRAR). *Note: Materials may be edited for content and length.*

Entire star cluster thrown out of its galaxy

Galaxy M87 has thrown an entire star cluster toward us at more than 2 million mph, and it's now on a fast journey to nowhere.



This artist's illustration shows the hypervelocity star cluster HVGC-1 escaping from the supergiant elliptical galaxy M87. HVGC-1 is the first runaway star cluster discovered by astronomers. It is fated to drift through intergalactic space.

David A. Aguilar (CfA)

The galaxy known as M87 has a fastball that would be the envy of any baseball pitcher. It has thrown an entire star cluster toward us at more than 2 million mph (3.2 million km/h). The newly discovered cluster, which astronomers named HVGC-1, is now on a fast journey to nowhere. Its fate: to drift through the void between the galaxies for all time.

"Astronomers have found runaway stars before, but this is the first time we've found a runaway star cluster," said Nelson Caldwell of the Harvard-Smithsonian Center for Astrophysics in Cambridge, Massachusetts.

The "HVGC" in HVGC-1 stands for hypervelocity globular cluster. Globular clusters are relics of the early universe. These groupings usually contain thousands of stars crammed into a ball a few dozen light-years across. The Milky Way Galaxy is home to about 150 globular clusters. The giant elliptical galaxy M87, in contrast, holds thousands.

It took a stroke of luck to find HVGC-1. The discovery team has spent years studying the space around M87. They first sorted targets by color to separate stars and galaxies from globular clusters. Then they used the Hectospec instrument on the MMT Telescope in Arizona to examine hundreds of globular clusters in detail.

A computer automatically analyzed the data and calculated the speed of every cluster. Any oddities were examined by hand. Most of those turned out to be glitches, but HVGC-1 was different. Its surprisingly high velocity was real.

"We didn't expect to find anything moving that fast," said Jay Strader of Michigan State University.

How did HVGC-1 get ejected at such a high speed? Astronomers aren't sure but say that one scenario depends on M87 having a pair of supermassive black holes at its core. The star cluster wandered too close to those black holes. Many of its outer stars were plucked off, but the dense core of the cluster remained intact. The two black holes then acted like a slingshot, flinging the cluster away at tremendous speed.

HVGC-1 is moving so fast that it is doomed to escape M87 altogether. In fact, it may have already left the galaxy and be sailing out into intergalactic space.

Background
M87, source of the hypervelocity cluster HVGC-1, is a king among galaxies. This supergiant elliptical galaxy weighs as much as 6 trillion Suns, making it one of the most massive galaxies in the nearby universe.

The discovery of HVGC-1 suggests that the core of M87 holds not one but two supermassive black holes. This must be the result of a long-ago collision between two galaxies, which merged to form a single giant galaxy. The same fate awaits our Milky Way, which will collide with the Andromeda Galaxy in a few billion years to create an elliptical galaxy that astronomers have dubbed Milkomeda.

Courtesy: astronomy.com

By Harvard-Smithsonian Center for Astrophysics, Cambridge, Massachusetts | Published: Thursday, May 01, 2014

A Study in Scarlet

This new image from ESO's La Silla Observatory in Chile reveals a cloud of hydrogen called Gum 41. In the middle of this little-known nebula, brilliant hot young stars are giving off energetic radiation that causes the surrounding hydrogen to glow with a characteristic red hue.

This area of the southern sky, in the constellation of Centaurus (The Centaur), is home to many bright nebulae, each associated with hot newborn stars that formed out of the clouds of hydrogen gas. The intense radiation from the stellar newborns excites the remaining hydrogen around them, making the gas glow in the distinctive shade of red typical of star-forming regions. Another famous example of this phenomenon is the Lagoon Nebula (eso0936), a vast cloud that glows in similar bright shades of scarlet.

The nebula in this picture is located some 7300 light-years from Earth. Australian astronomer Colin Gum discovered it on photographs taken at the Mount Stromlo Observatory near Canberra, and included it in his catalogue of 84 emission nebulae, published in 1955. Gum 41 is actually one small part of a bigger structure called the Lambda Centauri Nebula, also known by the more exotic name of the Running Chicken Nebula (another part of which was the topic of eso1135). Gum died at a tragically early age in a skiing accident in Switzerland in 1960.

In this picture of Gum 41, the clouds appear to be quite thick and bright, but this is actually misleading. If a hypothetical human space traveller could pass through this nebula, it is likely that they would not notice it as — even at close quarters — it would be too faint for the human eye to see. This helps to explain why this large object had to wait until the mid-twentieth century to be discovered — its light is spread very thinly and the red glow cannot be well seen visually.

This new portrait of Gum 41 — likely one of the best so far of this elusive object — has been created using data from the Wide Field Imager (WFI) on the MPG/ESO 2.2-metre telescope at the La Silla Observatory in Chile. It is a combination of images taken through blue, green, and red filters, along with an image using a special filter designed to pick out the red glow from hydrogen.

Credit: ESO.org

Astronomical Forensics Uncover Planetary Disks in NASA's Hubble Archive

Astronomers using NASA's Hubble Space Telescope have applied a new image processing technique to obtain near-infrared scattered light photos of five disks observed around young stars in the Mikulski Archive for Space Telescopes database. These disks are telltale evidence for newly formed planets. If astronomers initially miss something in their review of data, they can make new discoveries by revisiting earlier data with new image processing techniques, thanks to the wealth of information stored in the Hubble data archive. This is what Rémi Soummer, of the Space Telescope Science Institute (STScI) in Baltimore, Md., and his team recently did while on a hunt for hidden Hubble treasures.

The stars in question initially were targeted with Hubble's Near Infrared Camera and Multi-Object Spectrometer (NICMOS) based on unusual heat signatures obtained from NASA's Spitzer Space Telescope and the Infrared Astronomical Satellite that flew in 1983. The previous data provided interesting clues that dusty disks could exist around these stars. Small dust particles in the disks might scatter light and therefore make the disks visible. But when Hubble first viewed the stars between 1999 and 2006, no disks were detected in the NICMOS pictures.

Recently, with improvements in image processing, including algorithms used for face-recognition software, Soummer and his team reanalyzed the archived images. This time, they could unequivocally see the debris disks and even determine their shapes.

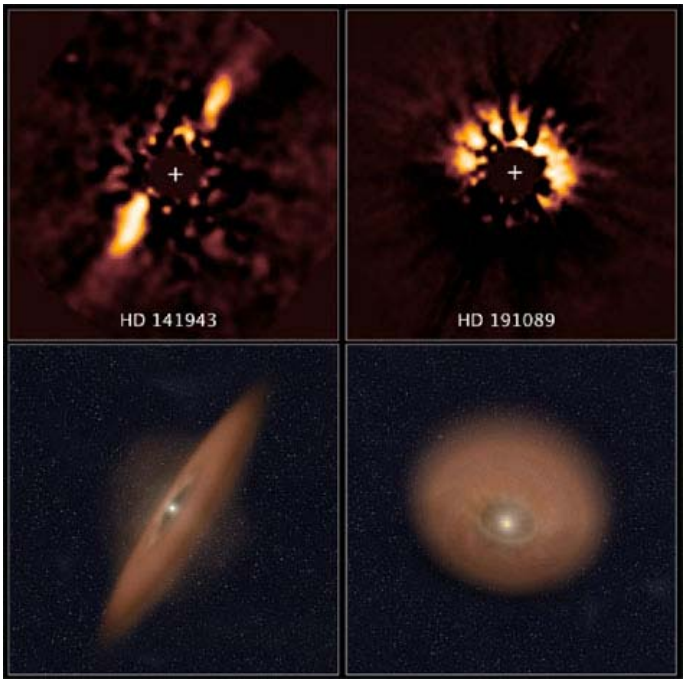
The NICMOS instrument, which began collecting data in 1997, has been so cutting-edge that ground-based technology only now is beginning to match its power. Because Hubble has been in operation for almost 24 years, it provides a long baseline of high-quality archival observations.

"Now, with such new technologies in image processing, we can go back to the archive and conduct research more precisely than previously possible with NICMOS data," said Dean Hines of STScI.

"These findings increase the number of debris disks seen in scattered light from 18 to 23. By significantly adding to the known population and by showing the variety of shapes in these new disks, Hubble can help astronomers learn more about how planetary systems form and evolve," said Soummer.

The dust in the disks is hypothesized to be produced by collisions between small planetary bodies such as asteroids. The debris disks are composed of dust particles formed from these grinding collisions. The tiniest particles are constantly blown outward by radiation pressure from the star. This means they must be replenished continuously though more collisions. This game of bumper cars was common in the solar system 4.5 billion years ago. Earth's moon and the satellite system around Pluto are considered to be collisional byproducts.

"One star that is particularly interesting is HD 141943," said Christine Chen, debris disk expert and team member. "It is an exact twin of our sun during the epoch of terrestrial planet formation in our own solar system."



The two images at top reveal debris disks around young stars uncovered in archival images taken by NASA's Hubble Space Telescope. The illustration beneath each image depicts the orientation of the debris disks.

Hubble found the star exhibits an asymmetrical, edge-on disk. This asymmetry could be evidence the disk is being gravitationally sculpted by the tug of one or more unseen planets.

"Being able to see these disks now also has let us plan further observations to study them in even more detail using other Hubble instruments and large telescopes on the ground," added Marshall Perrin of STScI.

"We also are working to implement the same techniques as a standard processing method for NASA's upcoming James Webb Space Telescope," said STScI teammate Laurent Pueyo. "These disks will also be prime targets for the Webb telescope."

Soummer's team has just begun its work. They next will search for structures in the disks that suggest the presence of planets.

The Hubble Space Telescope is a project of international cooperation between NASA and the European Space Agency. NASA's Goddard Space Flight Center in Greenbelt, Md., manages the telescope. STScI in Baltimore conducts Hubble science operations. STScI is operated for NASA by the Association of Universities for Research in Astronomy, Inc., in Washington.

For images and more information about Hubble, visit:

http://www.nasa.gov/hubble

Courtesy: NASA

'Upside-down planet' reveals new method for studying binary star systems

What looked at first like a sort of upside-down planet has instead revealed a new method for studying binary star systems, discovered by a University of Washington student astronomer. Working with UW astronomer Eric Agol, doctoral student Ethan Kruse has confirmed the first "self-lensing" binary star system -- one in which the mass of the closer star can be measured by how powerfully it magnifies light from its more distant companion star. Though our sun stands alone, about 40 percent of similar stars are in binary (two-star) or multi-star systems, orbiting their companions in a gravitational dance.

Kruse's discovery confirms an astronomer's prediction in 1973, based on stellar evolution models of the time, that such a system should be possible. A paper by Kruse and Agol was published in the April 18 edition of *Science*.

Like so many interesting discoveries, this one happened largely by accident.

Astronomers detect planets too far away for direct observation by the dimming in light when a world passes in front of, or transits, its host star. Kruse was looking for transits others might have missed in data from the planet-hunting Kepler Space Telescope when he saw something in the binary star system KOI-3278 that didn't make sense.

"I found what essentially looked like an upside-down planet," Kruse said. "What you normally expect is this dip in brightness, but what you see in this system is basically the exact opposite -- it looks like an anti-transit."

The two stars of KOI-3278, about 2,600 light-years (a light-year is 5.88 trillion miles) away in the Lyra constellation, take turns being nearer to Earth as they orbit each other every 88.18 days. They are about 43 million miles apart, roughly the distance the planet Mercury is from the sun. The white dwarf, a cooling star thought to be in the final stage of life, is about Earth's size but 200,000 times more massive.

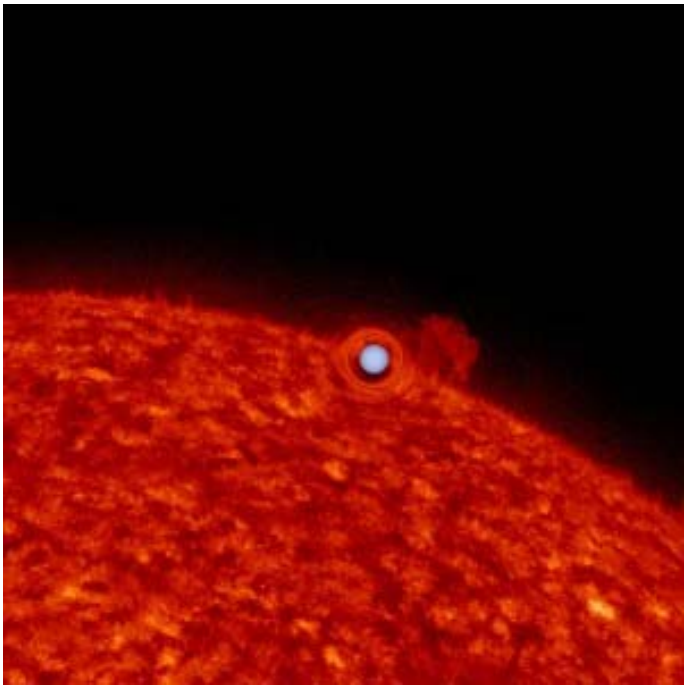
That increase in light, rather than the dip Kruse thought he'd see, was the white dwarf bending and magnifying light from its more distant neighbor through gravitational lensing, like a magnifying glass.

"The basic idea is fairly simple," Agol said. "Gravity warps space and time and as light travels toward us it actually gets bent, changes direction. So, any gravitational object -- anything with mass -- acts as a magnifying glass," though a weak one. "You really need large distances for it to be effective."

"The cool thing, in this case, is that the lensing effect is so strong, we are able to use that to measure the mass of the closer, white dwarf star. And instead of getting a dip now you get a brightening through the gravitational magnification."

This finding improves on research in 2013 by the California Institute of Technology, which detected a similar self-lensing effect minus the brightening of the light because the two stars being studied were much closer together.

"The effect in this system is much stronger," said Agol. "The larger the distance, the more the effect."



An image of the Sun used to simulate what the sun-like star in a self-lensing binary star system might look like.

Credit: NASA

Gravitational lensing is a common tool in astronomy. It has been used to detect planets around distant stars within the Milky Way galaxy, and was among the first methods used to confirm Albert Einstein's general theory of relativity. Lensing within the Milky Way galaxy, such as this, is called microlensing.

But until now, the process had only been used in the fleeting instances of a nearby and distant star, not otherwise associated in any way, aligning just right, before going their separate ways again.

"The chance is really improbable," said Agol. "As those two stars go through the galaxy they'll never come back again, so you see that microlensing effect once and it never repeats. In this case, though, because the stars are orbiting each other, it repeats every 88 days."

White dwarfs are important to astronomy, and are used as indicators of age in the galaxy, the astronomers said. Basically embers of burned-out stars, white dwarfs cool off at a specific rate over time. With this lensing, astronomers can learn with much greater precision what its mass and temperature are, and follow-up observations may yield its size.

By expanding their understanding of white dwarfs, astronomers take a step closer to learning about the age of the galaxy.

"This is a very significant achievement for a graduate student," Agol said.

The two have sought time to use the Hubble Space Telescope to study KOI-3278 in more detail, and to see if there are other such star systems waiting to be discovered in the Kepler data.

"If everyone's missed this one, then there could be many more that everyone's missed as well," said Kruse.

The research was funded by grants from the National Science Foundation (#AST 0645416) and NASA (#12-OSS12-0011).

Source: University of Washington