FAS Newsletter

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

41st FAS Annual Convention and AGM 2016

As last year, The Poynting Institute of the University of Birmingham was our host for this year's Convention and AGM. This evocative building, full of scientific instruments and history, was a very atmospheric venue.

A small team of FAS officers helped set up, ably and enthusiastically aided by members of the University's Astro Soc. FAS publications were available and the Astrocalendars in particular did a brisk trade. Several trade stands were present this year, offering BAA membership and merchandise, superbly engineered telescope parts and dew heaters . The Society for the History of Astronomy, was a talking point for many, as was a display by the Birmingham AS.

Not satisfied with being our willing porters and tea/coffee/biscuit providers, Astro Soc members also displayed one of their telescopes, and did ad-hoc observatory tours.

Callum Potter welcomed everyone to the event and opened proceedings. The first talk was by Chris Longthorn. He outlined the triumphs and the pitfalls of building an amateur observatory. Lessons to take away – Waterproof, no level flat surfaces, measure the telescope before you buy it, to see if it will fit (and be useable). Next up, Prof Andreas Friese told us of more pitfalls, but also great triumphs in the study, and recently, detection, of gravitational waves. The lunch break followed.

Returning, we joined the (sadly depleted) numbers for the AGM. The usual reports were given and elections made. President Callum Potter explained that there were several long-standing job vacancies on council, and urged members to consider whether they might have something to contribute. Graham Bryant explained about the FAS initiative to gather examples of best practice in the use of green laser pointers. Paul Daniels FRAS (not magician, as he pointed out) encouraged members to consider RAS membership, and to join the Pro-Am dialogue and co-operation.

Numbers swelled again, and our next speaker, Rhodri Evans, outlined the story of the discovery of the Cosmic Background Radiation, and its implications in cosmology. He explained, along the way, the relevance of pigeon-droppings and digressed to the vagaries of book publication. Dr Peter Wheatley talked about the various methods used in detecting exoplanets, and how amateurs are involved. Many methods are

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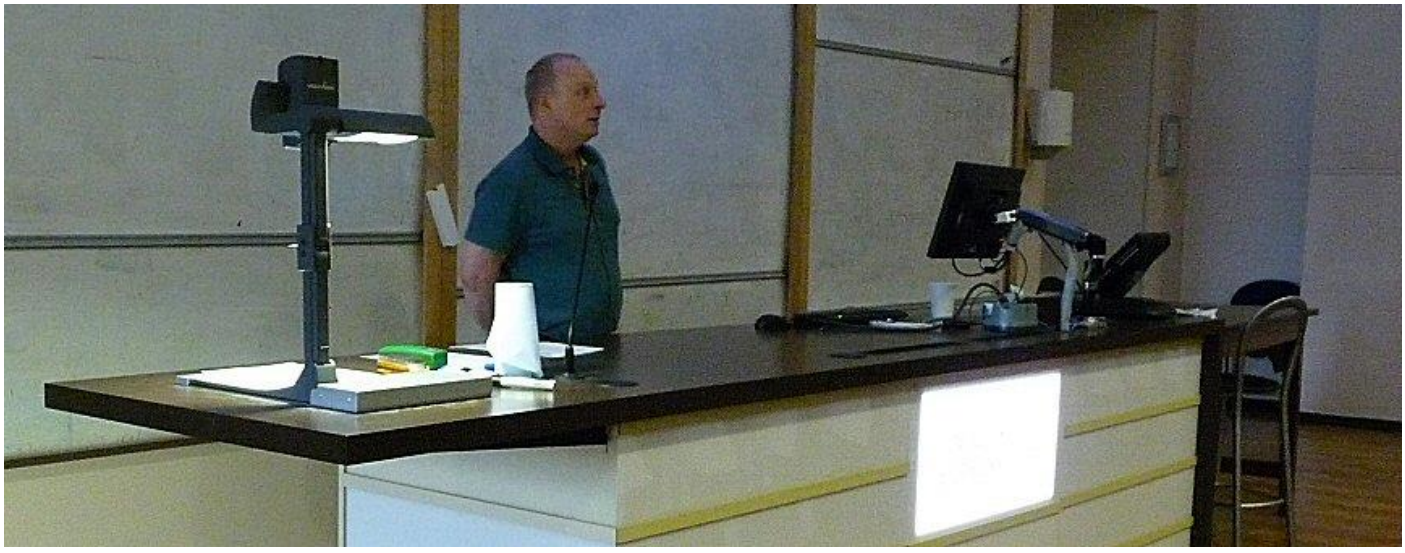

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President's Spot

It was nice to see and meet many members at the Annual Convention and AGM in Birmingham. Sorry I was not able to get round as many people as I would have liked, but as is often the case when part of the organisation much time is spent trying to keep things running smoothly.

We are gathering feedback about the convention so if you attended or not, we would still value feedback - there is an online survey form at:

https://goo.gl/forms/lff0Lx5xQTT569m62

Plans are afoot for the 2017 Convention, and I hope you might be able to attend. It really is a grand day out.

Sadly we are still struggling to find volunteers to come onto council - we had no volunteers at the AGM itself, but two have expressed an interest in response to my appeal in the last Newsletter - Neville Browne of Aberdeen Astronomical Society and Owen Brazell of the Webb Deep Sky Society (amongst others). Owen has volunteered to take on the Newsletter from Frank Johns, starting from the following issue (Spring 2017). Much thanks goes to Frank for doing this issue to ease the handover process.

So we are still keen to find more volunteers which could be as members 'without portfolio' or as a deputy or shadow for one of the existing roles. We have two face-to-face meetings a year, the rest are done by Skype, and email is used for much of our communications - so participation is not particularly onnerous. I would be happy to discuss what is involved with any of the roles so please get in touch if you would like to find out more.

At our last council meeting we discussed redeveloping our membership database system, known as MARS. Whilst the current system serves its purpose well, it is difficult to maintain, and misses some functionality we would like. And it is only partly integrated with the main website. So in particular we would like to find a software / web developer that might be able to help us with this project. It is possible that we might consider offering a small honorarium. So if you are interested, or know of someone that might be, please get in touch.

As always we are keen to hear how the FAS could help you - what are the problems and challenges that you have solve. Or perhaps you have useful experiences to share. If so, please let us know!

EDITORIAL

After a dozen years or so of editing the FAS Newsletter, I have decided it is time to pass the quill pen on to others. It has been a pleasure to try to put something back into the world of astronomy, if only in a small way.

In addition to the Newsletter, it has meant serving on the FAS Council, another enjoyable experience, meeting up and making friends with like-minded people. Although, at times the train journey up from Cornwall to London was not always so great. Over this time I also authored the Starter-Series of booklets and edited the FAS Handbook.

I am pleased to say that the Newsletter will be passing to Owen Brazell and the Handbook to Roger Steer. I wish them well and hope that you will give them the help / information / news about your societies activities that they will need to continue producing these publications.

This is not the last you will see/hear of me, however, as I now come to the subject of the Astrocalendar.

For many years the information for this was put together by Tony Williams of Liverpool AS, but with his retirement from the task, the data for the 2016/17 edition was provided in tabular format by William Roberts of Huddersfield AS.

I have had a number of comments, including the letter on this page, that the tabular format has not been overly popular. To this end, I have volunteered to have a go at producing a more narrative form of laying out the astro-data.

So, to those of you who are less than content with the current edition of the Astrocalendar, I would ask you to look out for the next edition and then let me have your comments and /or brickbats. In common with many members, we consider this to be a useful document and wish it to not only survive but to improve.

Frank Johns

LETTERS

Astrocalendar—new style

I am sorry but this is rather poor when compared with previous versions.

It should highlight that best time to see planets , inner and outer by giving a brief summary of elongation and opposition as being the best times to see the planets say on page 7.

Ascending and descending node references are completely irrelevant in my view. It would be better to simply list full and new and what is the point of giving us values for perigee and apogee ??

The wordy but much more user friendly previous version style should be re adopted, please.

I teach Astronomy to a group from the University of the third Age here in Norfolk and having recommended this book to my students was disappointed when it arrived, as the less academic and more user friendly style is perfect for their consumption.

Julian Halls

Hi Julian
Thanks for your comments, please see the 'Editorial', for comments about future of the Astrocalendar.

Editor

Are you new to Astronomy?

Then the BAA "Back to Basics" Workshop is for YOU!

Saturday March 11th 2017

SWINTON MASONIC HALL, 63 STATION STREET, SWINTON, MEXBOROUGH S64 8PZ

The **British Astronomical Association** has designed a programme of talks and practical sessions to help you learn basic techniques and develop your interest to its full potential. Experienced people will be on hand to answer your questions.

The cost for the meeting is £8.00 BAA Members & children under 16. £10.00 for non-members. Price includes refreshments and a buffet lunch.

We are pleased to advise the following retailers will also be coming, BAA Sales, W&W Astro and The Far-Sighted Binocular Company

SPACE IS LIMITED SO ALL ATTENDEES MUST PRE-BOOK

The day will cover what equipment, maps and books to help you get started. Lunar observing workshop, Planet observing workshop, Radio Astronomy and Imaging for beginners.

Booking details, directions and a map can be found on the BAA web site www.britastro.org and on the Mexborough and Swinton Astronomical Society web site www.msas.org.uk

Event Organisers:

Mrs Hazel Collett: email meetings@britastro.org Tel: 07944 751277 (mobile)
Steve Taylor Local contact: email steve.taylor27@blueyonder.co.uk
Tel: 01709 590444/07779447353 (mobile)

Details can be found on the BAA website at: www.britastro.org/swintonb2b

Send to: The British Astronomical Association, Burlington House, Piccadilly, London W1J 0DU by the closing date of **1st March 2017** (Telephone: 020 7734 4145).

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Taking refreshments between talks

used, the most intriguing being nothing more than a bank of commercially available SLR lenses and CCD cameras – Expensive for the average photographer, but a very reasonable cost for a successful scientific research tool.

Lastly Dr Nigel Bannister told us about the JUICE – JUpiter ICy moons Explorer – probe, destined to examine three of Jupiter's Galilean satellites – The 'Icy' moons.

Stand-in-President Roger Steer thanked all for attending. He thanked all for their efforts in making the day happen – In particular the stellar efforts of Astro Soc, and invited all back to next year's event, exhorting all to 'Bring a friend'.

Andreas Freise during his talk

The expectant audience

The Society for the History of Astronomy

AUTUMN CONFERENCE & A.G.M. 29th October 2016

By Carolyn Kennett

The AGM and autumn conference was held on Saturday 29th October 2016. It was held at the usual venue and home

of the SHA library the Birmingham Midland Institute. The conference had a stellar line up with four talks scheduled as well as the AGM. 70 people attended with the majority being members but also several guests and another new member signed up on the day.

The conference started with Bill Barton's talk discussing his interesting research into the Chaldean Society. This society had a short but very productive history. Producing quarterly magazines over the course of several years from 1916, this society mainly had a program of work which focused on naked eye observations, although several their more experienced astronomers had access to telescopes. They were particularly keen on eclipse watching and by 1927 they produced an eclipse special. Not only did they have a central branch but towards the keen on eclipse watching and by 1927 they produced an eclipse special. Not only did they have a central branch but towards the end of the society they had several branches.

Dr Lee Macdonald's talk was about the Astronomer Royal George Airy and the Magnetic and Meteorological department which was built at Greenwich by 1838. He painted a vivid picture of a radical Airy who wasn't afraid to speak out not only scientifically but politically as well. Airy was instrumental in the obtaining and building of the 'mag and met' office at Greenwich. He was also in charge of its ensuring its success and implementing the processes by which it would be run.

After a leisurely lunch the AGM was held. Bob thanked everyone for their hard work over the last year in particularly in promoting and expanding the society to its highest number of members. Amongst other business a new prize was announced. This will be given in honor of Madeline Cox the former chairperson who left a generous bequest to the society. This new prize will be given at the next AGM in 2017, it will be awarded for the best Bulletin article received for issues 26, 27 and 28.

James Dawson was in attendance and was awarded the Roger Jones award by Kevin Johnson for his all his work on the survey during the last year.

The afternoon conference was started by a talk by Dr Mike Leggett who spoke about his research on the Hartwell Synod. The Synod had been centered on Dr Lee's observatory at Hartwell House. But it extended out to several local observatories which were established in a very small area of the country.

The synod included many experienced astronomers such as James Glaisher, Norman Pogson and William R. Birt. Mike has done a large amount of research about the members of the synod and was a wealth of information on the subject.

There were the usual refreshments provided and opportunity for the members and guests to mingle during the afternoon break. Also held was a sale of several duplicate library books. This sale was well received and a total of £390 was taken at the door by the end of the day.

After the afternoon break the final speaker of the day was Dr Alan Chapman. Alan is one of the society's honorary presidents and regular speaker at the AGM. This year he spoke with his usual enthusiasm about Mary Somerville. Mary was a self-taught Scottish lady. She used correspondence and books by

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From the Moon to Rodington Village Hall

We all know the 1969 story of Apollo 11 and those famous words of Neil Armstrong. Well, the Apollo programme was remembered at Rodington Village Hall during the September meeting of the Shropshire Astronomical Society.

It all started with this year's monthly meetings falling on, or close to a full moon. This raised many questions resulting in lots of discussion at committee meetings. What do we do about our deep sky observers was the mantra. However it was agreed to have the Moon as a specific focus for the full year. So fully prepared with maps, guides and a stock of moon filters to sell to members, we embarked on our adventure. Little did we know that the weather would not cooperate until the 'Super Moon' of November, but then, when has that ever put us off? However, Vice Chairman Steve Szwajkun is always exploring ways to excite and enthuse members in all things space, and it was sheer coincidence that he landed on the STFC page for applying for the Moon Rocks. Without any discussion the on-line form was completed and submitted.

Little did he know what lay ahead. It was only when the terms and conditions were read did Steve realise what he had ordered and the security surrounding the exhibits that was needed. Many thanks must be bestowed on chairman Peter Gunn for his cunning approach on dealing with STFC and the provision for safe keeping of the exhibits. I must say please do not let this put you off applying for these samples, the whole experience is worth the odd sleepless night, or so Pete assured me.

So, on Saturday 24th September the monthly meeting commenced with John Thatcher giving a presentation on past and current theories of the moons to over fifty members and guests. These included exploring and discussing:

▯ Fission ▯ Capture ▯ Co-accretion ▯ Impact

This was followed by Steve Szwajkun guiding the group round features of the moon including the terminator, Maria, craters, cones and

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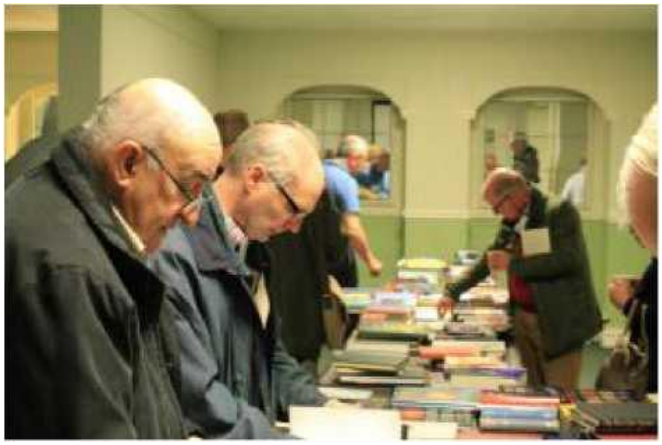
people such as Laplace to became one of the leading mathematicians and astronomers of her time. She was awarded membership of the Royal Astronomical Society before women were admitted. Her books were gained several awards across the world. They were particularly readable and went on to become best sellers during her lifetime. Thank you, Alan, for bringing to life this intelligent woman who was at the forefront of science in the 19th century

.We must thank all the speakers for enjoyable and informative talks. Also, to Gerard Gilligan our membership secretary, for the organisation of the conference. We look forward to seeing you all at either the Paris Observatory trip, or the spring conference which this year will be held at the Institute of Astronomy Cambridge on April 22nd 2017.



The Society For The History of Astronomy

Making Astronomical Discoveries On Cloudy Nights - ***frsl*** *2002*

membership@shastro-org.uk

Gerard Gilligan ***Membership Secretary***

do Birmingham Midland Institute 9 Margaret ST. Birmingham B3 3BS www.shastro.org.uk

Astro-Equipment
Design, Reliability and Service

This is a tale of astronomy equipment which had or developed faults and the level of service received from the suppliers/manufacturers.

We, Kernow Astronomers, are based in Cornwall and have had some experiences with various equipment, which we think are worth sharing.

The Big Dobsonian

Some years ago several of our members went for a week at COAA in Portugal and spent many a happy hour peering through their half-metre scope—and at a dark site.

This experience was used as an incentive for us to be as frugal as possible and run many-a-raffle, etc. After a while, we had amassed sufficient funds to be able to invest in a 'real light bucket'. Around that time, Sky at Night did a review of the 16 inch Explore Scientific dobsonian mounted reflecting telescope. Furthermore, being of braced tube construction, it seemed ideal for use both at our regular observing site, and also to take to various star parties we organise.

This unit was within our budget and so we duly ordered it from Telescope House. See inset image.

With great anticipation, we assembled it in the daylight, just to ensure familiarity and then took it to our on-site store. On the first available clear night (this was some while later, given the ability of Cornish skies to cloud over just before sunset!) we set up the telescope and proceeded to collimate it. A fairly easy task using a laser collimator. The finderscope was then collimated with the scope onto the top of a nearby pole.

As it was only dusk the only celestial object visible to the naked eye was Jupiter, very low down towards the horizon, so we had to depress the scope until it was almost horizontal. Then, when we got Jupiter in the finderscope, try as we might we could get nothing in the eyepiece.

Nonplussed, we looked inside at the mirror and was surprised to find that it had tilted forward, and was being supported only by the safety straps glued to the underside of the mirror. It was clear that there was something fundamentally wrong. As it was by now dark, we packed it all up and went to my garage where we could investigate further.

What we found was that the mirror is, or should be, held in position by friction of three contact points. One was a friction pad on the upper side of the mirror, when in the depressed position, and two roller wheels on the lower side. However, the problem became clear when it was seen that not all three of these points were in contact with the edge of the mirror.

On closer examination it was seen that the mounting support for one of the rollers had been displaced a considerable amount, resulting in about 1 cm of space between the mirror and the roller.

Photographs were taken of this damage, and immediately emailed to the suppliers, Telescope House, with a description of the problem.

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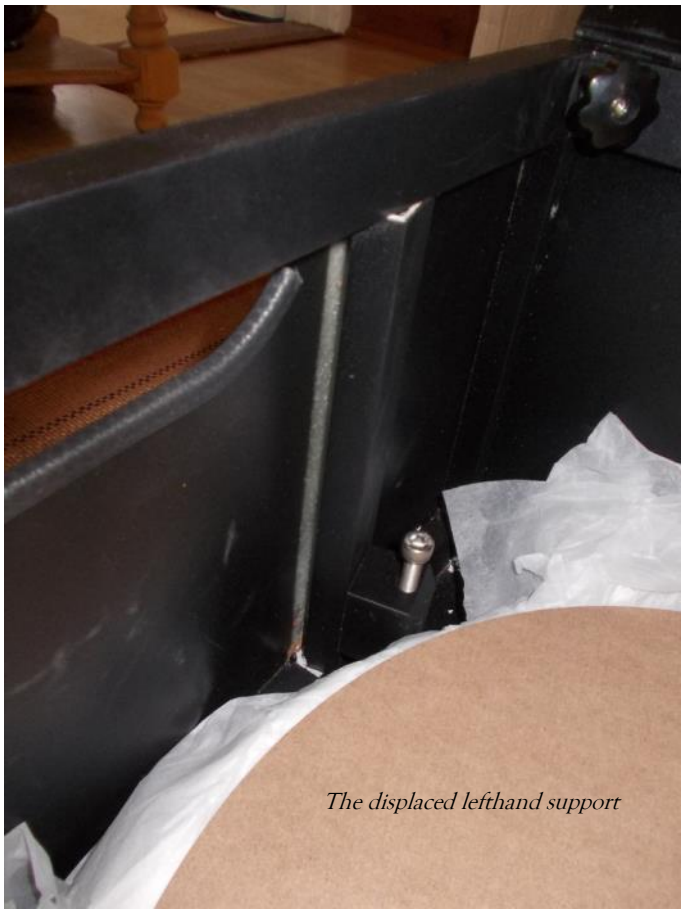
The displaced left-hand side support.

The unaffected right-hand side support.



The displaced lefthand support

(Continued from page 6)

To their credit, Telescope House responded promptly and said that they did not have a new replacement mirror housing in stock but would send down their shop demonstration unit to tide us over until a new one was available. This was done almost by return and they arranged collection of the original damaged box/mirror.

However, and there is almost always 'a however', on its arrival we immediately checked on the mirror mounting supports, and were very surprised and disappointed to see that the left had support was also displaced, although not quite as much as the first one.

One thing to point out here was in both instances the overall packing and packaging were in good condition with no sign of damage or mishandling.

We of course contacted Telescope House with the photographic evidence, who expressed their concerns and said that they were awaiting a replacement mirror box unit from the manufacturers. They asked if we would be prepared to 'soldier on' with this unit until then.

In practice we found that by inserting a packing piece between the top support pad and the mirror, it would function satisfactorily, so we decided to await the final replacement.

It is worth, at this stage, giving our opinion as to the cause of this problem. It is clear that the structural design of the mirror box is probably fine for general operation observing and reasonably careful handling that an astronomer/astronomy club would give it. However, the mirror is a heavy object and even if the box is well supported, the bumps and bangs of handling during long distance transport, mean that high inertia forces by the mirror will be encountered.

A similar problem exists with washing machines, in that the rotating drum is heavy and will show similar inertial forces and the manufacturer inserts packers which hold the drum in place during transport. In my opinion, if Explore Scientific had bothered to provide a simple packing piece which supported the mirror into the box, then that would not cost much and would eliminate this problem.
Rocket science it ain't.

We maintained contact with Telescope House over the next few weeks /months waiting for the replacement unit, but eventually it was felt that resolution was as far away as ever. We costed getting the box structure fixed locally and then Telescope House they said they would either take the scope back and reimburse us or would cover the repair costs. In the end we decided on the latter and they covered these costs plus a donation, as some compensation for our troubles.

The scope is now fully operational and we would like to state that we are pleased with the response we had from Telescope House, who gave excellent service.

Our opinion of Explore Scientific, however, is not as complimentary.

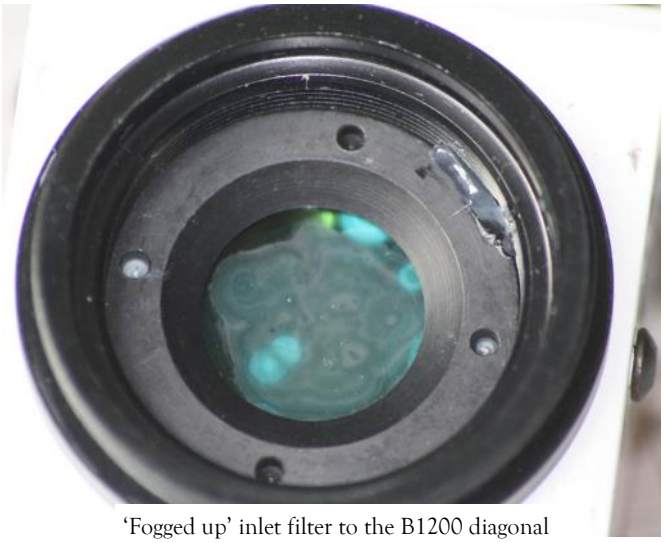
The Solar Scope

Kernow Astronomers, in common with many other societies, are keen to develop astronomy in local schools but of course dark starry skies rarely occur during school hours. This means that apart from the occasional star party, any practical astronomy has to concentrate on solar. Whilst white light astronomy is OK for sunspots, there is not much else to show the children, so we hankered after a H-alpha scope.

Thanks to the generosity of a trust fund in the name of the late husband of one of our members, we were given a donation sufficient to acquire a dedicated solar scope and several low-end white-light scopes.

This enabled us to undertake various courses in astronomy where the school had full time use of the white light scopes and we took along the H-alpha scope for use in the lessons. Of course, having a Solarscope meant that it was available for all our outreach work which happened when the Sun was up. The instrument we decided on was a Lunt LS60T Ha fitted with a B1200 diagonal, which we acquired from Astronomia.

This instrument performed well, as expected, and gave many a viewer



'Fogged up' inlet filter to the B1200 diagonal

an insight into the Sun and how it works.

Over the next couple of years or so, the Lunt had quite a bit of use but little by little, the performance seemed to drop of. The change was almost imperceptible and it is only in retrospect we realised how much it had deteriorated.

It was at one of our regular major astro-events at Trerice, our nearby National Trust property, when the view of the Sun was poor—with no detail observable, and even the larger sunspots were very indistinct.

This led us to investigate and after unscrewing the B1200 diagonal from the tube it became obvious what the problem was, The inlet filter/glass had developed a 'skin'. See the image.

My first thought was to contact the supplier, but unfortunately as most readers will know, Astronomia had gone bust.

I sent an email to Lunt, but as there were no named email addresses just the online report form, I was not hopeful of a quick response, which proved correct.

I then did an internet search and eventually posted a question on the SolarChat Forum. I asked whether this problem was common and did anyone have the email address to anyone at Lunt.

The answer came back that this was not overly unusual and could be resolved by replacing the glass filter or even cleaning it. I also got the contact address for Faye Heyde, in Lunt customer service.

I emailed Faye and immediately got an auto reply. She was now Faye Roman and was on maternity leave, but left a couple of contact addresses. One of these was of Jennifer Lunt.

I then sent off an email to Jennifer and had a reply within the hour, saying that she would get a replacement filter out to me next morning. However an hour or so later, another email from her said that they had in fact shipped it that evening.

It only took about 4 days to go from California to Cornwall and it arrived with detailed instructions as to how to change it. It proved to be a simple job. Jennifer also said that in the event that we encountered this problem in the future, they would happily send another filter. The LS60T is now back in fighting trim.

The service from Lunt was exemplary, and they are to be commended.

post script - Losmandy G11—Gemini Controller

I did think the Lunt solarscope would be the last item of kit that would be referred to in this article, However sometime before Christmas 2016 the Gemini-1 controller for my Losmandy G11 died and I ordered the upgraded Gemini-2, which arrived mid December. Unfortunately this did not work correctly, and in early January, I am still trying to get it resolved. This will be subject to a follow-up in the next issue of the FAS Newsletter.

Frank Johns

(Continued from page 5)

rilles as well as discussing terms such as phases, libration, albedo and tidal lock. The focus then teasingly turned to the exhibits with a summary of what was available. The samples supplied included: Basalt: Solidified lava found in the dark lowland maria or 'seas'. Breccia: Rocks made of fragments of other rocks created in violent impacts. Highland Soil (Regolith): Fragments from the breakup of highlands rocks by meteorites. Anorthosite: White rock consisting of feldspar crystals, predominant rock of the lunar highlands. Mare Soil (Regolith): Fragments from the breakup of mare rocks by meteorites. Orange Soil: Volcanic glass beads from a lunar eruption 3.5 billion years ago. Found by Apollo 17.

As part of NASA's programme of manned exploration of the Moon in the late 1960s and early 1970s, the Apollo astronauts brought back to Earth 382 kilograms of lunar materials. NASA used a small proportion of the rock and soil to develop lunar and planetary sciences educational packages. The Science and Technology Facilities Council (STFC) is the only body that lends out samples of this precious material to educational or scientific organisations within the United Kingdom. In addition to these special samples three rare and irreplaceable hand-held meteorites and three equally rare encapsulated meteorites are on loan from the Natural History Museum were also included: Henbury, Parnalle, Imilac, Murchinson, Camel Donga, Nakhla

The highlight of the evening was to be these exhibits provided by NASA and STFC and so it proved. Members were encouraged to bring along their own moon-related collections, which they did in abundance. Signed pictures and posters, Apollo memorabilia, meteorite collections amongst other treasured items were all in evidence, with the owners prepared to share their stories. The committee ensured that everybody had ample opportunity to explore, at their leisure, what was an unique opportunity. Support material was provided via the Internet and text, as well as microscopes and lenses all aiming to enhance the experience. It must be said that the support material provided by STFC is very good and suitable across all abilities and ages, and with a little creativity was put to good use. The most pleasing sight was the smiles and grins on people's faces as they worked their way round the various exhibits. This was coupled with

their questions and virtual disbelief that they had in the palms of their hands real samples from the Apollo missions. The atmosphere in the room was well worth all the effort and agony and an activity that I would recommend to any Society; one I would repeat again and again. In fact, following debrief discussions, John and I are quite prepared to offer our services to any group which undertakes to borrow the samples for their own school, Society or group. It seems a pity not to share our expertise and experiences. As a footnote I would like to thank the SAS committee for their support, especially chairman Pete together with all the members and guests who contributed to such a memorable evening.

This report includes text and images from the STFC support package.

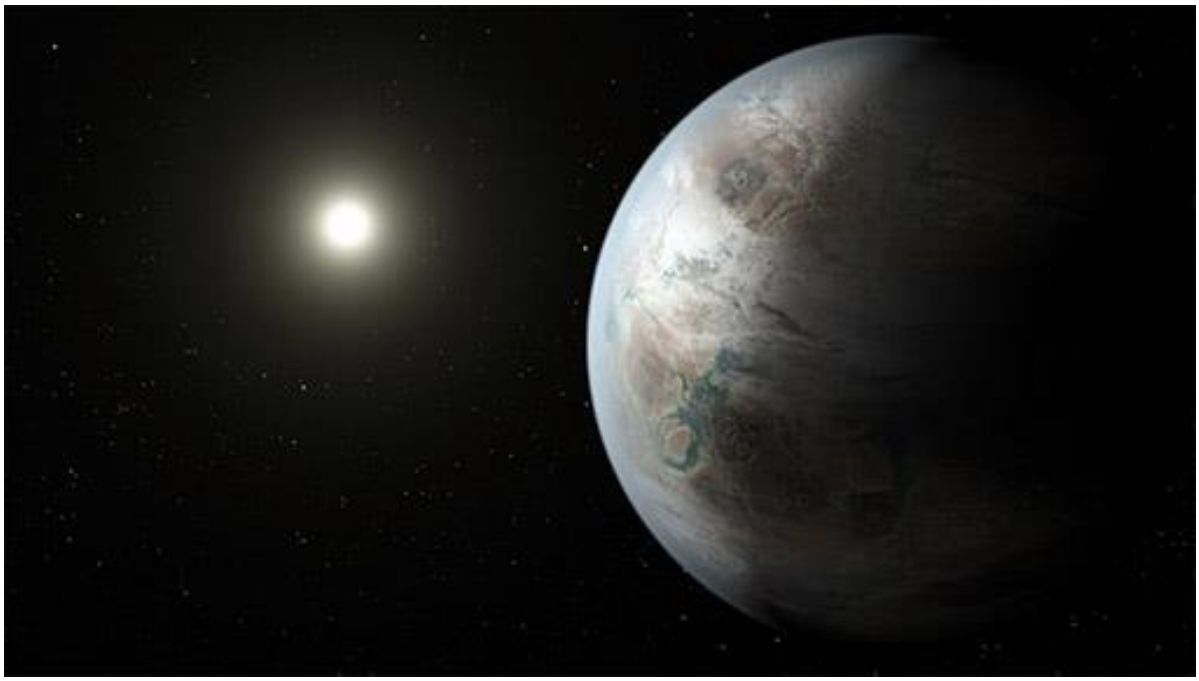
Steve Szwajkun

Shropshire Astronomical Society

Courtesy: Hermes

A team of astronomers open dataset of nearby stars to the public

Now anyone can help the search for new exoplanets.



An artist's rendering of Kepler-452b, the first near-Earth-size world in the habitable zone
NASA Ames/JPL-Caltech/T. Pyle

A team led by the Carnegie Institution for Science along with MIT has given the public a chance to assist with exoplanet research.

The team has released two decades worth of data, a software package, and an online tutorial to the public to bring a fresh look into the observations of more than 1,600 nearby stars.

"This is an amazing catalog, and we realized there just aren't enough of us on the team to be doing as much science as could come out of this dataset," Jennifer Burt, a Torres Postdoctoral Fellow in MIT's Kavli Institute for Astrophysics and Space Research, said in a press release. "We're trying to shift toward a more community-oriented idea of how we should do science, so that others can access the data and see something interesting."

The team has found more than 100 potential exoplanets during a study has appeared in *The Astronomical Journal* . The released data is from the High Resolution Echelle Spectrometer (HIRES), which is designed to help astronomers measure wavelengths to determine characteristics of the starlight.

"[HIRES] wasn't specifically optimized to look for exoplanets," Burt says. "It was designed to look at faint galaxies and quasars. However, even before HIRES was installed, our team worked out a technique for making HIRES an effective exoplanet hunter."

HIRES helps astronomers by splitting incoming light from the star into the "colour" of certain elements (most commonly known as "spectrum"), making it easier to measure the wavelengths with accuracy. HIRES really came in handy, though, by finding when a star's spectra moves in a regular pattern, indicating a potential exoplanet's orbit of Earth.

The data collected from HIRES has more than 1,600 "neighbourhood" stars within 325 light years from Earth, and the team has highlighted more than 100 stars that may host exoplanets. These observations require more research, though, so nothing has been confirmed yet.

"I think this opens up possibilities for anyone who wants to do this kind of work, whether you're an academic or someone in the general public who's excited about exoplanets," Burt says. "Because really, who doesn't want to discover a planet?"

By Nicole Kiefert | Published: Monday, February 13, 2017

Source & Courtesy: Astronomy News

A bridge of stars connects two dwarf galaxies

Pale white veils and the narrow bridge between the clouds represent the distribution of the RR Lyrae stars.
Credit: V Belokurov, D Erkal, A Mellinger

The Magellanic Clouds, the two largest satellite galaxies of the Milky Way, appear to be connected by a bridge stretching across 43,000 light years, according to an international team of astronomers led by researchers from the University of Cambridge. The discovery is reported in the journal Monthly Notices of the Royal Astronomical Society (MNRAS) and is based on the Galactic stellar census being conducted by the European Space Observatory, Gaia.

For the past 15 years, scientists have been eagerly anticipating the data from Gaia. The first portion of information from the satellite was released three months ago and is freely accessible to everyone. This dataset of unprecedented quality is a catalogue of the positions and brightness of a billion stars in our Milky Way galaxy and its environs.

What Gaia has sent to Earth is unique. The satellite's angular resolution is similar to that of the Hubble Space Telescope, but given its greater field of view, it can cover the entire sky rather than a small portion of it. In fact, Gaia uses the largest number of pixels to take digital images of the sky for any space-borne instrument. Better still, the Observatory has not just one telescope but two, sharing the one metre wide focal plane.

Unlike typical telescopes, Gaia does not just point and stare: it constantly spins around its axis, sweeping the entire sky in less than a month. Therefore, it not only measures the instantaneous properties of the stars, but also tracks their changes over time. This provides a perfect opportunity for finding a variety of objects, for example stars that pulsate or explode -- even if this is not what the satellite was primarily designed for.

The Cambridge team concentrated on the area around the Magellanic Clouds and used the Gaia data to pick out pulsating stars of a particular type: the so-called RR Lyrae, very old and chemically un-evolved. As these stars have been around since the earliest days of the Clouds' existence, they offer an insight into the pair's history. Studying the Large and Small Magellanic Clouds (LMC and SMC respectively) has always been difficult as they sprawl out over a large area. But with Gaia's all-sky view, this has become a much easier task.

Around the Milky Way, the clouds are the brightest, and largest, examples of dwarf satellite galaxies. Known to humanity since the dawn of history (and to Europeans since their first voyages to the Southern hemisphere) the Magellanic Clouds have remained an enigma to date. Even though the clouds have been a constant fixture of the heavens, astronomers have only recently had the chance to study them in any detail.

Whether the clouds fit the conventional theory of galaxy formation or not depends critically on their mass and the time of their first approach to the Milky Way. The researchers at Cambridge's Institute of Astronomy found clues that could help answer both of these questions.

Firstly, the RR Lyrae stars detected by Gaia were used to trace the extent of the Large Magellanic Cloud. The LMC was found to possess a fuzzy low-luminosity 'halo' stretching as far as 20 degrees from its centre. The LMC would only be able to hold on to the stars at such large distances if it was substantially bigger than previously thought, totalling perhaps as much as a tenth of the mass of the entire Milky Way.

An accurate timing of the clouds' arrival to the galaxy is impossible without knowledge of their orbits. Unfortunately, satellite orbits are difficult to measure: at large distances, the object's motion in the sky is so minute that it is simply unobservable over a human lifespan. In the absence of an orbit, Dr Vasily Belokurov and colleagues found the next best thing: a stellar stream.

Streams of stars form when a satellite -- a dwarf galaxy or a star cluster -- starts to feel the tidal force of the body around which it orbits. The tides stretch the satellite in two directions: towards and away from the host. As a result, on the periphery of the satellite, two openings form: small regions where the gravitational pull of the satellite is balanced by the pull of the host. Satellite stars that enter these regions find it easy to leave the satellite altogether and start orbiting the host. Slowly, star after star abandons the satellite, leaving a luminous trace on the sky, and thus revealing the satellite's orbit.

"Stellar streams around the Clouds were predicted but never observe," explains Dr Belokurov. "Having marked the locations of the Gaia RR Lyrae on the sky, we were surprised to see a narrow

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bridge-like structure connecting the two clouds. We believe that at least in part this 'bridge' is composed of stars stripped from the Small Cloud by the Large. The rest may actually be the LMC stars pulled from it by the Milky Way."

The researchers believe the RR Lyrae bridge will help to clarify the history of the interaction between the clouds and our galaxy.

"We have compared the shape and the exact position of the Gaia stellar bridge to the computer simulations of the Magellanic Clouds as they approach the Milky Way," explains Dr Denis Erkal, a co-author of the study. "Many of the stars in the bridge appear to have been removed from the SMC in the most recent interaction, some 200 million years ago, when the dwarf galaxies passed relatively close by each other. "We believe that as a result of that fly-by, not only the stars but also hydrogen gas was removed from the SMC. By measuring the offset between the RR Lyrae and hydrogen bridges, we can put constraints on the density of the gaseous Galactic corona."

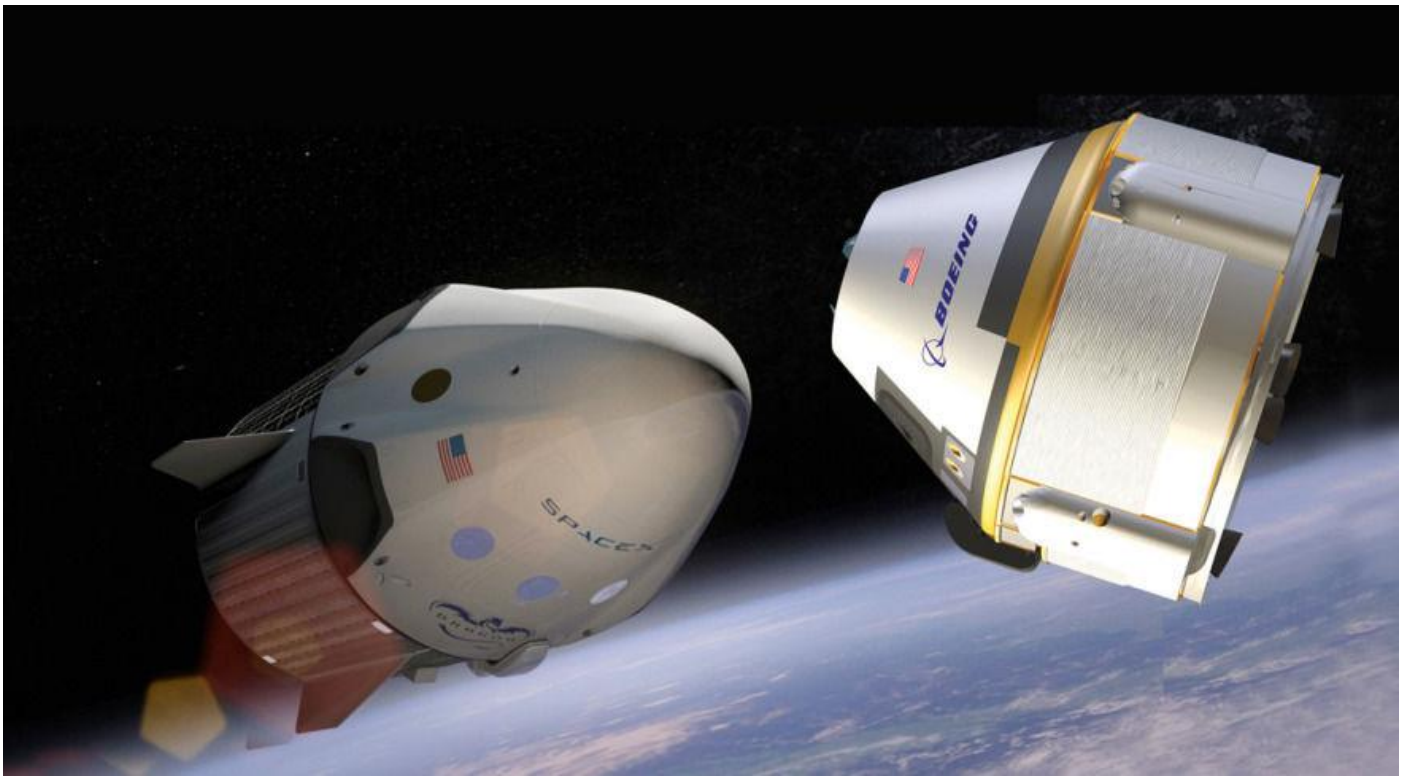
Composed of ionised gas at very low density, the hot Galactic corona is notoriously difficult to study. Nevertheless, it has been the subject of intense scrutiny because scientists believe it may contain most of the missing baryonic -- or ordinary -- matter. Astronomers are trying to estimate where this missing matter (the atoms and ions that make up stars, planets, dust and gas) is. It's thought that most, or even all, of these missing baryons are in the corona. By measuring the coronal density at large distances they hope to solve this conundrum.

During the previous encounter between the Small and Large Magellanic Cloud, both stars and gas were ripped out of the Small Cloud, forming a tidal stream. Initially, the gas and stars were moving at the same speed. However, as the Clouds approached our Galaxy, the Milky Way's corona exerted a drag force on both of them. The stars, being relatively small and dense, punched through the corona with no change in their speed. However, the more tenuous neutral hydrogen gas slowed down substantially in the corona. By comparing the current location of the stars and the gas, taking into account the density of the gas and how long the Clouds have spent in the corona, the team estimated the density of the corona. Dr. Erkal concludes, "Our estimate showed that the corona could make up a significant fraction of the missing baryons, in agreement with previous independent techniques. With the missing baryon problem seemingly alleviated, the current model of galaxy formation is holding up well to the increased scrutiny possible with Gaia."

Story Source: University of Cambridge
Courtesy: Science Daily

NASA Developing Contingency Plan for Commercial Crew Delays

By Jeff Foust, SpaceNews Writer



NASA will develop a contingency plan by mid-March to ensure continued access to the ISS if SpaceX's Crew Dragon (left) and Boeing's CST-100 Starliner suffer additional delays. *Credit: SpaceX and Boeing*

ORLANDO, Fla. — *NASA plans to complete by the middle of March a contingency plan for ensuring access to the International Space Stationshould its two commercial crew partners suffer additional delays.*

In a response included in a U.S. Government Accountability Office report issued Feb. 16, Bill Gerstenmaier, NASA associate administrator for human exploration and operations, concurred with a report recommendation that NASA develop alternative ways of getting astronauts to and from the ISS if commercial crew vehicles are not certified once NASA's current contract with Russia for Soyuz flights expires at the end of 2018.

"NASA will develop a contingency plan for maintaining a presence on the ISS beyond 2018 if the Commercial Crew Program's partners experience additional schedule delays," Gerstenmaier wrote. That report, he said, would be completed by March 13.

The GAO recommended the report because of concerns that Boeing and SpaceX will not have their commercial crew vehicles certified to carry astronauts by the end of 2018. Those certification reviews, which will come after both uncrewed and

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crewed test flights of their vehicles, are intended to confirm that the vehicles are able to safely transport astronauts to and from the station.

The certification review for SpaceX's Crew Dragon vehicle is currently planned for the third quarter of 2018, after an uncrewed test flight in November 2017 and a crewed test flight in May 2018. That review is at least 15 months later than the original schedule for the vehicle in SpaceX's contract with NASA.

Boeing's CST-100 Starlineris currently scheduled to have its certification review in the fourth quarter of 2018, after an uncrewed flight test in June 2018 and a crewed flight test in August 2018. That review is at least 14 months behind the original schedule in Boeing's contract.

While both companies state they are making good progress on their vehicles after encountering a range of technical issues, NASA is less confident in their ability to remain on their revised schedule. "The Commercial Crew Program is tracking risks that both contractors could experience additional schedule delays and its own analysis indicates that certification is likely to slip into 2019," the GAO report stated.

One challenge in coming up with a contingency plan is that the advance time for purchasing Soyuz seats from the Russian space agency Roscosmos has traditionally been three years, which would have required NASA to purchase seats for 2019 flights to the ISS in 2016. As of last fall, NASA officials had indicated that they had no plans to purchase additional seats.

According to the GAO report, NASA and Roscosmos are discussing one option where they would repeat the "year in space" experiment of 2015 and 2016, when NASA astronaut Scott Kelly and Roscosmos cosmonaut Mikhail Kornienko spent nearly one year on the ISS. A second one-year mission, starting in late 2018, would eliminate NASA's need for one seat in mid-2019 as that astronaut would remain on the station until late 2019.

Another option not directly addressed in the report is for NASA to purchase Soyuz seats from Boeing. In January, NASA announced it was considering a Boeing proposal to purchase two Soyuz seats in the fall of 2017 and spring of 2018, with an option for three additional seats in 2019. Boeing acquired the seats from Russian company RSC Energia as part of a settlement of a lawsuit between the two companies about the Sea Launch joint venture.

NASA issued a "sources sought" announcement Jan. 17 seeking responses from companies before entering into negotiations with Boeing for a sole-source contract to acquire the seats. Neither Boeing nor NASA have provided an update about any negotiations since that announcement. According to the announcement, NASA has until the fall of 2017 to exercise the option for the Soyuz seats in 2019.

As NASA examines its options, Boeing and SpaceX are dealing with technical issues with their vehicle designs. Boeing's top risks, according to the GAO report, include obtaining adequate information about the capsule's parachute system and getting data on the design of Russian-built RD-180 engines used by the CST-100's launch vehicle, the Atlas 5. The engine data is needed by NASA to verify the engine meets human certification requirements, but access to the data is restricted.

SpaceX's risks involve a number of issues with the design of the Falcon 9, including a concern that frequent updates hinder the development of a stable design of the vehicle. Another issue is previously-reported criticism by some NASA advisers about SpaceX's plans to fuel the Falcon 9 after astronauts have boarded the Dragon spacecraft, rather than fueling the rocket first.

A recent news report stated that NASA had also raised concerns about cracks seen in the turbines of the Falcon 9's engines that NASA deemed an "unacceptable risk" for crewed launches. That issue was included in the GAO report, but it also noted that SpaceX has already made design changes to the turbine that "did not result in any cracking during initial life testing."

This story was provided by SpaceNews, dedicated to covering all aspects of the space industry.

NASA is enlisting the public to find Planet Nine

Backyard World: Planet Nine can help you find a missing piece of our solar system from the comforts of your couch.

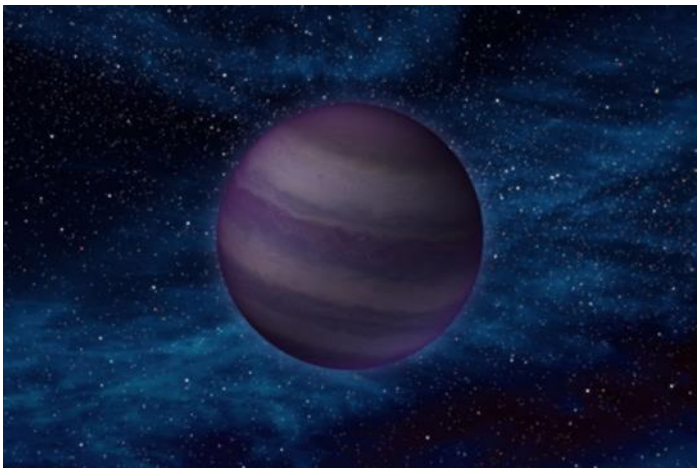
By John Wenz www.astronomy.com

Last year, astronomers Mike Brown and Konstantin Batygin shocked the astronomy community with the announcement of a possible ninth planet in our solar system. There was just one problem: they hadn't seen it. Instead, it was inferred from the bizarre, oblong orbits of a handful of dwarf planets on the outskirts of the Kuiper Belt.

That's where you come in. Yes, you!

NASA is funding a new program to bring together data from the Wide-field Infrared Survey Explorer to create miniature movies. These loops look for objects that move across the sky compared to relatively stationary background stars.

NASA is turning to crowdsourcing rather than algorithms to find real objects that might have been missed the first time around because they were marked as instrument errors.



Although it's proposed as a way to find Planet Nine, the Backyard Worlds program may also help find asteroids near Earth, faint dwarf planets in the outskirts of the solar system, and failed stars within a few dozen light years of us, all of which appear faint to the naked eye but will still give off heat in infrared.

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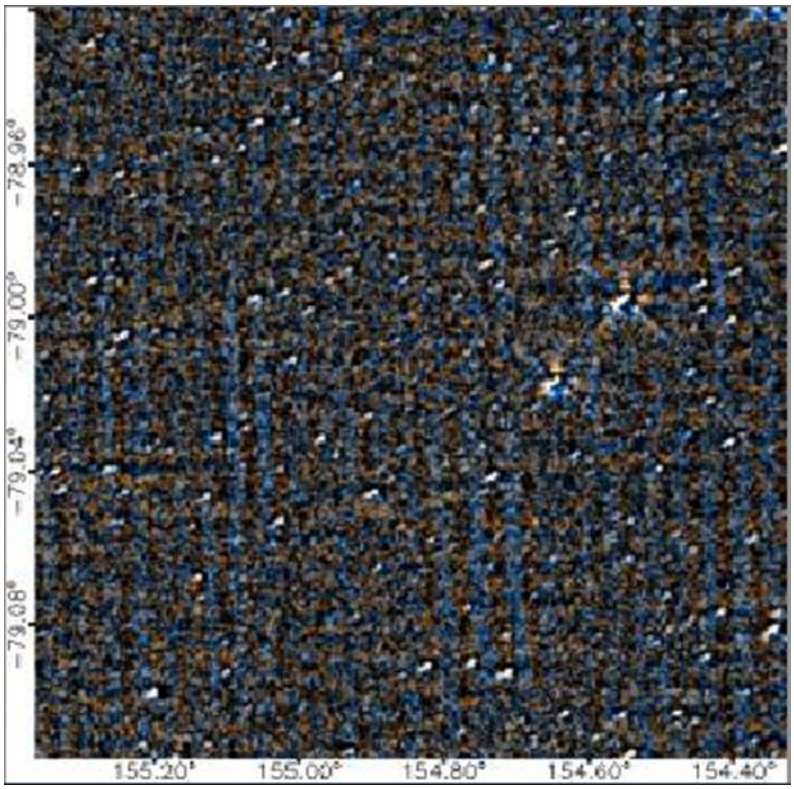
Be warned, your field of view will look a little like this:



To get started, visit the Backyard Worlds website. You may end up finding a planet … or at least a comet or two.

https://www.zooniverse.org/projects/marckuchner/backyard-worlds-planet-9

The following is extracted from the Backyard Worlds website:

Is there a large planet at the fringes of our solar system awaiting discovery, a world astronomers call Planet Nine? We're looking for this planet and for new brown dwarfs in the backyard of the solar system using data from NASA's Wide-field Infrared Survey Explorer (WISE) mission. But we need your help! Finding these dim objects requires combing through the images by eye to distinguish moving celestial bodies from ghosts and other artifacts. There are too many images for us to search through by ourselves. So come join the search, and you might find a rogue world that's nearer to the Sun than Proxima Centauri---or even the elusive Planet Nine.

Mysterious white dwarf pulsar discovered

An exotic binary star system 380 light-years away has been identified as an elusive white dwarf pulsar -- the first of its kind ever to be discovered in the universe -- thanks to research by the University of Warwick.

Professors Tom Marsh and Boris Gänsicke of the University of Warwick's Astrophysics Group, with Dr David Buckley from the South African Astronomical Observatory, have identified the star AR Scorpii (AR Sco) as the first white dwarf version of a pulsar -- objects found in the 1960s and associated with very different objects called neutron stars.

The white dwarf pulsar has eluded astronomers for over half a century.

AR Sco contains a rapidly spinning, burnt-out stellar remnant called a white dwarf, which lashes its neighbour -- a red dwarf -- with powerful beams of electrical particles and radiation, causing the entire system to brighten and fade dramatically twice every two minutes.

The latest research establishes that the lash of energy from AR Sco is a focused 'beam', emitting concentrated radiation in a single direction -- much like a particle accelerator -- something which is totally unique in the known universe.

AR Sco lies in the constellation Scorpius, 380 light-years from Earth, a close neighbour in astronomical terms. The white dwarf in AR Sco is the size of Earth but 200,000 times more massive, and is in a 3.6 hour orbit with a cool star one third the mass of the Sun.

With an electromagnetic field 100 million times more powerful than Earth, and spinning on a period just shy of two minutes, AR Sco produces lighthouse-like beams of radiation and particles, which lash across the face of the cool star, a red dwarf.

As the researchers previously discovered, this powerful light house effect accelerates electrons in the atmosphere of the red dwarf to close to the speed of light, an effect never observed before in similar types of binary stars. The red dwarf is thus powered by the kinetic energy of its spinning neighbour.

The distance between the two stars is around 1.4 million kilometres -- which is three times the distance between the Moon and the Earth.

This is AR Scorpii, the first discovered white dwarf pulsar.
Credit: Mark Garlick/University of Warwick

Professor Tom Marsh comments, "The new data show that AR Sco's light is highly polarised, showing that the magnetic field controls the emission of the entire system, and a dead ringer for similar behaviour seen from the more traditional neutron star pulsars."

Professor Boris Gänsicke comments, "AR Sco is like a gigantic dynamo: a magnet, size of the Earth, with a field that is ~10.000 stronger than any field we can produce in a laboratory, and it is rotating every two minutes. This generates an enormous electric current in the companion star, which then produces the variations in the light we detect."

The latest research, 'Polarimetric evidence of a white dwarf pulsar in the binary system AR Scorpii', is published in *Nature Astronomy*.

Source: University of Warwick