



## Cardiff Astronomical Society Newsletter

### December – February Issue 185

*Merry Christmas and Happy New Year to all our Members!*

Dear Members

Merry Christmas and a Happy New Year to you all! 2018 has been a fantastic year for the Society and we hope that 2019 will be bigger and better! A big thank you to you all not only for your continued membership but also for the support you have given the Society over the past 12 months through attending lectures or volunteering at the events. We are working towards a few changes in 2019. The newsletter will be revamped and we are looking to update and modernise the merchandise we have but more of that later! Apologies for the shorter, basic and less formatted newsletter this month but due to changes in the Publication Officer post, which I have now taken over, I have not had enough time to put together a full update. Instead, I have decided to provide an overview of our achievements in 2018 and what we can look forward to in 2019. I have also managed to include an interview that I did with Chris Lintott from the Sky at Night. Interviews should become a regular feature for the newsletter, I already have three ready to go! Thanks to everyone who did manage to contribute something for this issue given the short notice.

I hope you enjoy the read and please, as always, if you wish to contribute to future newsletters with any exciting articles, stories, photographs, suggestions or new discoveries....please let me know! Issue 186 is out in March 2019 so get your thinking caps on.

*Katrin Raynor-Evans, CAS librarian and Publications Officer*

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## THE TWELVE DAYS OF CASMAS

*Our Vice Chair, Ian McLean has been busy spending some time putting together an alternative to the 12 Days of Christmas. We hope it provides you with a smile and a bit of Christmas cheer!*

On the **1<sup>st</sup>** day of CASmas the Astronomer Royal gave to me, the Andromeda Galaxy!

On the **2<sup>nd</sup>** day of CASmas the Astronomer Royal gave to me, two Voyager Spacecraft and the Andromeda Galaxy!

On the **3<sup>rd</sup>** day of CASmas the Astronomer Royal gave to me, three solar eclipses, two Voyager Spacecraft and the Andromeda Galaxy!

On the **4<sup>th</sup>** day of CASmas the Astronomer Royal gave to me, four gas giants, three solar eclipses, two Voyager Spacecraft and the Andromeda Galaxy!

On the **5<sup>th</sup>** day of CASmas the Astronomer Royal gave to me, five dwarf planets, four gas giants, three solar eclipses, two Voyager Spacecraft and the Andromeda Galaxy!

On the **6<sup>th</sup>** day of CASmas the Astronomer Royal gave to me, six Moon landings, five dwarf planets, four gas giants, three solar eclipses, two Voyager Spacecraft and the Andromeda Galaxy!

On the **7<sup>th</sup>** day of CASmas the Astronomer Royal gave to me, Seven Sisters twinkling, six Moon landings, five dwarf planets, four gas giants, three solar eclipses, two Voyager Spacecraft and the Andromeda Galaxy!

On the **8<sup>th</sup>** day of CASmas the Astronomer Royal gave to me, eight Planets orbiting, Seven Sisters twinkling, six Moon landings, five dwarf planets, four gas giants, three solar eclipses, two Voyager Spacecraft and the Andromeda Galaxy!

On the **9<sup>th</sup>** day of CASmas the Astronomer Royal gave to me, nine Jupiter explorations, eight planets orbiting, Seven Sisters twinkling, six Moon landings, five dwarf planets, four gas giants, three solar eclipses, two Voyager Spacecraft and the Andromeda Galaxy!

On the **10<sup>th</sup>** day of CASmas the Astronomer Royal gave to me, ten Dark Skies, nine Jupiter explorations, eight planets orbiting, Seven Sisters twinkling, six Moon landings, five dwarf planets, four gas giants, three solar eclipses, two Voyager Spacecraft and the Andromeda Galaxy!

On the **11<sup>th</sup>** day of CASmas the Astronomer Royal gave to me, eleventh magnitude Proxima Centauri, ten Dark Skies, nine Jupiter explorations, eight planets orbiting, Seven Sisters twinkling, six Moon landings, five dwarf planets, four gas giants, three solar eclipses, two Voyager Spacecraft and the Andromeda Galaxy!

On the **12<sup>th</sup>** day of CASmas the Astronomer Royal gave to me, twelve Apollo missions, eleventh magnitude Proxima Centauri, ten Dark Skies, nine Jupiter explorations, eight planets orbiting, Seven Sisters twinkling, six Moon landings, five dwarf planets, four gas giants, three solar eclipses, two Voyager Spacecraft and the Andromeda Galaxy!



## Highlights of 2018

By Katrin Raynor-Evans

**January 2018** - We were busy this year, attending and hosting various events around South Wales. 2018 got off to our usual start at the National Museum of Wales where we were a guest at the Star Attractions event hosted by the museum in January. We had our usual spot in the foyer and some three thousand visitors poured through the doors on the day. We mingled with our fellow societies from Bridgend, Swansea and Usk and had our telescopes out on display for the public to use.

**June 2018** - Star parties and observing sessions were plentiful throughout the year but perhaps the most popular was the Solar observing day which we held at the Brecon Beacons visitor Centre in Libanus with the BBNP. We couldn't have asked for a better day...the sun was shining, it was warm and the crowds turned up in their hundreds. Visitors were not disappointed as we they looked through the Society's equipment and also the volunteers. Sun spots 2715 and 2713 were present on the day but only 2715 could easily be viewed perhaps because it was a much darker and cooler spot than 2713 and their positioning on the Sun. Members of the Society explained to the keen and enquiring observers looking through the scopes what Sun spots are, how they form and what the Solar Cycle is for example. Throughout the day, members were on hand to answer any general astronomy questions from the public and to promote the Society. The event was written up by myself and published in *Astronomy Now* magazine. More publicity for CAS!



**September 2018** - The Society for Popular Astronomy (SPA) held a special meeting in conjunction with the Cardiff Astronomical Society (CAS) on the 29<sup>th</sup> September. The meeting was held at the School of Physics and Astronomy at Cardiff University. The aim of the day was to bring the societies together, meet members old and new, and promote what each of the societies do and to enjoy an afternoon of talks. Speakers included our very own Phill Wallace, Dr Megan Argo from the University of Central Lancashire and Professor Robson from the Royal Observatory in Edinburgh.



**October 2018** – We held a very successful evening at the Brecon Beacons Visitor Centre with Dark Sky Wales (DSW). It was the first event we had done with DSW and needless to say, we will be doing them again in the future! We couldn't really have asked for a better evening weather wise. It was clear and

cold. CAS provided binoculars and short tours of the night sky to the groups. They were on hand to answer questions and talk about what the Society does. Inside, CAS had a table of meteorites on loan from the National Museum of Cardiff, along with educational booklets and leaflets suitable for astronomers of all ages.

Allan Trow from DSW had assembled his Skywatcher 120mm Esprit Apo telescope, mounted on a Skywatcher NEQ6 Pro R. He wowed the crowds with the likes of the Andromeda Galaxy (M31) and the Great Globular Cluster (M13) in Hercules, a globular cluster of several hundred thousand of stars. Unfortunately as a bright waning moon rose in the sky, the brilliance of it drowned out a lot of dimmer objects and the Milky Way was no longer visible. However, lunar viewing through the scopes was a great hit with some people attaching their cameras to the scopes and getting some fantastic images.



Edward Cooper, Committee member also attended the fourth UKMON conference held at the National Museum of Wales. Edward has written an article on the event which is discussed on page 7.

**November 2018** - I think the highlight for us all was taking part in the Tim Peake Family Fun Day at the Museum. 3,600 people came through the door to enjoy a day of all things space themed! Of course the main feature was the Soyuz space capsule which Tim Peake, Tim Kopra and Yuri Malenchenko shared in their descent back to Earth after a 6 month stint on the International Space Station.



The virtual reality experience was a must and all volunteer members at the museum had a free experience of what it was like on the descent back to Earth, narrated by Tim Peake. We sold a lot of merchandise that day and hopefully drummed up a lot of new interest for the society!



## Notable Achievements by CAS Members



**Royal  
Astronomical  
Society**  
Advancing Astronomy and Geophysics

### Fellowship to the Royal Astronomical Society, London

Feras Tuma and Phill Wallace were successfully accepted as Fellows to the Royal Astronomical Society following references provided by Katrin Raynor-Evans. Ian McLean and Theresa Cooper have also been referred to RAS for fellowship and we await the outcome on the 14<sup>th</sup> December.

If any members of CAS would like to be elected for Fellowship please speak to any of the Fellows already mentioned above for further information. Election is free and requires a written reference but once accepted there is an annual membership fee of £125 which includes a whole host of exciting benefits.

### Media publications

It has been a successful year for Katrin Raynor-Evans, writing book reviews for the Sky at Night magazine and providing articles for their website. She has written for Astronomy Now and perhaps her proudest achievement has been writing about Astro Philately for the Journal of Astronomy and Geophysics, the magazine of the Royal Astronomical Society. Astro Philately is a passion for Katrin and she has been asked to write for the Astro Space Stamp Society's magazine *Orbit*, Occasional Notes (an independent newsletter written by Bob Marriott, consultant for Astronomical Instruments at the BAA) and attend as a guest speaker for the Newtown Astronomical Society in 2019. She is a guest blogger for the Dark Sky Wales website and has been writing and reviewing books for the Society for Popular Astronomy.



*A set of Halley's Comet Benham silks, 1987 from Katrin's collection*

## **Bill Sutherland Award**

Feras Tuma was awarded the Bill Sutherland Award at the CAS AGM meeting earlier in the year for commitment and enthusiasm for the society. The award was set up in memory of Bill Sutherland, an earlier member of CAS who passed away in 1990. If you would like to nominate a member or even nominate yourself then please look at our website or talk to a member for details.

## **Social Events**

A few of us at CAS namely Ian McLean have been busy setting up a social group for CAS members on Facebook. If you are on Facebook and want to join then please search for the group 'CAS Social'. Alternatively, please let us know if you would like to be notified of any future events by email. We will also announce these at the fortnightly meetings. We had a successful pub meet up at Central Bar in September and a few members visited the National Spaceguard Centre, the National Near Earth Objects Information Centre in Knighton Powys which was thoroughly enjoyed by all. Now that we have visited the Spaceguard Centre and know what to expect, we are planning on running a CAS trip in 2019. The Centre is capable of accommodating groups up to 25 people.

We hope to run a few more events in the coming year whether it be a meet up in the local pub or trips away. If you have any ideas or want to get involved then let us know.

## **CAS positions**

We welcomed Katrin Raynor-Evans as our new librarian, publications officer and committee member and we are pleased to announce that Feras Tuma has taken over as Observatory Manager.

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Useful links:

The Royal Astronomical Society - <https://ras.ac.uk/>

Occasional Notes - <http://www.hamaldemon.com/>

The Spaceguard Centre - <https://spaceguardcentre.com/>

The Astro Space Stamp Society - <http://www.astrospacestampssociety.com/>

## FOURTH UKMON COLLABORATION MEETING

By Edward Cooper

Members of UKMON (UK Meteor Observation Network) gathered at the National Museum Wales in Cardiff on **20th October 2018** for its fourth collaboration meeting. UKMON brings together amateur and professional astronomers from around the country who share a common interest in meteor science. This annual get-together allows members to get to know each other and to share knowledge and experience. The event was coordinated by CAS with the venue and facilities provided by Dr Jana Horák at the National Museum Wales, Jana will be giving a talk to CAS on the 10<sup>th</sup> January 2019.

The meeting was attended by 20 people, a mixture of academics and amateurs.



Richard Kacerek presented an update on the UKMON network the key points being:

- There are now 32 cameras and another 7 in preparation;
- There are now 3 (SCAMP) all sky viewing cameras and more planned;
- A UKMON for schools' initiative is active;
- In 2018 a total of 23 cameras contributed data to the UKMON repository. Together, these cameras recorded 20,829 individual meteor observations;
- The exposure on the BBC Sky at Night Programme had been of great benefit.

**Jim Rowe** gave an update on the growing Fripon / Scamp network, SCAMP being the UK spin-off of the French FRIPON network and part of an international effort to recover meteorites.

**Luke Daily** (University of Glasgow) presented an update on the UK fireball network which already has four cameras in place.

**Sarah McMullan** (University of Glasgow) then shared with us the research she is undertaking on the energy deposited in the atmosphere by meteor events.

**Peter Campbell-Burns** (UKMON) completed the morning programme with a presentation of his dark flight model.

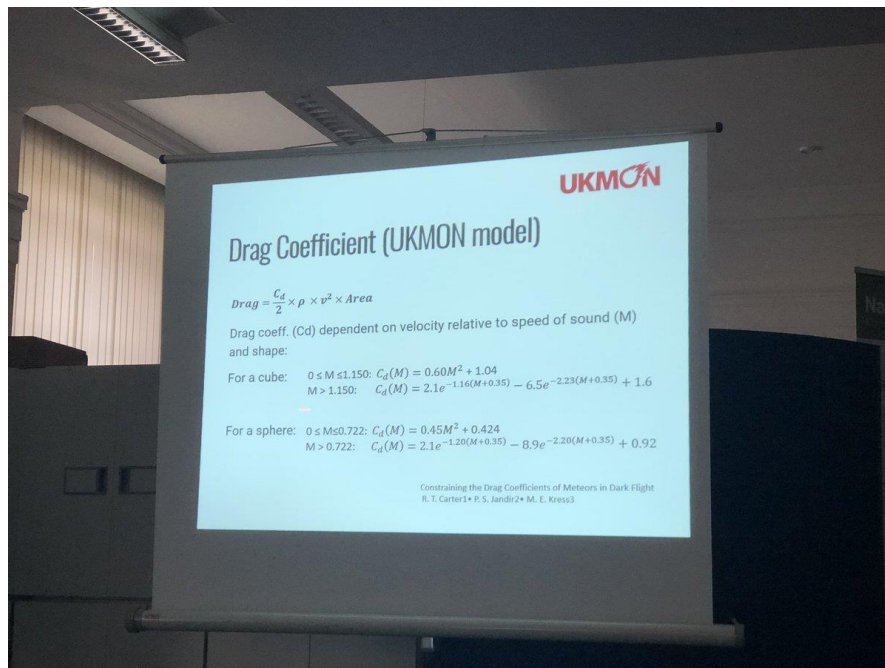
**Jana Horák**, Head of Mineralogy and Petrology at the National Museum Wales opened the afternoon programme. Dr Horak gave us an excellent introduction to meteorites and Impactites and brought with her an interesting selection of meteorites from the museum's collection.

**Dr Martin Fullekrug** (University of Bath) and **Simon Ghilain** presented on lightning and sprites.



Dr Martin Fullekrug showing us transient luminous events also known as sprites

**Peter Campbell-Burns** (UKMON) took the last two sessions to present the data analysis and data visualisation projects he has been working on over the last year.



Peter Campbell-Burns showing us Dark flight calculations

Throughout the day there were many touch-points where member's interests were piqued, and it was evident that stronger links were forged between members. Further information on most of the presentation is available at: <https://ukmeteornetwork.co.uk/downloads-presentations/>



## INTERVIEW WITH CHRIS LINTOTT FROM THE BBC SKY AT NIGHT

By Katrin Raynor-Evans



Hello Chris! Thank you so much for agreeing to be our first interviewee for our newsletter. I have been excited to interview you and I hope you find the questions fun and interesting...let's get started...

- **First of all, please tell us a little bit about yourself and how you came to develop a passion for astronomy. You have achieved so much in your career. What has been your highlight so far?**

*I grew up as a small kid who enjoyed looking up at the night sky; I joined the Torbay Astronomical Society which had a wonderful observatory attached to my school, and the rest is history. As for a highlight – I think the first time I got to travel to Mauna Kea in Hawai'i to use the telescopes there was pretty special.*

- **The Sky At Night is a programme that many of us love and have grown up with. I certainly never miss an episode. How did you get involved with the programme?**

*I was originally employed as a researcher, but got thrown in front of the camera pretty quickly after that. I grew up with the program too, and it's a scary responsibility to try and keep making programs people want to see.*

- **As a Professor of Astrophysics at Oxford University, what are you researching at the moment?**

*I'm spending a lot of time worrying about whether mergers between galaxies make much of a contribution to how we got the mix of galaxies we see around us today. We've also found an intriguing set of objects which are barred spirals – but where the bar isn't in the middle.*

- **You are the co-founder of Zooniverse. How did you come up with the idea and development of it? It is a hugely popular site and I know that some of our members participate. Where do the images of the galaxies for Galaxy Zoo come from?**

*We were trying to work out how to classify nearby a million galaxies when I heard about a program called Stardust@Home, which asked people to look at blurry images of dust grains brought back from space by NASA's Stardust mission. I realised that if people would look at dust, they might look at galaxies...The original data was from a telescope in New Mexico – the Sloan Digital Sky Survey – but we're now adding images from a big survey of the Southern sky, called DeCALs.*

- **How many members have signed up and what is the most exciting discovery on Galaxy Zoo to date? What is the information collected for Galaxy Zoo being used for?**

*Hundreds of thousands of people have taken part so far. I think the most interesting individual discovery is that of the 'Peas' – tiny galaxies that are suddenly, inexplicably converting all of their gas*

*to stars. People think they might be the local equivalents of a stage that most large galaxies went through billions of years ago. There are lots of research projects underway using the bulk of the data, all aimed at understanding why our local Universe is the way it is.*

- **You are relying on members of the public to classify galaxies, often people with no or little knowledge about galaxies...how accurate are the answers that they provide?**

*Very accurate – collectively, better than individual experts! People are very good at pattern recognition, and that's all that this is.*

- **As the librarian for the Cardiff Astronomical Society, which book on galaxies could you recommend for our library?**

*The reissued de Vaucouleurs' atlas is a thing of beauty.*

- **Social media can definitely be a blessing and a curse. Do you think social media is having a positive impact on reaching out to people about the importance of science and its future especially in astronomy?**

*I think the astronomical community is pretty friendly on things like Twitter. It's great that people are sharing research in progress, so that people can follow along with our attempts to understand the Universe; you can really see the power of it when something unexpected happens, like the recent journey through the Solar System of the interstellar visitor 'Oumuamua. A lot of the debate about what that weird object was was carried out in public.*

- **One of my favourite astronomy topics to research is our Moon. Do you think, one day that we will go back to the Moon? Can we successfully colonise the Moon and Mars and do you think it will be beneficial to humanity?**

*It's just a question of political will; sadly, our politicians don't fill me with much confidence. I hope we'll travel to the Moon and beyond, but I hope that the expeditions are scientifically driven – there's a lot to learn!*

- **And finally, you are being sent on a yearlong mission to space. If you could choose anyone to be your partner on the mission who would you pick and why?**

*It would depend where in space we're going! If it's the Moon or Mars we'll need a planetary scientist – Katie Joy from Manchester is an expert, and has spent time looking for meteorites in Antarctica, so must be pretty intrepid. Let's put her in charge, and I'll come along for the ride.*

## A SHORT ESSAY - PROJECT ORION

by Phillip Wallace

*Our Chairman, Phill Wallace provides a short essay on Project Orion, a study of spacecraft intended to be propelled by the energy of atomic bombs through explosions behind the craft.*

The 50's and 60's gave the world a great many marvels. The advent of commercial nuclear power promised cheap electricity for countless homes, the emergence of jet aircraft made global travel faster and cheaper. The birth of rock and roll gave generations yet to come their own sound. The American Civil Rights Movement emerged and triumphed, finally giving millions of people the equality supposedly given by the Founding Fathers two centuries earlier.

These decades also produced horrors. The Korean and Vietnam wars, the dark days of McCarthyism, the invention of the hydrogen bomb, the emerging Cold War between East and West and the omnipresent threat of all-out nuclear confrontation over the slightest issue. And in the mid-50's it became even worse with the launch of Sputnik-1; now the Soviets could hit the Americans (and the British) with nuclear weapons in minutes, not hours and with no possible defence.

But this potential apocalypse gave rise to what I would argue is the greatest marvel of these decades, the Space Race: the contest between America and Russia in the struggle to send satellites and men into the heavens. A contest as bitterly fought as any jungle war but with far fewer casualties, a contest waged by out-doing each other in some element of space travel: the first satellite, the first man in space, the first spacewalk, the first lunar probe and the first lunar landing.

The race began (as far as the public cared) on October 4<sup>th</sup>, 1957 when the USSR launched Sputnik-1 atop an R-7 rocket from the remote launch site of Baikonur, shocking the world and terrifying the Americans. Less than twelve years later, a tiny span of time given the circumstances, the race ended on July 20<sup>th</sup>, 1969 when Neil Armstrong stepped out onto the Sea of Tranquility. The first man on the Moon.

Since then, the world's space programs have continued in the same mould. Huge, expensive liquid-fuelled rockets burn hundreds of millions of dollars of fuel to get a mere handful of tonnes of payload into space. Even the Saturn-V, the largest and most powerful rocket in service, still needed about thirty tonnes of liquid fuel per tonne of payload delivered to orbit. It's expensive, it's dangerous (as the recent aborted Soyuz launch in Russia proves) and most damningly of all to a scientist, it's *inefficient*.

But there was a better way.

Another product of the 50's and 60's offered an alternative and vastly superior method. It was a bizarre confluence of events, joining together a few chance observations from the nuclear weapons test program with a different group of rocket scientists than those working for NASA. It also relied on what can be termed the Age of Atomic Innocence – in the 50's nuclear (or atomic) power was not feared but celebrated as the solution to all problems: there would be atomic-powered ships (which are reasonably commonplace today), atomic aircraft (which was tested once and found to be workable if not practical), atomic cars (a concept version was built and worked perfectly, but weighed seven tonnes) and of course atomic *spaceships*.

This was Project Orion: an audacious plan to harness not just nuclear power but nuclear weapons as well, for a purpose other than destruction. The project began in the 50's with the involvement of the great British physicist Freeman Dyson (of Dyson Sphere fame for science-fiction fans) and the idea that setting off a firecracker under a tin can would make the can jump in the air. Use a big enough

firecracker and you could lift a *very* big can. The biggest firecrackers available were of course nuclear weapons, and so the idea of nuclear pulse propulsion was born.

The idea is deceptively simple, throw a nuclear bomb out the back of your spaceship, detonate it and let the blast energy push you forwards. Then you do it again and again. It's the same basic principle as conventional rockets, just with much higher energies. The design also recognised that repeated detonations would put an unacceptable strain on both ship and crew, so a way had to be found to turn the repeated bursts into smooth, continuous acceleration. And of course you also needed a way to shield the vulnerable crew compartments from the nuclear blasts.

The planned design looked rather odd. At its base it featured a massive curved graphite-coated steel plate. This was the "pusher" that could catch the energy from the detonation and move forwards. The graphite coating was present to stop the steel plate ablating from the repeated blasts. On the upper surface of the steel plate was a layer of plastic, polystyrene and *wood*, which would prevent the shockwaves present in the steel plate from breaking off fragments from the upper surface and sending them flying forwards causing catastrophic damage.

Connecting this pusher plate to the rest of the ship was a collection of shock absorbers and airbags. These would slow down the pusher plate as it jerked forwards under the hammer of the nuclear detonation, reducing the effect from a sudden, massive acceleration into a gentler, continuous thrust, which had a great many advantages. Not only was it far less stressful on the materials and the crew, it meant that the astronauts did not have to spend long periods in microgravity, vastly reducing long-term health problems associated with spaceflight.

Also in this section was the storage magazines and ejection system for the bombs themselves. The bombs would (on the interplanetary design) yield about 30 kilotons (about half again the power of the Hiroshima bomb) and look like a big soup can, being about 6 inches in diameter and a foot long. The design for the loading/ejection system was actually provided by the Coca-Cola Corporation and was based on soft-drink vending machine designs.

Finally, in the upper section would be crew compartments and payload bays. And this would be payload on a grand scale, more than anything else before or since. The Saturn-V weighed 3,000 tonnes at lift off, just 110 tonnes of payload would be delivered to low orbit (or just 45 tonnes on a trajectory for a Lunar mission). The planned interplanetary Orion craft would weigh ten thousand tonnes at lift off – six thousand tonnes would be payload delivered to low orbit.

The planned Orion craft would have astonishing performance. In addition to the aforementioned payload capacity and benefits to the crew from avoiding microgravity was the range and the speed. Being able to maintain a constant 1g acceleration would give the ship far greater options for interplanetary missions. You would not need thirteen months, a careful course and exact timing to get from Earth to Mars – you could fly that mission in about two weeks. Instead of a decade-long flight of slingshots and gravity assists to get a probe to Saturn (like Cassini), you could simply point your ship at where Saturn *would* be, fire your engines and cruise out. With the 10,000 tonne design you would be able to fly there, have nearly two months in orbit to study the planet and its moons and return to Earth – all within twelve months.

The most exciting thing about Project Orion though is not the incredible performance of the engine, or the payload capacities or the prospect of direct manned Jupiter missions (providing no-one calls the computer HAL of course) or the use in asteroid mining (or diverting incoming asteroids away from Earth), but rather the fact that this incredible idea would work. It *did* work.

This is not a work of science fiction. Every single problem with the initial design was either solved during the actual project or solved within a few years by discoveries elsewhere. The ship could have been built, reasonably easily with materials and technologies available by 1965. They even built a scale model (using conventional explosives) to test the principle – it successfully flew over the White Sands missile range in western America several times. It *worked*.

Ultimately, Project Orion was killed by politics and public opinion not by physical or engineering problems. By 1963 the Age of Atomic Innocence had ended – the terror of the Cuban Missile Crisis and the prospect of a global Armageddon ensured that nuclear weapons would only ever be seen as tools of destruction. The Partial Test Ban Treaty signed in 1963 definitively ended any hope of Orion ships flying – the Treaty made it illegal to detonate nuclear weapons in the atmosphere, underwater or in space and there was no provision for “peaceful” or “scientific” detonations.

Which is a real shame. Not just for the lost dreams of mankind spreading out among the Solar System but that Orion engines would, to my mind, be a lot better use for nuclear weapons than just sitting in a silo pointing at Moscow.

Even now, half a century on when liquid-fuelled rockets are still in use but not feasible for longer missions, Orion is not being revived as a concept. Many other ideas, from ion engines, to plasma thrusters to solar sails are being considered for the next great leap into the heavens, but poor Project Orion, which could have outshone them all five decades ago is left to languish in science-fiction works and the minds of those who still dare to dream of riding a trail of nuclear fire to the stars.

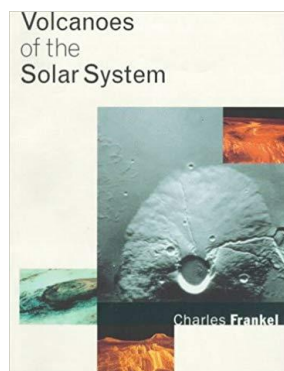


## BOOK REVIEW FROM THE LIBRARIAN

By Katrin Raynor-Evans

### **Volcanoes of the Solar System by Charles Frankel**

*To promote the Joan Thomas library further to our members, I will be writing quarterly reviews on books, which can be found in our library for the newsletter. This month's review is **Volcanoes of the Solar System**.*



Volcanoes are not just an amazing natural phenomena that happens on Earth. Planets and moons within our Solar System have similar Earth systems within their own. Frankel reminds us of this and provides us with some excellent information on the volcanic processes which have happened or are happening on Mars, the Moon, Io and the Outer moons and even Venus.

This book is more of a text book. It is clearly written and the information is presented in layman's terms (Frankel's words not mine!) which makes it a great read. There are plenty of black and white photos, diagrams and data to inform the reader on the chemical analyses of each planet or moon discussed.

The book starts by looking at Earth's volcano systems and how Earth can be used as a model for the rest of the Solar System. After all, we can learn a lot about other planets and their systems through applying what we know from our own. There is an interesting chapter on the Moon describing the Apollo landings and the samples that were taken, the experiments that were undertaken and the findings.

The following chapters on Mars, Venus, Io and the outer moons to Saturn are fascinating. It is the first book on geology that I have read concerning anything outside of Earth so it really was an interesting and thought provoking book. Frankel even takes us on a field trip around Mars which I really enjoyed.

Anyone with an interest in geology or volcanology will enjoy this book. It is clearly written and I really do think that if you think you know it all, you will still learn something from Frankel. Let's not forget, it is not only lava that is spewed from volcanoes in space. It would be interesting now given the advance in satellite imagery or the deployment of rovers on Mars for example for the book to be re-published with the inclusion of colour photographs.

## FORWARD LOOK TO 2019

### Merchandise

Our Merchandise Officer Ann Bennett along with Katrin Raynor-Evans are looking to revamp our merchandise notably t-shirts and sweatshirts. Anne successfully sold the last of our old stock at the Tim Peake day which was a great achievement and means we can now start afresh.

They are planning on asking students from the Cardiff and Vale College to work on new designs as a project for their art coursework. The students will be given a brief of what we are after and given a deadline to have their designs finished by. CAS will then look at the submissions and decide on a winner. It would be great to vote on three final designs so please keep an eye out on our webpage early next year and you could have a chance to vote! If you, our readers also have an idea for a design please do not hesitate to let Anne or Katrin know as they would love to hear from you.

### Events

As usual we have a jam packed year coming up. Our **talks** will run until the 11<sup>th</sup> July and we are excited to welcome back some guest speakers from previous years including Dr Jona Horak from Cardiff Museum and Dr Patrick Sutton from Cardiff University. We even have some 'in-house' speakers presenting talks on the *Life and Death of Stars* and the *UKMON project* which CAS are involved with. We are still keen to keep the pre-meeting discussions going. These are on an ad-hoc basis so keep an eye out on our website and social media pages. If you have an idea or need help or advice with anything astronomy related then get in touch.

We will be at Cardiff Museum again at the start of the year on Saturday 19<sup>th</sup> January taking part in the **Star Attractions Day**, which is always a great event. We will have our stand and telescopes on display. Phill Wallace, CAS Chairman will be presenting two talks; The Science of Stark Trek and Dr Who. If you would like to volunteer, we would love to have you involved so please let one of us know.

After the success of the **Solar Observing session** in Brecon, we are hoping to hold one again at the BBNP visitor centre. There will be our usual Star Parties and observing sessions at Dyffryn and we really hope to work with Dark Sky Wales again.

Perhaps our most anticipated date in our events calendar will be the **Celebration of the 50<sup>th</sup> Anniversary of the First Moon Landing**. There will be a huge event at the museum celebrating the landing and all things lunar! There will be lunar samples on loan, Buzz Aldrin memorabilia, moon maps and Ian Davies' model of a Saturn V rocket.

### Gift Aid reminder from our Treasurer

CAS is now registered for Gift Aid. This means that, if you are a UK tax payer, we can claim back the standard rate tax on subscriptions (and on any donations) paid since October 31st 2016 (giving an effective 25% boost to the amount the society has received).

However, in order to reclaim these monies, we need you to complete and sign a Gift Aid form. Please note that, if you have paid your subscriptions by PayPal, you will have already been asked if you would consent to them being Gift Aided – however we still need a completed and signed Gift Aid form in order to actually reclaim the Gift Aid.

The form is at the end of this Newsletter. If you haven't already completed a form and your subscription and/or donation is eligible to be Gift Aided (see the details on the form itself) please print the form out, complete it, and sign it. You can return completed & signed forms either at meetings, by post, or (as a scanned document) by email but they MUST have a signature to be valid.

Thank you for your help!

**DO YOU NEED THIS NEWSLETTER PRINTED?**

**PLEASE CONSIDER WHETHER YOU COULD HAVE THIS NEWSLETTER EMAILED TO YOU INSTEAD OF BEING PRINTED AND MAILED. IF YOU WOULD LIKE TO HAVE YOUR DETAILS UPDATED PLEASE LET KATH COMPTON KNOW.**