



CAS MAG

The official magazine of the Canterbury Astronomical Society

www.cas.org.nz www.facebook.com/CanterburyAstronomicalSociety

Monthly Meeting: Our Monthly Meetings are held in ER225 Ernest Rutherford Building

6.30–7.30pm - CAstronauts & Introduction to Astronomy for Beginner's

7.30 - 8pm - Refreshments

8pm - Meeting Starts

PLEASE REMEMBER TO SIGN THE ATTENDANCE BOOK AS WE STILL NEED TO KEEP A RECORD FOR CONTACT TRACING AS WELL AS USING THE NZ COVID SCAN WE HAVE AVAILABLE.

JUNE MEETING: 20th JULY 2021

DALE KERSHAW

A UPDATE ON THE TOWNSEND TEECE TELESCOPE RESTORATION

I will present a updated slideshow of the progress of the restoration,



CAS Membership Subscriptions for 2021

THIS YEARS MEMBERSHIP SUBSCRIPTIONS ARE NOW OVERDUE

Please use your name and member number as a reference when banking, then email membership@cas.org.nz to advise so payments can be matched to you correctly. **PLEASE also include any changes to your details (eg: phone, email, address)**

IT IS VERY IMPORTANT THESE DETAILS ARE KEPT UP TO DATE.

Full details are included on the last page of this newsletter.

You are also welcome to pay by cash at our monthly meetings.

NOTE: We can no longer accept cheques for payments

(If you have joined Cas in the last couple of months your membership is not due till April 2022)

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From Your Editor

This is your Casmag, for YOU our members,
So I welcome any ideas or articles you would like to share with the other members. Please email your Article or favourite photo with details so I can include it in future issues.

Deadline for each issue is 1st of each month

Remember you can have your advert added in the future casmag's,
(see page 26 for details)

Any questions, Ideas or suggestions please email to editor@cas.org.nz

Dale Kershaw

From 7.2.4.6 on page 15 of Constitution of the Society

“Any member wishing to have an article or paper published in CASMAG or other publications of the society shall in the first instance, forward a copy to the editor who may request the approval of the committee before publication.”

COMING UP IN NEXT MONTHS ISSUE

New Puzzles

Next part of A Beginners Guide to Astrophotography

CAS Calendar JULY—SEPTEMBER 2021

JULY 2021

Friday 2nd	Last Quarter
Saturday 3rd	New members training at Observatory
Saturday 10th	New Moon
	Kidsfest starts
Tuesday 13th	Committee meeting
Saturday 17th	First Quarter
Tuesday 20th	Castronauts meeting 6.30-7.30pm
	Members Meeting at University from 7.30pm
Saturday 24th	Full Moon
	Members Night at Observatory



AUGUST 2021

Saturday 7th	New Members training at Observatory
Monday 9th	New Moon
Tuesday 10th	Committee Meeting
Monday 16th	First Quarter
Tuesday 17th	Castronauts meeting 6.30-7.30pm
	Members Meeting at University from 7.30pm
Saturday 21st	Members Night at Observatory
Monday 23rd	Full Moon
Monday 30th	Last Quarter

SEPTEMBER 2021

Saturday 4th	New Members training at Observatory
Tuesday 7th	New Moon
Tuesday 14th	First Quarter
	Committee Meeting
Tuesday 21st	Full Moon
	Castronauts meeting 6.30-7.30pm
	Members Meeting at University from 7.30pm
Saturday 25th	Members Night at Observatory

PUBLIC OPEN NIGHTS

Our public open night season has started and we have managed to hold 2 Friday nights plus some Wednesday groups, We always welcome your help on these nights.

We ask all who are able to help out to advise us by using

<https://cas.ivolunteer.com/2021>

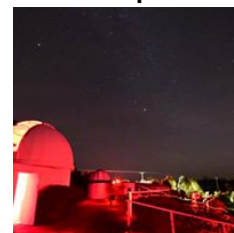
Open nights this year are set as follows:

July: 2nd, 30th (see next page for kidsfest dates)

August: 6th, 13th, 20th, 27th

September: 3rd, 10th, 17th, 24th

Any changes to Open Nights will be published on our Facebook public page and our website. Training is always available & this works towards your accreditation



UPCOMING EVENTS: 2021 Calendar:

KIDSFEST 2021

This year it runs from **Saturday 10th -Saturday 25th July**

Excluding 13th Committee Meeting Night and 20th Members Meeting

As you can see a very busy winter season for us at CAS and we ask all who are able to help out to advise us by using

<https://cas.ivolunteer.com/kidsfest>

and keep an eye out on the forums

Remember as a Paid member of Cas you are able to attend any of our events free of charge, BUT we would love you to help out as you are

able to, Training is always available to you and this works towards accreditation on the equipment.



Changes to our Monthly Observatory Nights for 2021

Some of the observant amongst you may have noticed a change to our CAS calendar, which has been updated for our winter 2021 programme.

This year to accommodate the growing number of new members we have added an additional observatory night to our programme.

Members nights are now tagged in the calendar as Training or General:

Members Nights (Training) – held on the **1st Saturday of each month** -specifically aimed at induction training and members training. We will have accredited members onsite to support training aimed at adult and kids. Session starts earlier to allow the younger members some telescope time before bed! All members are welcome to attend and bring along gear. The intention of this session is to encourage all members to become familiar with observatory scopes and encourage usage of the observatory with a focus on training our new junior members. These sessions start earlier than normal to accommodate this.

Members Nights (General) – held on the Saturday following our Tuesday members meeting 'Free for All' – no specific training planned – All members welcome to bring along gear or use CAS gear if accredited or accredited members are in attendance.

Members nights are a great time to get out and enjoy a night under the stars at the observatory and do a little socialising. Many members bring out their dinner and enjoy that on the terraces before dark. Come out stay a while or stay all night, the observatory is warm and you can dip in and out all night as you like.

Reminder: Our members nights at the observatory go ahead regardless of the weather!

Enquiries regarding members nights can be posted on the CAS Members forum:

<https://cas.org.nz/forums/forum/canterbury-astronomical-society-forums/cas-members>

Changes to UC Members Meetings

(3rd Tuesday each month)

From March onwards there are some changes to the members meetings at the UC to accommodate the new CAStroNauts kids and beginners to astronomy programme:

6.30pm – 7.30pm	CAStroNauts & Introduction to Astronomy for beginner's session.
7.30pm – 8pm	Tea/Coffee Break.
8pm – 9pm	Normal CAS members meeting, general business and talk by Our Guest Speaker

The earlier session is designed for our newcomers to astronomy and our kids CAStroNaut programme and content will be pitched at this level.

More seasoned astronomers are requested to join the 8-9pm session as spaces are limited.

Enquires about the CAStroNaut and beginner's session should be sent to the CAS Vice President, Simon Lewis, at vice-president@cas.org.nz

General information on our UC members nights and lecture topic will be posted in the CASMAG and on our CAS website

MONTHLY MEETINGS:

Meeting Venue:

**Room ER 225 in the Ernest Rutherford Building, University of Canterbury,
(1 building over from the east building we used last year)
Entrance to the building will be via the north side entrance,
Then using the lift or stairs up to level 2**

Carol McAlavey is asking you, our members to make suggestions or offer to give a talk at our monthly meetings.

PLEASE CONTACT CAROL WITH YOUR SUGGESTIONS OR IF YOU CAN GIVE A TALK via **member2@cas.org.nz**

Upcoming Members Meetings

20th July: Dale Kershaw

Progress update on Townsend Teece Telescope

17th August: Soapbox

21st September: Antonio Herrera Martin

Postdoc working under Prof Micheal Albrow

"Gravitational Lensing as a Astronomical Tool"

19th October: John Pickering

Topic TBA

16th November: Simon Lewis

"Interpreting Astronomical Images"

(correct as at 1st July 2021, Subject to change as required)

Many thanks go to Sharlene Wilson and Orlon Petterson from the School of Physical and Chemical Sciences, University of Canterbury for arranging the meeting room for CAS this year.

Also Thanks to Associate Professor Karen Pollard for organising the Lecture theatres for our public talks

PLEASE Remember we are only able to hold our meetings at the University at Covid-19 Level 1

We will update the website if there are any changes and will host meetings via ZOOM if possible:

CAS YOUTUBE CHANNEL

Have a look at our new you tube channel

<https://www.youtube.com/channel/UChLhFm7yaLUTlgH3IjvA11g>

WELCOME TO OUR NEW MEMBERS:

A warm welcome to our new members, We look forward to meeting you at our meetings and/or events,

Please make yourselves known to others.

We like to welcome our new members here after the membership is accepted by the committee at the meeting following memberships are received.

Welcome to:

Sharon Hayward

Ella & Deirdre Hart

Peter Wilde

Chris Henderson

Michael Ivonof

(Apologies if your name is not spelled correctly, ED)



It is always great to see our new members coming along to our Members Meetings, Members Nights and Events.

CASMAG PUZZLE PAGE

Saturn

1. Saturn is tilted on its _____, which occasionally makes the rings disappear
2. The largest gap in the rings is called the _____ division
3. The second largest division in the rings is the _____ division
4. The _____ probe will be dropped on to the surface of Titan
5. The moon _____ has a bright side and a dark side
6. The moon _____ has a very large impact crater
7. Saturn's high rotation speed makes it _____ at its equator
8. Saturn is the _____ largest planet
9. Saturn is the _____ planet from the Sun
10. A day on Saturn is a little over ___ hours long
11. Saturn has at least _____ moons
12. The moon _____ has a very thick atmosphere
13. Saturn is lighter than _____

Saturn

P	S	K	A	S	W	A	W	I	L
T	H	I	R	T	Y	A	X	I	S
M	A	U	X	C	T	I	T	A	N
R	I	R	Y	T	D	N	E	E	F
S	S	M	T	G	H	W	N	A	R
D	E	I	A	P	E	T	U	S	E
C	C	A	S	S	I	N	I	D	T
A	O	B	L	A	T	E	S	H	J
E	N	C	K	E	D	U	R	O	R
H	D	Y	S	I	Q	C	A	V	Q

CAS 2022 CALENDAR

Your committee has decided to create a “CAS 2022 Calendar” to sell as a Fundraiser,

We are asking for our members to submit any photos they would like to be considered for this publication.

Full credit will be given to you as who took the photo and with any details re equipment used.

If you have a photo or 2 you would like to be considered for this publication please post on the website using

- * **MY GALLERY**
- * **select Post Image**
- * **Select Calendar 2022 and up load your image**



You are submitting on the understanding that images may be selected for publication in our calendar - IP remains the ownership of the author

TABLE OF SOUTHERN METEOR SHOWERS 2021

Shower	Dates		Moon	Peak Rate	RA	Dec	Near Star
	Active	Peak	2021				
Centaurids	Jan 28 - Feb 21	Feb 8	3 days after Last quarter	5 (-25)	14.1	-59	β Cen
gamma-Normids	Feb 25 - Mar 22	Mar 13	New moon	8	16.6	-51	γ Nor
pi-Puppids	Apr 15 - Apr 28	Apr 23	3 days after First quarter	var to 40	7.3	-45	σ Pup
eta-Aquariads	Apr 19 - May 28	May 5	1 day after Last quarter	60	22.5	-1	η Aqr
Pisces Austrinids	Jul 15 - Aug 10	Jul 27	3 days after Full moon	5	22.7	-30	α PsA
alpha-Capricornids	Jul 3 - Aug 15	Jul 30	2 days before Last quarter	4	20.5	-10	α Cap
Southern delta-Aquarids	Jul 15 - Aug 25	Jul 27	5 days before Last quarter	20	22.6	-16	δ Aqr
Southern iota-Aquarids	Jul 25 - Aug 15	Aug 4	3 days after Last quarter	2	22.3	-15	ι Aqr
Northern delta-Aquarids	Jul 15 - Aug 25	Aug 13	3 days before First quarter	4	22.3	-5	θ Aqr
Northern iota-Aquarids	Aug 11 - Aug 31	Aug 19	3 days after First quarter	3	21.8	-6	β Aqr
Piscids	Sep 1 - Sep 30	Sep 19	2 days before Full moon	3	0.3	-1	λ Psc
Orionids	Oct 2 - Nov 7	Oct 21	Full moon	20	6.3	+16	γ Gem
Leonids	Nov 14 - Nov 21	Nov 17	2 days before Full moon	100+	10.2	+22	γ Leo
alpha-Monocerotids	Nov 15 - Nov 25	Nov 22	3 days after Full moon	var to 5	7.9	+1	δ Mon
Pheonids	Nov 28 - Dec 9	Dec 6	2 days after New moon	var	1.2	+53	Achernar
Geminids	Dec 7 - Dec 14	Dec 14	3 days after First quarter	120	7.3	+33	Castor

OBITUARY FOR MALCOLM FLAIN

We were very saddened to hear that Malcolm Flain passed away on June 17th 2021 at Christchurch Hospital, in his 83rd year.

The following tributes are from several members with their own memories of Malcolm

Carol McAlavey

Malcolm has been an integral part of the Canterbury Astronomical Society for nearly twenty years and in that time, our Society, and many members, have taken advantage of his freely-given expertise in all things optics and telescopes. His knowledge was legendary and he made sure that he passed on that knowledge to everyone.

He was particularly fond of passing on that knowledge to new members and young budding astronomers.

I could always count on him for a talk or two during Soapbox, and even a few monthly talks, which were always well-received. He turned up on most members' nights and Society milestones and his presence was always welcomed by all. His humour was a big part of him that was appreciated by many.

He will leave a huge gap in our CAS family and will be sorely missed by all.

I and many CAS members will miss him dearly.

Ray Pointon

In September 2017 I went to a Tuesday CAS meeting for the first time. Sitting outside the room in the Biology block of the university Malcolm was waiting for the meeting to start.

I sat next to him and said I was interested in buying a telescope. After some discussion he invited me to his place to view a few scopes. There were many! It was clear that I wanted a wide field refractor. He mentioned that Peter Wilde in Palmerston North was selling a 120mm F5 similar to his. This I duly bought.

I enjoyed a number of visits to Malcolm's home where we discussed optics, telescopes astronomy and many other things! He was a good intelligent conversationist and hours could slip by with topics ranging from Physics, biology to Politics.

He kept the optics in his telescopes spotless, was very inventive in designing and making bits and pieces for them, and collected many optical components. I was very impressed with his pair of right-angle binoculars so much so I copied the design using old binoculars I had and some 3D printing using the printer in Medical Physics where I worked.

The picture Shows Malcolm holding his and my right-angle binoculars.

Another instrument with wow factor was his 9 Inch F4 refractor housed in an old speaker box. He took it to the 2021 Star-date. The view was amazing.

I will miss Malcolm's expertise and experience with telescopes and astronomy, and good humour and thoughtful conversations.



OBITUARY FOR MALCOLM FLAIN

Tributes cont

Heather Skinner

Malcolm

I knew Malcolm for many years, and when I think of him, I always remember his big smile. He was ill for a long time, but, got on with life and lived the best he could and enjoyed as much as he could. He was a sort of a gadget-man, and he worked things out re. his astro equipment and got them to work best that suited himself.

I remember years ago;

I went to his place so he could give my bino a good clean.

His house, what I saw of it,

-the kitchen and dining room was an Aladdin's cave full of scopes, binos eye-pieces and bits of astro stuff; I loved it.

It reminded me of my dad's radio-shack many years ago, full of precious 'bits'..

He was part of CAS, and there is something 'missing' by not seeing his smiley face there amongst us, sharing his points of view on something...

We miss you Malcolm. It was good to share time with you...

From Heather...

Dale Kershaw

When Graeme and myself rejoined/joined Cas back in 2012-2013, One of the 1st persons we spoke with was Malcolm at the 1st meeting along with the other cas members.

He was always at the Cas meetings and various events. He was very willing to help out as needed and I could always rely on him to do as he had offered to do, or had been assigned to do.

He loved to share his knowledge and advise with all.

He was a very active member of the society and was also a committee member several times since he joined in September 2002 the last time being 2018-2019.

The following is a copy of his Bio in the April 2019 CASMAG introducing him to the members:

Malcolm was gifted a 25mm collapsible telescope at 8 years of age and the interest has grown ever since.

He has been a member of Cas for many many years, and has served on the committee several times, Malcolm has built several scopes and helped others with their own builds, as well as repairing Cas scopes



NOTES FROM YOUR COMMITTEE

SIGNING IN WHEN YOU ARE AT THE OBSERVATORY

Please remember to sign in the book on the table in the Lodge whenever you are out at the observatory, This helps give us an idea of who has been using the equipment etc, even if you are out there to do gardening or the like PLEASE SIGN THE BOOK and add what you have been doing,

Also please note and issues that have happened or that need fixing, and its good to follow that up with a email or phone call to Terry or the committee

CAS COFFEE MUGS & PENS

With our new logo we have had Coffee Mugs printed and also Pens which we have for sale to our members,

Coffee Mugs are \$15.00 each

Pens are also available to members

Waterproof Stickers with our new logo are also available

Payment can be cash or bank deposit

They are available from Editor (Dale),
contact via editor @cas.org.nz
or 0272426376



OBSERVATORY NEWS IMPORTANT INFORMATION

DOOR CODE & ALARM AT THE OBSERVATORY

The door code and Alarm code has been changed since our March AGM
Ask a committee member for the passwords.

INTERNET WI-FI:

Ask a committee member for the password

LASER POINTERS:

There is a legal requirement when importing them, and information is on our website and at the observatory, CAS has a drafted a set of guidelines which we were presented at our AGM and were voted and added to our By-Laws, If you need a letter confirming your membership for your application, please contact either membership secretary or secretary, (This letter will state you are a current financial member of our society)

ACCREDITATION

A reminder that unless you have full accreditation on the equipment you are not to use the equipment unless there is an accredited person with you.

Full training is available

contact Terry (our Observatory directory via his email listed on our website or page 26 in this casmag

CAS 2021 BBQ & BONFIRE PHOTOS

The CAS annual Mid-Winter BBQ & Bonfire was held on 19th June 2021, It was great to see lots of members there, Lots of food to share and eat, Our BBQ master chief was Simon, and he did a fantastic job, Terry assisted by Kieran then set about to light the huge bon-fire pile, after several attempts (assisted by some extra accelerant) to get it burning, due to the heavy rain we had had in the last couple of weeks they were very successful,

Later when the fire was well alight we had marshmallows for all to toast,

which everyone enjoyed.
Dale Kershaw.
*Photos submitted by Cameron McEwing,
Dale Kershaw*



CAS 2021 BBQ & BONFIRE PHOTOS cont



OBSERVATORY NEWS **IMPORTANT INFORMATION**

New Security System in Lodge

We are trialling a new security system in the Lodge. This takes the form of an intrusion sensor outside, and a Wifi cam inside the lodge in the back corner at the car park end. The intention is to add another camera outside the lodge overlooking the car park area. The advantage of these is that they will trigger on intrusion alert and can be viewed remotely in real time or reviewed within 2 weeks. These are not for the purpose of watching people, but rather to check that entry to the lodge is by legitimate members. Given the assets we have on site, this is necessary for any insurance claims. Access to these cameras is limited to Webmaster, Vice President and Observatory director only. We already have a surveillance network installed (several years ago) which records to a hard drive but cannot be remotely viewed in real time.

If anybody needs to know more please feel free to email me
observatory.director@cas.org.nz
Terry Richardson

SECURITY FOR OBSERVATORY KEYS- Accredited Members

Committee have decided that we need improved security for access to the observatory equipment. From now all keys are stored in a lock box in the library. Any accredited member will be given the combination (just ask me). This includes the key to the equipment room and for the dobs. Although the dobs do not require formal accreditation, they are precision instruments that can be damaged if not used correctly. A member accredited on any of the scopes can open these for you. Members still have free access to the lodge and its facilities, but any other access will require an accredited person to be present. Any accredited member can get access to the keys, but of course can only use (or supervise) the instrument they are accredited for. This sounds a bit restrictive, but has become necessary due to recent misuse and possible damage to some instruments.

Any questions please email me
observatory.director@cas.org.nz
Terry Richardson



SOUTHLAND ASTROMANY STARDATE 2021

Notes from Dale Kershaw

This was the first time Southland Astronomy held a Stardate Weekend on 11,12 &13th June 2021,

The event was held at Southland Astronomical Society's Oreti Sands Clubrooms, 254 Links Road at Sandy Point, Invercargill.

It was great to see that other CAS members attending along with folks from all over the South Island.

Friday started with registration starting at 1 pm and a meet and greet from 4 pm at Oreti Sands. Amie Young from Great South gave a talk about Dark Sky projects in and around Southland at 6.30 pm.

At 7 pm, guest speaker Dr Stephen Voss talked about the workflow using the Mount John Observatory for Deep Sky Photography.

Saturday morning started with a bus trip to the Awarua Satellite Tracking Facility and Radio Communications Museum.

Saturday afternoon was to start at 2 pm with "Fun with Science" presented by Amadeo Enriquez-Ballester. This was also open to the public

Due to some travelling issues (From Dunedin) and a puncture it started late but was well worth the wait. The Kids and adults loved using the solar scope to look at the sun while waiting

The food caravan and coffee truck were very popular with some very tasty food on offer Saturday evening began at 6 pm, with Assoc Professor Karen Pollard giving her talk about the Life and Death of Stars -

The Life Cycle of Stars in our Galaxy and Research at the University of Canterbury Mt John Observatory.

This was followed by some great observing using some society scopes and those who brought their own,

Sunday began at 10 am at Oreti Sands with a group photo of all available attendees.

This will be followed up by special guests Damien McNamara and Steve Butler will be discussing Light Pollution and Dark Skies. Followed by Dale Kershaw with an update and slideshow of the progress of the Townsend Teece Telescope restoration.

It was a fantastic weekend and well organized by all involved, Looks like this will happen every 2 years, Good luck to Southland Astro for future events.



Left: The Registration Desk

*Below:
All ready for the talks*



SOUTHLAND ASTROMANY STARDATE 2021 cont



*Photos from: Dale Kershaw, Rob Glassey
& Southland Astronomy Facebook Page*



*Above: Displays at the
Communications Museum.
Below: Awarua Satellite Tracking
Facility*



*Left: Telescopes set up and the Night Sky
on the Saturday Night*

SOUTHLAND ASTROMANY STARDATE 2021 cont



*Left: Ron Paine and his Solar Scope was very popular.
Below: Your Editor having Liquid Nitrogen poured over her arm.
(No it did not hurt)*



Fun with Science:

Amadeo Enriquez-Ballesteros showed us heaps of fun with Liquid Nitrogen, including dropping cheesiness into it then popping them in your mouth and crunching it quickly,



Then lighting Hydrogen Bubbles in Soapy water



[A Beginners Guide to Astrophotography – Part 2](#)

Simon Lewis – CAS Vice President

Welcome to Part 2

In part one of our series “A Beginners Guide to Astrophotography” we looked at the basics of our imaging systems, some of the key components used and started to piece together what our sensors are doing when collecting the light from the night sky and the process of how they turn this into usable data.

This understanding will really help you as we move forward into the intricacies of imaging and post processing. But do not worry, we will continue in small steps before we get into the complicated world of image processing!

In part two of this series, we are going to explore some more about what our sensors are doing inside our cameras. These basics will help you understand how we choose cameras to suit certain telescopes and imaging targets.

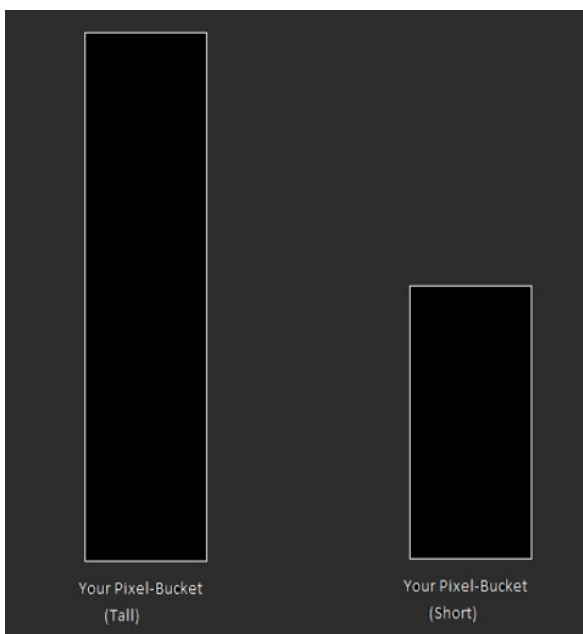
Sensor Basics – Well Depth

As you wander through the adverts for astronomy cameras you will notice a recurring set of specifications that define our sensors. We have already spoken about some of these, which are more related to the physical size of the sensor, its pixel density and pixel size, but there are several important characteristics that we need to consider in correctly choosing an astrophotography sensor.

One of these terms is Well depth. This is an important specification to consider particularly for cameras designed for long exposures.

This electrical specification refers to ‘how much’ light can be stored in each pixel.

If you recall our pixels carry an analogy of a bucket capturing water. Like all buckets they have different capacities and an easy way to distinguish between different buckets is the variation of the physical size of the bucket. A common difference is how deep is our bucket?



Even if the opening at the top of the bucket remains the same, there can be a difference in how deep it is and this affects the amount of water that the bucket can hold. A deep bucket has a bigger capacity before it is full. This is the exact same with light hitting pixels in our camera and is commonly called the “well-depth” of the pixel and refers to how many electrons it can carry before it can’t register any more.

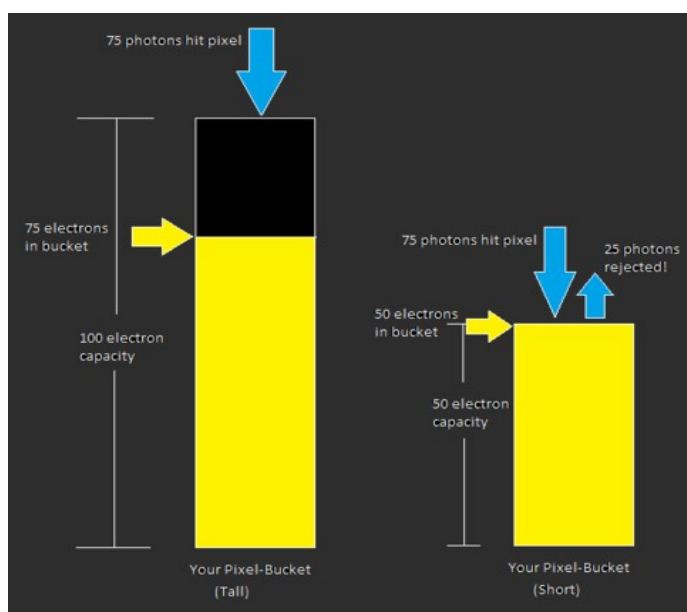
Cont next page

[A Beginners Guide to Astrophotography – Part 2 cont](#)

Once a pixel-bucket is full, it cannot hold any more electrons, and so any further incoming photons are ignored. There are some subtle differences here depending on the technology.

On older model CCDs, any extra photons would bleed over into adjacent pixels, called blooming, causing all sorts of bleeding over lines and general causing issues when over exposed. Modern CCDs have anti-blooming gates to help prevent this effect.

CMOS sensors do not suffer from this effect and the pixels do not transfer charge to one another, so additional incoming photons beyond a full well value are lost, like water overflowing the lip of the bucket. This is commonly called “saturated” or “blown out” and is something to avoid in astrophotography. Every photon is precious to us and if our bucket is full and rejecting further electrons then we are losing data and not representing fine differences in detail or brightness.



Imagine that the full-well depth value on our tall pixel-bucket is 100 electrons and the full-well depth value on our short pixel-bucket is 50 electrons.

Now assume that everything else remains constant in this example (such as noise amounts, gain/ISO settings, exposure length, focal length and aperture, and that our buckets capture every photon) and over a particular amount of time 75 photons hit each of our pixel buckets.

The result would be that our tall bucket captured all of them, while the short bucket captured 50, was then full, and the remaining 25 were rejected.

Now, with our well depth reached we have lost data and have a saturated/blown-out pixel. The way we could have avoided this is to have used a shorter exposure.

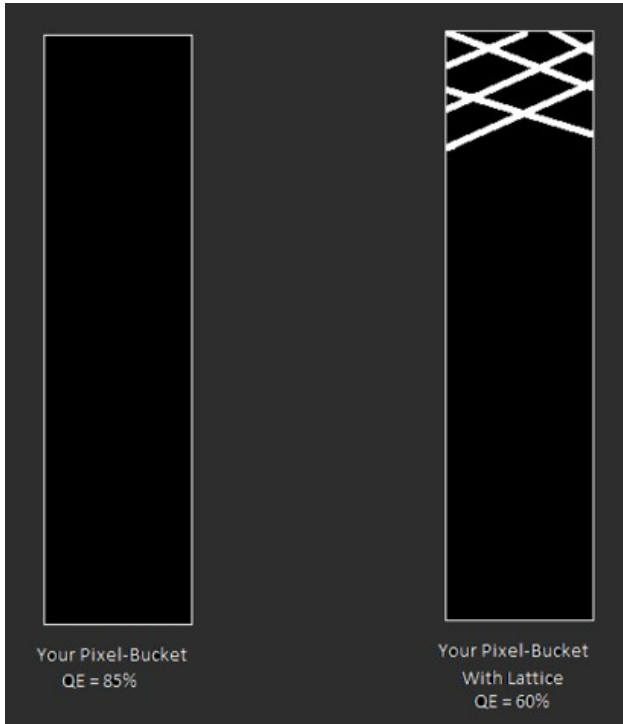
The practical result in differences of well depth (all other aspects of our setup being equal) is that deeper wells allow us to gather more photons for each frame, which means we can have longer exposures, and longer exposures improve our signal to noise ratio, as well as shortening integration times when it comes to post processing.

Cont next page

[A Beginners Guide to Astrophotography – Part 2 cont](#)

Sensor Basics – Well Depth

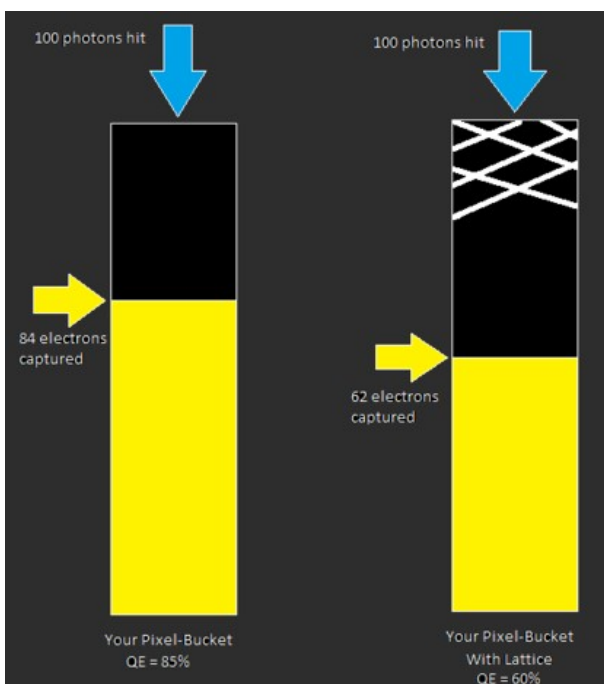
There is another important physical characteristic of our sensors that are different between various cameras and that is the efficiency with which our Sensor gathers incoming photons. This is called the *Quantum Efficiency* (QE) of the sensor.



Don't let the big term worry you any. This is just the rate at which a pixel captures incoming photons, on average, as a percentage. It is unfortunately not the case that our sensors pixels catch every photon that hits it. Some are just lost and that is just how things work with electronics!

The QE of a sensor is a fixed value that depends on the sensor manufacturer's design choices and chip technology. Some sensor designs are more efficient than others due to the physical construction and that is one characteristic you can look at when choosing your equipment. Let's look at our handy bucket in the rain analogy again.

Imagine that for stability purposes, one bucket manufacturer chose to install a lattice over its opening. This would result in the bucket not gathering every raindrop that would fall over its opening: some raindrops would hit the lattice and get dispersed, bounce out, or otherwise just not get collected by the bucket.



The Quantum Efficiency is averaged out over the entire sensor and is the chance that a photon will be captured and converted to an electron. The outcome of this is that there is a variation of the actual number of photons captured between different frames of the same object. Let's suppose for simplicity that for a given image 100 photons hit a particular pixel-bucket. If we again keep everything else constant in our system and image the same target over two different frames, then in the first frame, our pixel might have captured 83 of the photons, and in the second frame our pixel might have captured 87 of the photons,

thus averaging out to 85% efficiency.

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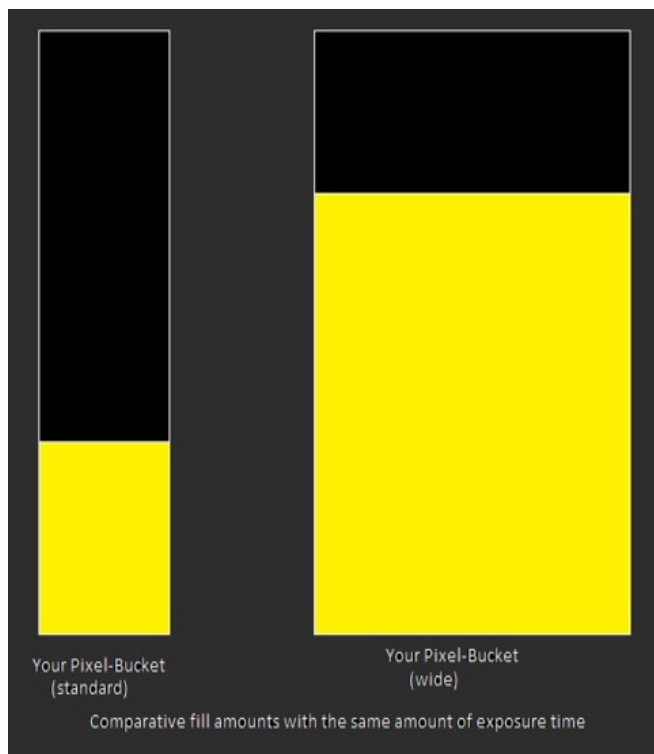
[A Beginners Guide to Astrophotography – Part 2 cont](#)

There is no way to increase (nor decrease) the sensitivity of your camera sensor. This value is a fixed value based on the sensor type and manufacturer. Increasing the ISO or the gain setting on your camera does not increase the sensitivity. This is a common misconception shared on many of the Internet astrophotography sites. Just remember - altering the ISO or the Gain setting *does nothing to the sensitivity of your sensor*. The sensitivity is nothing other than the QE value and is fixed. All of the major astro camera manufactures will show the main characteristics of their models and you can compare this on paper to choose the right one for your scope.

Sensor Basics – Pixel Size

The final physical feature that I want to cover off this time round is pixel size.

So, we discussed that our well depth (or depth of our bucket) allows us to collect more photons but, we could also alter the diameter of the opening of the bucket to collect more raindrops.



This has two different effects for purposes of astrophotography. If we have a bucket with the same depth but a larger opening, then the first result is that it will fill up faster; there will be more raindrops that make it into the bucket for the same amount of time (a slight *difference* here between our pixels and the bucket is that a larger bucket has a higher volume capacity, while a pixel that is larger in area can have the same well-depth, and so hold the same quantity of electrons while more photons hit the pixel).

This is what allows a larger pixel to fill quicker. The other result is that a larger bucket results in a lower

resolution of a mapping of the amount of rainfall hitting a given area.

Imagine it this way: if you have a larger area opening on the bucket, then in exchange for gathering more total water, the fine differences in the amount of rainfall in different areas *within* the bucket itself is lost.

If you have smaller and smaller sized bucket openings, then this resolution is regained, and you can measure the differences in the amount of rainfall on smaller and smaller scales on the lawn.

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If a bucket has a 300mm opening, then you will be able to measure the amount of rainfall that fell over every 300mm of area on the lawn. But if a bucket has a 30mm opening, then the total volume of water gathered in each bucket will be less, but you will be able to measure the differences in rainfall that fell over every 3" of area on the lawn.



This would also allow you to measure any *differences* in the amount of rainfall *within* that 300mm bucket that would otherwise all get gathered into a single measurement.

All of this is exactly the same in regard to your pixel size and incoming photons.

The larger the pixel size, the faster you can gather light but at the cost of not having as much fine detail and picking out variations in light intensity of your object.

The smaller the pixel size, the slower each pixel will gather light, but you gain fine detail and can pick out smaller variations in light intensity of your object.

There are some very good reasons why you choose a particular pixel size over another and we will cover that off next time round.

Sensor Basics – Wrap Up

- * Pixels gather incoming photons and convert them to electrons to convert to an image
- * Larger well-depth allows you to catch more photons in each image
- * There are trade-offs with larger or smaller pixel sizes
- * Aim for as much QE as you can find

There is plenty more ground to cover with our bucket and pixel analogy. In future chapters we will cover focal ratio effects, gain and ISO effects along with what is really happening with the ADC, how to handle things that you don't want in your bucket, and recommendations to match some cameras to your imaging setup.

Stay tuned for the further parts of this series. Good luck out there with your buckets!

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[A Beginners Guide to Astrophotography – Part 2 cont](#)

Homework

In this chapter we covered off some more basics of the sensors in our astronomy cameras such as pixel sizes and their efficiency. Let's put that into practise and see if you might be able to guess how these relate to the real world.

Here are three modern CMOS astrophotography cameras available on the market.

<https://astronomy-imaging-camera.com/product-category/dso-cameras>

		
ASI2600MM – APSC Mono Sensor: SONY IMX571 APS-C CMOS Diagonal: 28.3mm Image area: 23.5 x 17.5mm Resolution: 26 Mega Pixel - 6248*4176 Pixel Size: 3.76µm Read Noise: 1.0-3.3e QE peak: 91% Full well: 50000e	ASI1600MM Pro Sensor: Panasonic MN34230 - 4/3" CMOS Diagonal: 22.2mm Image area: 17.7 x 13.4 mm Resolution: 16Mega Pixels - 4656×3520 Pixel Size: 3.8µm Read Noise: 1.2-3.6e QE peak: 60% Full well: 20000e	ASI2400MM Pro Sensor: Sony IMX410 Full Frame CMOS Diagonal: 43.3mm Image area: 36 x 24 mm Resolution: 24 Mega Pixels - 6072×4042 Pixel Size: 5.94µm Read Noise: 1.1-6.4e QE peak: 80% Full well: 100000e

Using the information in Chapter 1 and 2 can you answer the following questions?

1. Of all three cameras, which one has the biggest sensor area?
2. Which camera has the smallest pixels?
3. Comparing well depths, and keeping all aspects of the imaging train the same and the exposure/gains the same, which camera could you expose for longest without saturating the sensor?
4. Which camera sensor is the most sensitive?
5. Comparing read noise – which camera has the lowest read noise?

Bonus question!

Comparing the ASI2600mm and 1600mm QE figures, these two cameras have similar pixel sizes but a large variance in efficiency values. How would this affect your imaging time and data capture rates?

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Answers

1. ASI2400MM is a full frame sensor and the largest sensor of the three
2. ASI2600MM – 3.76um pixel size
3. ASI2400 has a well depth of 100000 and able to run the longest exposure before saturation
4. ASI2600MM – QE value of 91%
5. ASI2600MM has the lowest read noise

Bonus question:

The ASI2600 has a QE value of 91% vs the ASI1600 which has a QE of 60%. This is a delta of 30%. That means for the same exposure length, gain and scope focal length and focal ratio, the 2600 will capture 30% more light than the 1600. That means for the same image outcome you could image for 30% shorter time and get the same result – means a big saving in the number of hours required and the change to image multiple targets in a shorter space of time.

Don't Forget - Competition Time

During this winter season we invite you to get out and take your first astro images. At the end of the season in October we will judge the entries and award some prizes for best adult and junior member's image.

This competition is only for newcomers not yet imaging or only just starting imaging.

Images may be submitted by logging into the website. Follow the My Gallery menu drop down found on the My Account tab. Use the Post Image button and choose Competition as the gallery type.

Reminder - CAS Calendar Image Submission

For the old hands our calendar submission is already open for entries.

You can go to the CAS site and submit your entries. We will select the best images in August and the top 12 will appear as image of the month on next year's calendar. Lucky winners will each receive a calendar as a prize.

Images may be submitted by logging into the website. Follow the My Gallery menu drop down found on the My Account tab. Use the Post Image button and choose Calendar 2021 as the gallery type.

Three bright planets are in the evening sky at the beginning of August. Brilliant silver **Venus** appears in the northwest soon after sunset. On the opposite side of the sky golden **Jupiter** appears, low in the east. As the sky darkens **Saturn** appears above Jupiter. After Venus sets Jupiter is the brightest 'star' in the sky.

In the second half of August **Mercury** moves up in the twilight toward Venus. (Mercury isn't shown on the chart.) On the evening of the 19th Mercury will be just a third of a full-moon diameter above Mars, but you will probably need binoculars to see Mars in the twilight. (It isn't on the chart, either.) By the end of August Mercury will be a lone bright 'star' below Venus, beginning its best evening-sky showing of the year. At the end of the month Mercury is setting two hours after the sun and Venus 3½ hours after the Sun. So Venus will be the brilliant 'evening star' in the dark night sky. It is bright enough to cast shadows in dark locations. The Moon will be near Venus on the 11th.

Bright stars are widely scattered over the sky. **Vega** on the north skyline is balanced by **Canopus** low in the south. Canopus twinkles with all colours as its white light is broken up by the air. So does Vega but, being fainter, it's not so obvious. Orange **Arcturus** is in the northwest, twinkling red and green as it sets. North of the zenith is a fainter orange star, Antares. The Southern Cross, **Crux**, and the Pointers are midway down the southwest sky. The Milky Way spans the sky from northeast to southwest.

Jupiter and **Saturn** move up the sky through the night. By midnight they are north of overhead. By dawn the two planets are low in the western sky. Jupiter and Saturn are both well placed for evening viewing in a telescope. Any small telescope will show the four 'Galilean' moons of Jupiter, though not all four are always seen. They can disappear behind Jupiter or hide in its shadow. Also they aren't easily seen when passing in front of Jupiter. Sometimes the shadow of one of the moons crosses Jupiter, making a tiny black dot on the planet. Saturn's ring is visible in any telescope magnifying 20x or more. Its biggest moon, Titan, is four ring-diameters from the planet. Big telescopes show other moons looking like faint stars closer in than Titan. Jupiter is at its closest this month, 600 million km away. Saturn 1340 million km away. The Moon will be above Saturn on the 20th, between the two planets on the 21st, and near Jupiter on the 22nd.

Midway down the southwest sky 'The Pointers', Beta and **Alpha Centauri**, point down and rightward to **Crux** the Southern Cross. Alpha Centauri is the third brightest star in the sky (planets not counted) and the closest of the naked eye stars, 4.3 light years* away. Beta Centauri, like most of the stars in Crux, is a blue-giant star hundreds of light years away and thousands of times brighter than the sun.

Antares marks the body of the Scorpion. The Scorpion's tail hooks around the zenith like a back-to-front question mark. Antares and the tail make the 'fish-hook of Maui' in Maori star lore. Antares is a red giant star: 600 light years away and 19 000 times brighter than the sun. Below or right of the Scorpion's tail is 'the teapot' made by the brightest stars of **Sagittarius**. It is upside down in our southern hemisphere view.

The **Milky Way** is brightest and broadest overhead in Scorpius and Sagittarius. In a dark sky it can be traced down past the Pointers and Crux into the southwest. To the northeast it passes Altair, meeting the skyline right of Vega. The Milky Way is our edgewise view of the galaxy, the pancake of billions of stars of which the sun is just one. The thick hub of the galaxy, 30 000 light years away, is in Sagittarius. The actual centre is hidden by dust clouds in space. The nearer dust clouds appear as gaps and slots in the Milky Way. Binoculars show many clusters of stars and some glowing gas clouds in the Milky Way.

The Large and Small Clouds of Magellan **LMC** and **SMC** look like two misty patches of light low in the south, easily seen by eye on a dark moonless night. They are galaxies like our Milky Way but much smaller. The LMC is about 160 000 light years away; the SMC about 200 000 light years away.

*A **light year (l.y.)** is the distance that light travels in one year: nearly 10 million million km or 10^{13} km. Sunlight takes eight minutes to get here; moonlight about one second. Sunlight reaches Neptune, the outermost major planet, in four hours. It takes four years to reach the nearest star, Alpha Centauri.

CAS COMMITTEE AND OFFICERS 2021/2022

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Canterbury Astronomical Society Facebook Group:

www.facebook.com/groups/CanterburyAstronomicalSociety

West Melton Observatory: 43° 29' 55.5" S, 172° 20' 59.0" E 218 Bells Road, West Melton

CAS Members Meetings:

The *CAS monthly members* meetings are currently held from 7.30pm onwards every third Tuesday of the month (except December and January) at the University of Canterbury, Room ER225 Ernest Rutherford Building (2nd floor)

CAStronauts Meeting's are 6.30-7.30, in the same venue on the same night (3rd Tuesday of the month)

Any member of the public who is considering in joining the society are most welcome to attend the meetings.

Members Nights at the Observatory are detailed on our website

Observatory Members Nights:

Cas holds these nights as follows

Members Nights (Training) on the 1st Saturday of the month

Members Nights (General) on the 3rd Saturday of the month after the Tuesday Members meeting at UC, (be aware some months it is the 4th Saturday, depending on the start of the month) check the website for details

CAS on Facebook:

Cas has a Facebook presence, Useful to keep up to date with events, interesting articles, asking for advice, For members please use the website forums for more detailed information etc

CAS Membership:

Subscriptions are due 1st April each year

Fees for current members shown on the membership form included on the back page of your Casmag,

Full details are included on our website.

Contributions to CASMAG:

Member contributions to CASMAG are always most welcome (letters, observing notes, articles, news)

Please submit articles by email to editor@cas.org.nz

The deadline for each issue is the 1st of each month

Small personal advertisements are free to financial members, (less than 8 lines in a column)

Charges for larger items range from \$5 to \$40, email the editor for more details.

The Constitution of The Canterbury Astronomical Society Inc:

This is available on request, Please ask for a copy if required

DISCLAIMER:

This newsletter is for general information purposes only. The views expressed herein are not necessarily those of the Canterbury Astronomical Society Inc (CAS)

CAS has taken all reasonable measures to ensure that the material contained herein is correct, but gives no warranty for, and accepts no responsibility for its accuracy or completeness.

Readers are advised not to rely solely on this information, and should seek independent advice before making any decision, CAS reserves the right to make changes at any time, as deemed necessary.

Canterbury Astronomical Society Inc

APPLICATION FOR MEMBERSHIP

To: Membership Secretary
 Canterbury Astronomical Society Inc.
 P.O.Box 25-137
 City East
 Christchurch 8141



Applicants Name in Full _____

Address: (Note a P.O.Box is NOT a legal address) _____

Home Phone: _____ Cell Phone: _____

Email: _____ Date of Birth: (if under 18) _____

Membership Category (*tick, subscription must accompany application*)

Online Banking Details (Please identify your payment): 03 0802 0098273 00

☐	Adult (any person 18years of age or over who is not eligible for any other category)	Full
☐	Family (two or more persons living at the same address)	\$70
☐	Junior (under 18 years of age on 1st April in the current year)	\$105
☐	Senior (over 65 Years)	\$35
☐	Community Services Card Holder	\$35
☐	Student (any person studying full-time at a tertiary institution, must reapply annually)	\$35
☐	Corporate (members have voting rights of one member, but cannot take office)	\$210

Name:	Date of Birth(if Under 18yrs)	Signature

All CAS members receive CASMAG a monthly newsletter,

Do you have access to a telescope? What type and size? _____

I the undersigned declare that the information given herein is true.

Signature: _____ Date: _____

By signing this application the applicant agrees to comply with the Constitution and By-Laws of the Canterbury Astronomical Society Inc.

Date Approved: _____