PRIME focus
MAS SOCIETY JOURNAL

macarthur astronomical society

Image Credit: Chris Malikoff
VLT - Cerro Paranal, Antofagasta, Chile
2,635 m (8,645 ft)f

june 2020
volume 20 issue 03

contents

from the editor

Hello, and welcome back to our re-booted PRIMEfocus. M.A.S. presents to you our June 2020 edition - volume 20, edition 3. In this edition, we continue to enjoy contributions from several new contributors. For their time and effort, we thank them sincerely.

To those of you who are connected to M.A.S. via our website, FaceBook group, Twitter or elsewhere, welcome to our Society and please feel free to join in. For the first time, this magazine will now be made available to all who'd like a copy each month, not just our financial member base.

Again I'd like to sincerely thank our new contributors. We have our patron Prof. Geraint Lewis, professional astronomer Emil Lenc and Jackie from the One Giant Leap Australia Foundation.

It's been a tough few months for everyone, but it's fantastic to see our society so well glued together over this period. I hope that we can communicate face to face again when it's safe to do so. Until then, please enjoy our monthly ZOOM meetings and your monthly editions of PRIMEfocus.

We'll see you all for the July edition.

Clear Skies!
Chris Malikoff

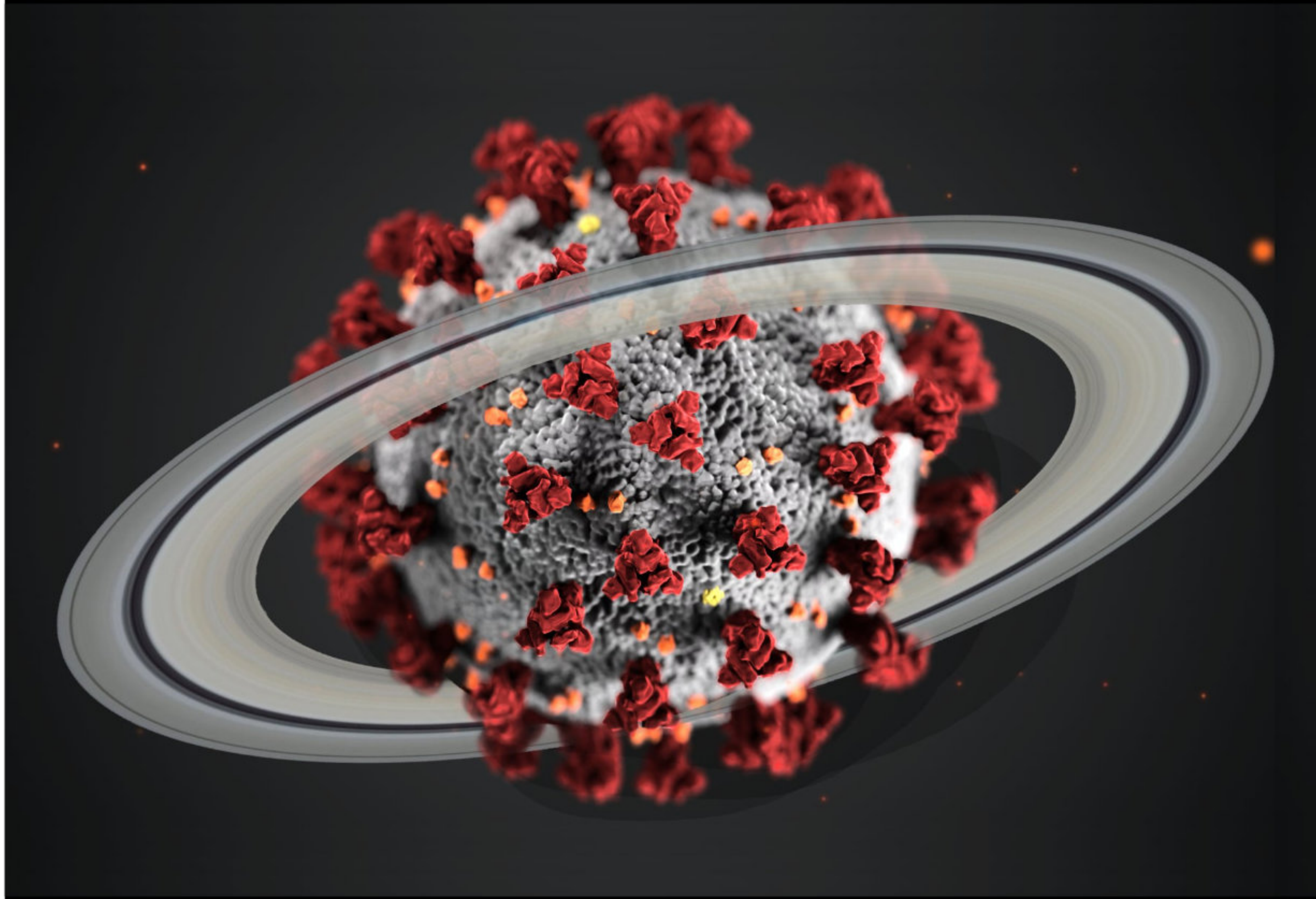


Image: "Jupiter's Corona" composite Chris Malikoff (MAS)
A composite image made up of data from various NASA images.

president's report

JOHN ROMBI

Dear Members & associates,

Welcome to another bumper edition of PRIMEfocus. I hope that you all enjoyed our May edition, and the introduction of our newest contributor, our Patron, Geraint Lewis. We also hosted two other new contributors, Dr Emil Lenc (ASKAP) and Jackie Carpenter (One Giant Leap Australia).

As of this month our editors have placed their contact details at the end of their articles. If you wish to ask them questions, please use these details.

Covid-19

As of this Saturday June 13th, we will be able to hold our observing night at Stargard. Social distancing will still apply and only 10 members are allowed to attend.

The following weekend, June 19th-20th will be our Forest session. The same conditions apply, with an added condition. All touch surfaces must be cleaned before vacating the cabin.

From July 1st, it appears that all conditions will be relaxed, and hopefully allow more members to take to the observing field. For the time being, all outreach events are still on hold.

MAS Forum

We will continue to hold these via the ZOOM app. All financial members of the MAS will be sent a link via their email address. Our speaker for our Forum on Monday June 15th will be Dr Lucyna Chudczer (AAL). Her presentation will be titled "Towards the Best Research Infrastructure for Australian Astronomers".

If you would like to take advantage of being a member (Forum, Observing nights, instrument selection and operation, etc) please contact our Membership Officer, Henry Sweirk at membership@macastro.org.au

Under The Southern Skies

This is the best time of the year to "look up"at the night sky.

We have the centre of our Milky Way directly overhead, and all you need is a pair of binoculars (a dark sky will enhance the view) and you will be treated to some of the best views you will ever see.

The early morning sky brings all the planets into view. Jupiter & Saturn are at the zenith and within 5 degrees of each other. Mars is trailing the first two by about 25 degrees, and can be distinguished from the stars by its deep red colour.

Pluto is very close to Jupiter & Saturn, but will need a large telescope to identify it. Neptune and Uranus are also nearby but, again, a large telescope is needed to observe them.

Jupiter, Saturn and Mars will be making their closest approach to Earth over the next couple of months, both visual and astro imaging will bring out the best features of these distant worlds.

If you have any questions, please don't hesitate to contact me via email.

Until next month, "Keep your feet on the ground, but keep reaching for the sky"

Cheers, John.

John Rombi
President, MAS
presidentmas55@gmail.com
www.macastro.org.au

what's on?

New Moon Weekends (Fri-Sat) Belanglo Forest

Members Private Observing Nights

~~Jan 24th-25th cancelled (bushfires).~~

~~Feb 21st-22nd cancelled (weather).~~

~~March 20th-21st went ahead.~~

~~April 24th-25th cancelled (public health).~~

~~May 22nd-23rd cancelled (public health).~~

June 19th-20th - 10 members, no visitors.

July 17th-18th

August 21st-22nd: Int. House cancelled

September 18th-19th

October 16th -17th

November 13th -14th

December 11th -12th

Third Quarter Moon Saturdays Stargard

Members Private Observing

~~Jan 18th cancelled (bushfires).~~

~~Feb 15th cancelled (weather).~~

~~March 14th pp to 20th (weather).~~

~~March 20th unscheduled - went ahead.~~

~~April 18th cancelled~~

~~May 16th cancelled (public health).~~

June 13th - 10 members, no visitors.

July 11th

August 15th

September 12th

October 10th

November 7th

December 5th & 12th

First Quarter Moon Saturdays Public Nights

~~January 4th : unallocated~~

~~February 1st : unallocated~~

~~March 7th : unallocated~~

~~April 4th : unallocated~~

~~May 2nd : Domes cancelled (public health).~~

~~May 30th : Domes cancelled (public health).~~

~~June 27th : Domes cancelled (public health).~~

~~July 25th : Domes cancelled (public health).~~

~~Aug 29th : Domes cancelled (public health).~~

~~Sept 26th : Domes cancelled (public health).~~

October 24th : unallocated

November 21st : unallocated

December 19th : unallocated

Third Mondays of the Month Macarthur Astronomy Forum

~~January 20th~~

~~February 17th~~

~~March 16th cancelled (public health).~~

~~April 20th online~~

~~May 18th online~~

June 15th Online

July 20th

August 17th

September 21st

October 19th

November 16th

December 7th (First Monday)

STOP PRESS: John Rombi
presidentmas55@gmail.com

From Saturday June 13th, the NSW government has (further) relaxed the rules on the number of people that may gather together. It is now 20 people.

This means that Stargard will now host 20, with all the usual social distancing rules.

If you would like to attend, and have not already notified me, please contact me asap. Unless I have your request to attend, you will not be allowed on the field. I will check with International House, concerning The Forest cabin for the following weekend. Until I have a clearance from them, the numbers will be limited to the current number of 10.

If you have any questions, please don't hesitate to contact me.

mas macarthur astronomical society

patronage

PROF. GERAINT LEWIS

View from the Trenches: Issue 2

As the pandemic lockdown slowly lifts, Australia creeps into winter. Astronomical groups are organising limited observing, as major observatories continue their way back to full operations. Of course, research into the universe does not stop, and Australian scientists have continued to lead the world in astronomical discoveries.

An international team led by the University of Sydney's Tim Bedding has uncovered the "singing" of delta-Scuti stars. All stars sing, vibrating due to the powerful forces at play inside them, with shakes and pulsations changing the stellar luminosity. Astronomers realised that if they measure the brightness fluctuations, they can "see" inside the star, in the same way geologists sense the inside of our planet through earthquakes. delta-Scuti stars are about twice as massive as the Sun, and their vibrations appear irregular, more like noise that a regular melody, due to their distortion due to rapid rotation. In this new study, exquisite data from NASA's "Transiting Exoplanet Survey Satellite" (TESS) revealed the variations in hundreds of delta-Scuti stars, allowing the astronomers to isolate the signal from the noise. Hearing the music is only the first stage, now they are faced with the task of understanding the lyrics!

Astronomers from Swinburne University revealed the existence of a giant ring galaxy in the early cosmos. We see these in the nearby universe, formed when two galaxies violently collide. The same mechanism formed this galaxy, known as R5519, but, existing only 3 billion years after the Big Bang, this new ring is harder to study. The astronomers called on the best eyes available, the Hubble Space Telescope and the 10m Keck Telescope in Hawaii, to explore the ring in detail, and now they are working on understanding the collision. This will improve important clues to the birth of our own Milky Way.

Another exciting result came out of Curtin in Perth, with a team led by J.-P. Macquart spotting several Fast Radio Bursts (FRBs) with the Australian Square Kilometre Array Pathfinder (ASKAP). These intense bursts of radio waves, thought to come from the extreme environment of magnetic neutrons stars, are bright enough to be seen across the universe and have been traveling for billions through the nearly empty vacuum of space. Nearly empty is important, because in between the galaxies there is a thin soup of nuceli and electrons, subtly influence the passage of the radio waves. The team were able to turn this around and so were able to measure the normal matter out there in the universe, most of it "hidden" in this intergalactic soup, finding excellent agreement with the expectations of our cosmological models.

Unfortunately, I'm sad to report that the lead, J.-P. has recently passed away at a tragically young age; a real loss for Australian astronomy.

Questions? Reach me at: geraint.lewis@sydney.edu.au

Animation: http://www.swinburne.edu.au/news/latest-news/2020/05/astronomers-see-cosmic-ring-of-fire-11-billion-years-ago.php

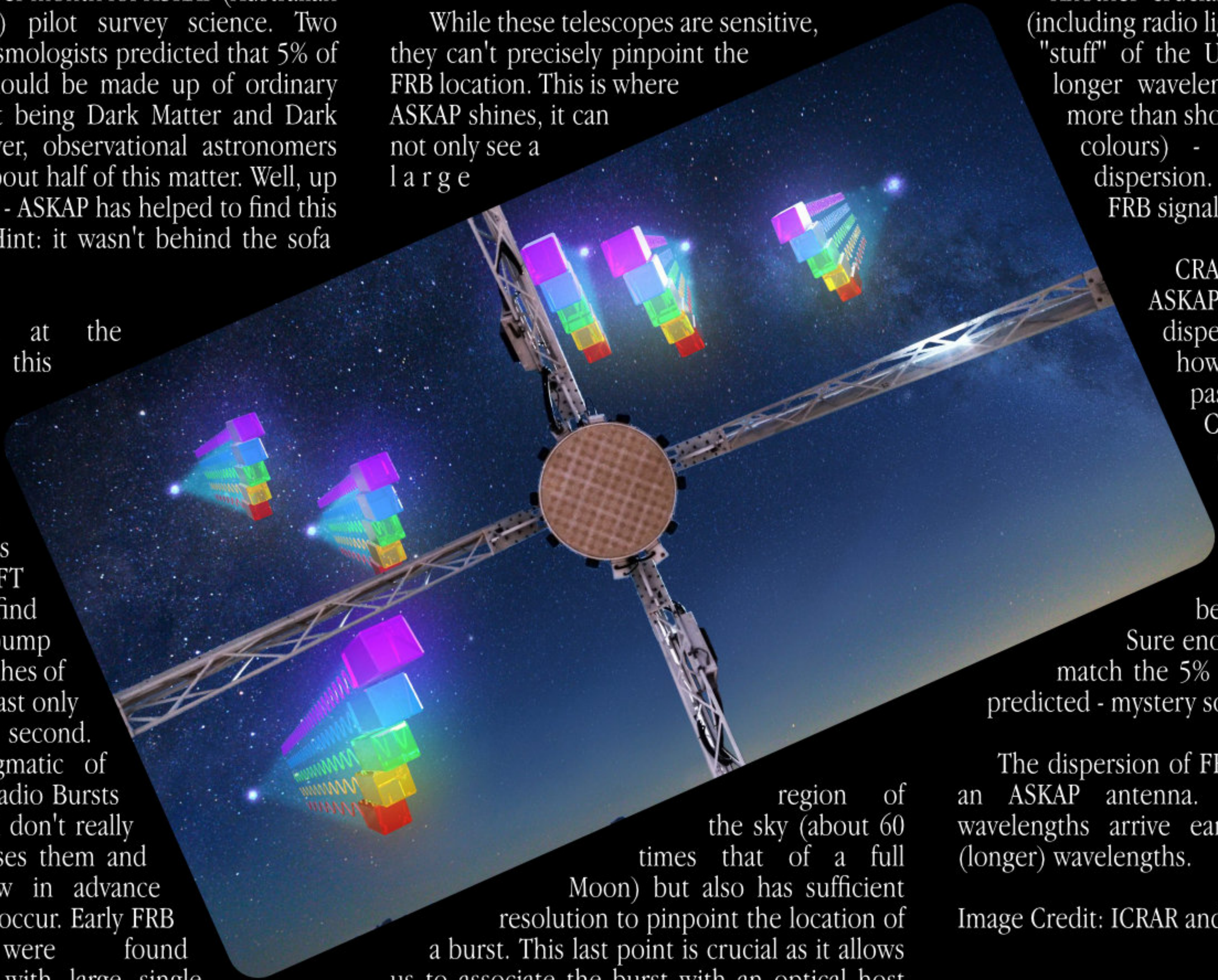
R5519 - NASA Hubble Image

the armchair radio astronomer

Dr. EMIL LENC

It's been a ripper month for ASKAP (Australian SKA Pathfinder) pilot survey science. Two decades ago, cosmologists predicted that 5% of the Universe should be made up of ordinary matter (the rest being Dark Matter and Dark Energy). However, observational astronomers only detected about half of this matter. Well, up until now that is - ASKAP has helped to find this missing mass (Hint: it wasn't behind the sofa cushions!)

The team at the forefront of this research was CRAFT (Commensal Real-time ASKAP Fast Transients Survey). CRAFT uses ASKAP to find things that go bump in the night - flashes of radio light that last only fractions of a second. The most enigmatic of these are Fast Radio Bursts (FRBs). We still don't really know what causes them and we never know in advance where one may occur. Early FRB detections were found serendipitously with large single dish telescopes such as the Parkes Radio Telescope ("The Dish").



While these telescopes are sensitive, they can't precisely pinpoint the FRB location. This is where ASKAP shines, it can not only see a large region of the sky (about 60 times that of a full Moon) but also has sufficient resolution to pinpoint the location of a burst. This last point is crucial as it allows us to associate the burst with an optical host galaxy and estimate its distance.

Another crucial point is that as light (including radio light) passes through the "stuff" of the Universe it slows down longer wavelengths (redder colours) more than shorter wavelengths (bluer colours) - an effect known as dispersion. This is effect is seen in FRB signals.

CRAFT astronomers used ASKAP to measure the dispersion and so estimate how much "stuff" the signal passed through. Combining this with the distance to the host galaxy provided sufficient information to work out the density of matter between us and the FRB. Sure enough, this turned out to match the 5% value the cosmologists predicted - mystery solved!

The dispersion of FRB signals as seen from an ASKAP antenna. The bluer (shorter) wavelengths arrive earlier than the redder (longer) wavelengths.

Image Credit: ICRAR and CSIRO/Alex Cherney

An out of this world problem to solve.

In our last issue we touched on one of the programs that we are providing in our space STEM education. This is the Kibo Robot Programming Challenge (Kibo-RPC) in which teams solve various problems by programming the Astrobee, NASA's new free-flying robotic system, that was only deployed to the ISS in 2020. The Astrobee system is three cubed-shaped robots, software and a docking station used for recharging. The robots use electric fans as a propulsion system that allows them to fly freely through the microgravity environment of the station. Cameras and sensors help them to "see" and navigate their surroundings.

The competition scenario for 2020 is:

- *'A meteor has crashed into the international Space Station and the air is leaking. Operate the Astrobee and stop the air leakage. JAXA needs your help!'*
- *'Emergency alert is activated! Save the International Space Station with robots.'*
- *The mission is to create a program to operate Astrobee and stop the leakage, saving the astronauts and the International Space Station.*

Globally, this program is hosted by the Japan Aerospace Exploration Agency (JAXA) in cooperation with the National Aeronautics and Space Administration (NASA).

In Australia, this program is hosted by One Giant Leap Australia Foundation with support from the Australian Space Agency and the Office of the NSW Chief Scientist and Engineer.

We have 14 teams of students from ages 15 up to University level (not yet graduated) across Australia. Each team has a minimum of 3 students and a team manager. One Giant Leap Australia Foundation is providing assistance with training and development for the programming of the Astrobee robots.

The programming is using the Android development system and Java language. These are the latest development tools and continues our mission of providing today's STEM opportunities for the 'Workforce of Tomorrow'.

June and July will see continued development for the teams with the plan to run all Australian teams packages across a simulator during August. The best solution from the Australian teams will be used on the International Space Station in September to control the actual Astrobee on the ISS. We are one of seven countries involved in this program.

Engineering teaches us that a simulation can only approximate the real world. Thus, participants are expected to learn techniques for creating simulation programs that perform well in the real world despite uncertainties and within margins of error. Students will learn the necessity of controlling and correcting positions and orientation of the free-flying Astrobee in micro-gravity and how to perform assigned tasks in the onboard environment through simulation trials.

The link to our Kibo Website teams section: https://kiboaustralia.com.au/kibo-rpc-teams/

'**Astrobee**' is designed to help astronauts reduce the time they spend on routine duties, leaving them to focus more on the things that only humans can do. Working autonomously or via remote control by astronauts, flight

controllers, or researchers on the ground, the robots can perform tasks such as taking inventory, documenting experiments, or moving small items or cargo throughout the station. https://www.nasa.gov/astrobee

Guest scientists, in this case our student teams, and this challenge, will be able to use Astrobee to carry out investigations that will help to develop technology – both hardware and software – for future missions. Since the robots are modular and can be upgraded, the system gives researchers and scientists diverse capabilities for performing a wide range of experiments inside the station.

These robots will play a significant part in the Artemis program to return to the Moon as well as other deep space missions. Robots such as Astrobee, have the capacity to become caretakers for future spacecraft, working to monitor and keep systems operating smoothly while crew are away.

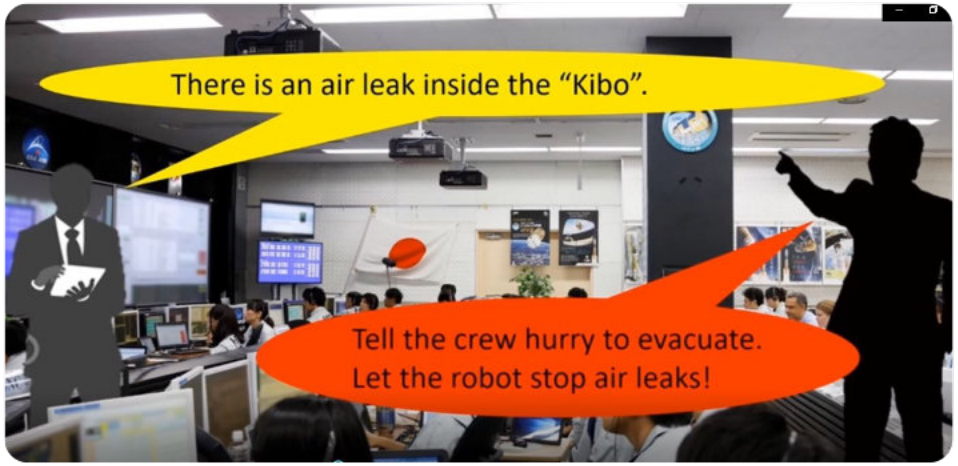
'Int-Ball' is a free-flying camera robot aiming to reduce crew time ultimately to zero for routine video-shooting tasks by crew in the ISS/Kibo. Like current consumer-grade cameras, Int-Ball works closely with onboard crew to provide flexible views for ground operators. Int-Ball is perhaps the first human-friendly camera robot in space. http://iss.jaxa.jp/en/kiboexp/news/171214_int_ball_en.html

The Int-Ball was manufactured entirely by 3D printing, and it uses existing drone technology. It is essentially a floating ball with luminous blue eyes that looks like something straight from Pixar. The drone can be controlled from Earth by the JAXA Tsukuba Space Center.

JAXA says the robot drone can move anywhere at any time through autonomous flight and can record images from any angle. The Int-Ball weighs 1kg (2.2lbs), has a diameter of 15cm, and has 12 propellers.

The Int-Ball also enables flight controllers and researchers on the ground to check the ISS team from the same viewpoint as the crew, which will help to maximize results of experiments. It has also cut the amount of work done by Japanese astronauts on the ISS by about 10 percent, photographing work and equipment for evaluation that otherwise would have to be done manually.

In the future, says JAXA, the Int-Ball will be able to check supplies and even help with onboard problems, though the details of how that will be accomplished by a "limbless orb of cuteness" are not yet known.



This program is intended to continue developing STEM outreach after 2020. If you are interested for in the future programs contact the Australian Co-ordinator, One Giant Leap Australia at: www.kiboaustralia.com.au

For information on our programs, head to our websites - One Giant Leap Australia Foundation:
https://onegiantleapfoundation.com.au/

One Giant Leap Australia:
www.onegiantleapaustralia.com

Image source: jpl.nasa.gov

Astrobee Video

After the demise of Comet 2019 Y4 (ATLAS) I was lucky to have Comet 2020 F8 (SWAN) to image. Now yet another cometary visitor is coming our way, Comet 2019 U6 (LEMMON).

Mount Lemmon Observatory (MLO), is an astronomical observatory located on Mount Lemmon, situated in the Santa Catalina Mountains approximately 28 kilometers northeast of Tucson, Arizona.

The site is in the Coronado National Forest and is used with special permission from the U.S.Forest Service by the University of Arizona's Steward Observatory, and contains a number of independently managed telescopes.

There are 8 telescopes currently operating at the observatory.

The 1.52 m (60 in) Steward Observatory Telescope is a Cassegrain reflector used for the Mount Lemmon Survey (MLS), which is part of the Catalina Sky Survey (CSS).

It was built in the late 1960s and first installed at Catalina Station on Mount Bigelow, which is nearby in the Santa Catalina Mountains. It was moved to Mt. Lemmon in 1972, and then re-housed in its current location in 1975. Its original metal primary mirror performed poorly and was replaced in 1977 with a glass mirror made of Cer-Vit.

It is one of the telescopes used by students at Astronomy Camp. It discovered 2011 AG5, an asteroid which achieved 1 on the Torino Scale.

Discovery: Comet 2019 U6 (LEMMON)

The post in the BAA Comet Section:

The Mt Lemmon Survey discovered an object of 21st magnitude in images taken with the 1.5m reflector on October 31. [MPEC 2019-V131, 2019 November 8].

It was placed on the PCCP as C1CKPL2.

The object is at perihelion at 0.9 au in 2020 June and has a parabolic orbit. It may show cometary activity when it gets closer to the Sun - at discovery it was 3.5 au away.

If it does develop a coma it may become a telescopic comet, though it will be at a relatively poor elongation.

Several observers report that they have detected a cometary appearance in images, so it should be re-classified.

C/2019 U6 LEMMON

JEN BRYENT - 29TH MAY 2020

Subsequently Michael Mattiazzo imaged it on March 11, when it showed a clear coma, and he suggests that it could reach 8th magnitude. It is actually brightening quite rapidly and may reach 6th magnitude around perihelion, in June. It was reclassified as a comet following the reports made since December [CBET 4735, MPEC 2020-F136, 2020 March 25]".

It won't become visible to UK observers until after perihelion, when it may be fading from 7th magnitude.

Luckily for us in the Southern Hemisphere it is visible NOW, just after sunset, due West about 30deg above the horizon approx Mag 6.8!

I have included a SkySafari map on the following page for 6:30pm, Friday 19th June, from Campbelltown's lat/lon. Hopefully we will have clear skies at The Forest and/or Stargard!!

Data | Description

BASIC INFORMATION

Name	C/2019 U6 (Lemmon)
Description	Comet in Hydra
Visual Magnitude	+10.4
Apparent Size	0.0 arcsec 67.3% illuminated
Distance	0.862342 AU 129.0 million km 7.17 light min

VISIBILITY

Rises	08:29:02 AM
Transits	03:05:02 PM
Sets	09:40:00 PM
Maximum	Wed Aug 12, 2020
Elongation	07:14:53 AM 066° 39' 59.8" from Sun

CELESTIAL COORDINATES

Azimuth	283° 18' 11.7" in the west
Altitude	+38° 23' 25.8" above horizon
Right Ascension	09h 00m 50.53s
Declination	-11° 26' 28.4"
Hour Angle	03h 24m 28.69s W
Ecliptic Longitude	141° 25' 56.9"
Ecliptic Latitude	-27° 10' 12.4"
Galactic Longitude	239° 22' 18.7"
Galactic Latitude	+21° 57' 36.3"

APPARENT MOTION

R.A. (2020.5)	+433.8690 s/day
Dec. (2020.5)	+2428.858 "/day
Total (2020.5)	6825.490 "/day @ 69.2°
Azimuth	-10.615 "/sec
Altitude	-12.079 "/sec
Radial Velocity	-12.028 km/sec

ANGULAR SEPARATION

From Sun	057° 33' 11.1" @ 122.1°
From Teapot	125° 26' 26.9" @ 226.2°
From Chart Center	000° 00' 00.0" @ 34.7°

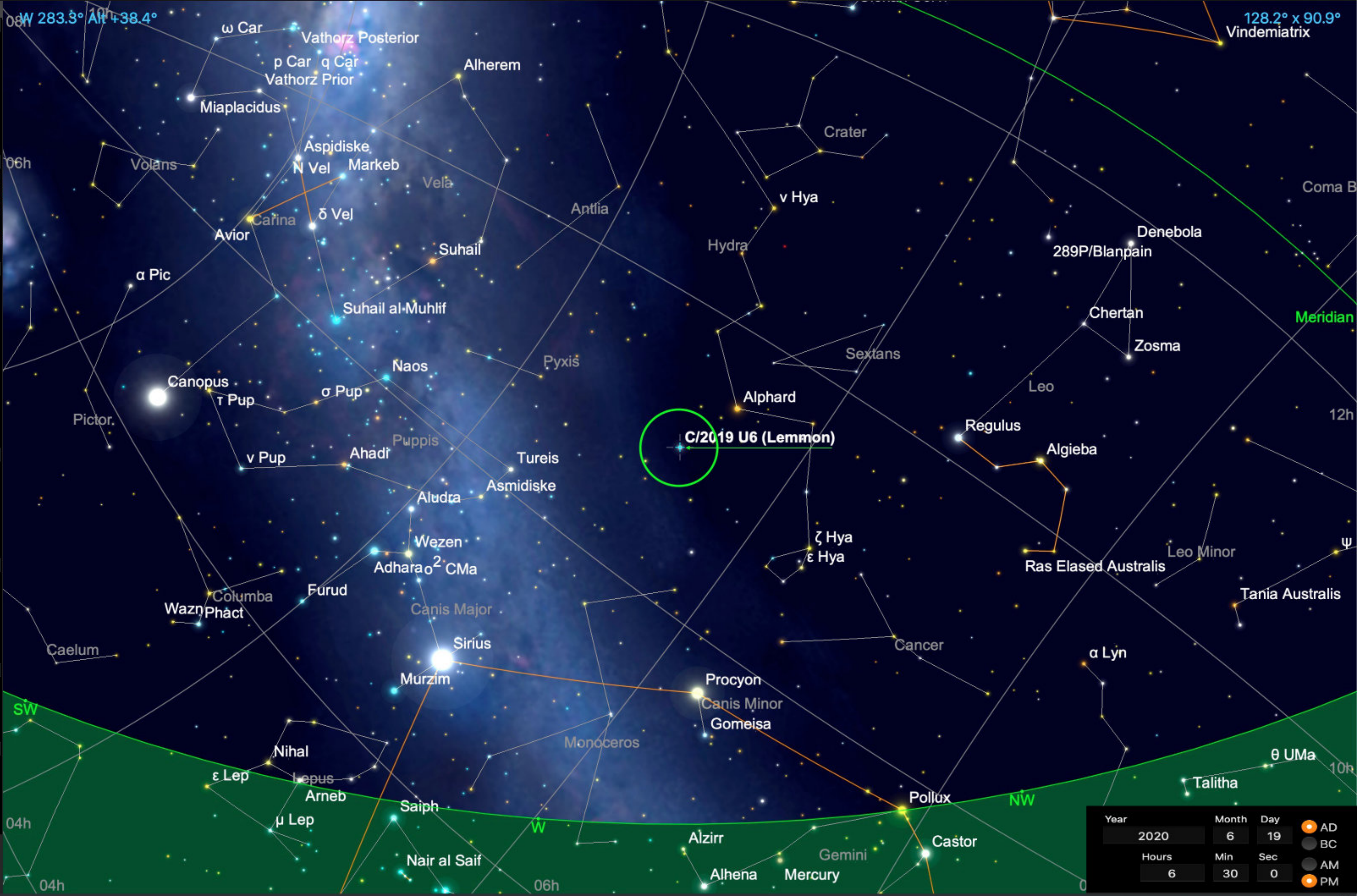
PHYSICAL PARAMETERS

Diameter	unknown
Mass	unknown
Density	unknown
Gravity	unknown

ORBITAL PARAMETERS

Orbit Epoch	Mon Dec 09, 2019
Perihelion Date	Thu Jun 18, 2020
Orbital Period	9240.79 years
Semimajor Axis	440.352705 AU 65875.8 million km

More | Center | Done



Campbelltown, NSW: 34° 04' 35.5" S, 150° 48' 12.9" E

C/2019 U6 (Lemmon) - Mag 10.4 Comet in Hydra

SpaceX/NASA Demo-2 Mission

Well last week ended up with a a couple of sleepless nights watching this Mission finally meet it's goal of getting an American crew to the ISS from American soil.

I took a lot of screen shots during this time but when preparing this article I found Tony Bela's infographics on the Space Hipsters FB page, with his permission I use them here, great clarity. Tony lives in Brisbane.

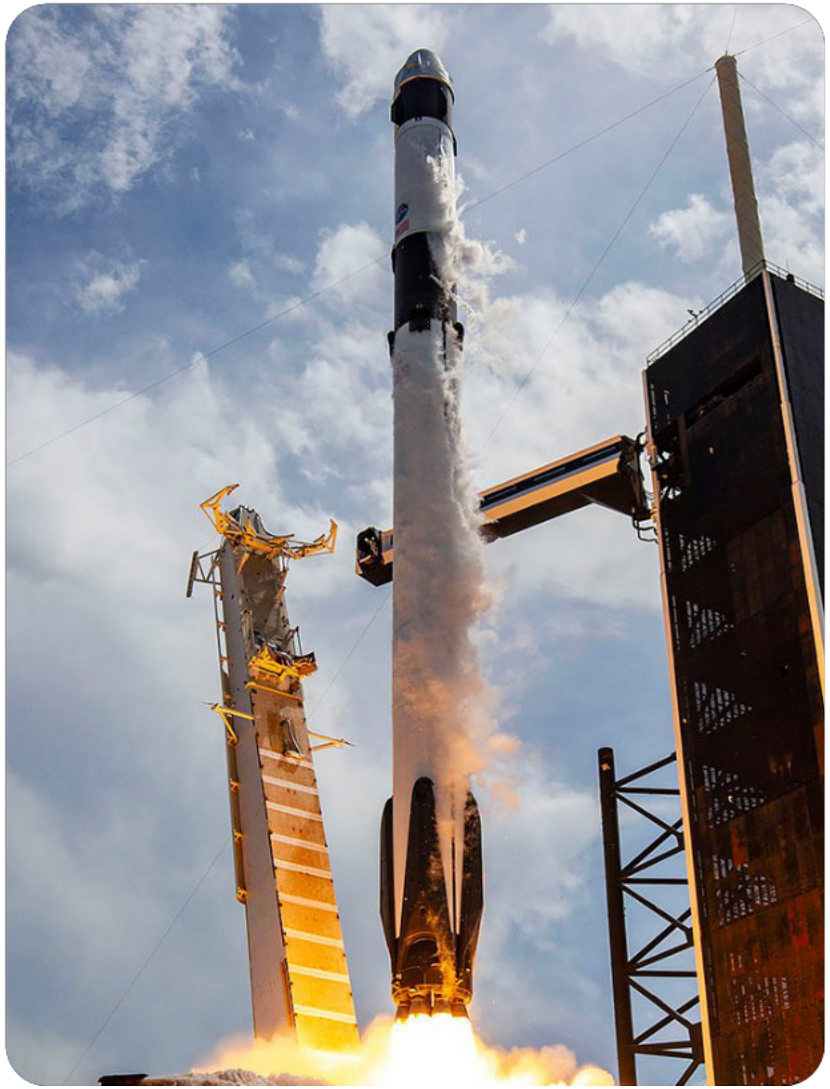
The Shuttle Era came to an end when Atlantis flew Mission STS-135 8-21 July 2011. Since then each Soyuz seat has cost NASA US$60M. SpaceX and Boeing have been given funds by NASA since 2006 to develop crewed capsules, Crew Dragon US$3.1B and Starliner US$4.8B respectively.

NASA's own Orion Capsule has so far eaten up over $20.0B, this capsule designed for long duration missions to Moon and Mars!

Astronauts:

Douglas Hurley is an American engineer, former Marine Corps pilot and current NASA astronaut, piloted Space Shuttle missions STS-127 and STS-135.

Bob Behnken is a NASA astronaut, engineer, and former Chief of the Astronaut Office. He holds a Ph.D in mechanical



engineering and the rank of colonel in the U.S. Air Force, where he served before joining NASA in 2000.

Space Shuttle missions: STS-123, STS-130

Both are married to Astronauts, Doug to Karen Nyberg (now retired) and Bob to Megan McArthur (still active).

Launch:

Launching from the iconic Pad 39A on 30 May 2020 at 15:22:45 EDT. The first attempt to launch on 27 May 2020 was aborted at T−16:53 minutes due to bad weather caused by Tropical Storm Bertha.

The Falcon 9 Stage 1 was recovered successfuly by SpaceX's drone ship "Of Course I Still Love You"

Shortly after entering orbit, Doug and Bob named their Dragon2 capsule 'Endeavour', honoring Space Shuttle Endeavour, on which they both took their first space expeditions.

This version of the Capsule has fewer features than the

full production model. The first of these will launch as Mission Crew 1 in August.

ISS Approach and Capture:

After a 'nominal' flight to the ISS, the spacecraft soft-docked with the ISS on 31 May 2020 at 10:16 a.m. EDT - 13 minutes early!

Onboard ISS:

Joining with Commander Chris Cassidy and two Russian Cosmonauts, Anatoly Ivanishin and Ivan Vagner to form Expedition 63. For Space Station Updates see https://blogs.nasa.gov/spacestation/

Departure:

It's unclear when they'll be coming home. The two are expected to stay somewhere between six and 16 weeks on board the ISS. It all depends on how much work NASA wants them to do while they're up there.

At some point, NASA will decide when to bring the duo home.

Next Scheduled SpaceX launch to the ISS:

Aug 30:Falcon 9 • Crew 1

Launch time: TBD Launch site: LC-39A, Kennedy Space Center, Florida

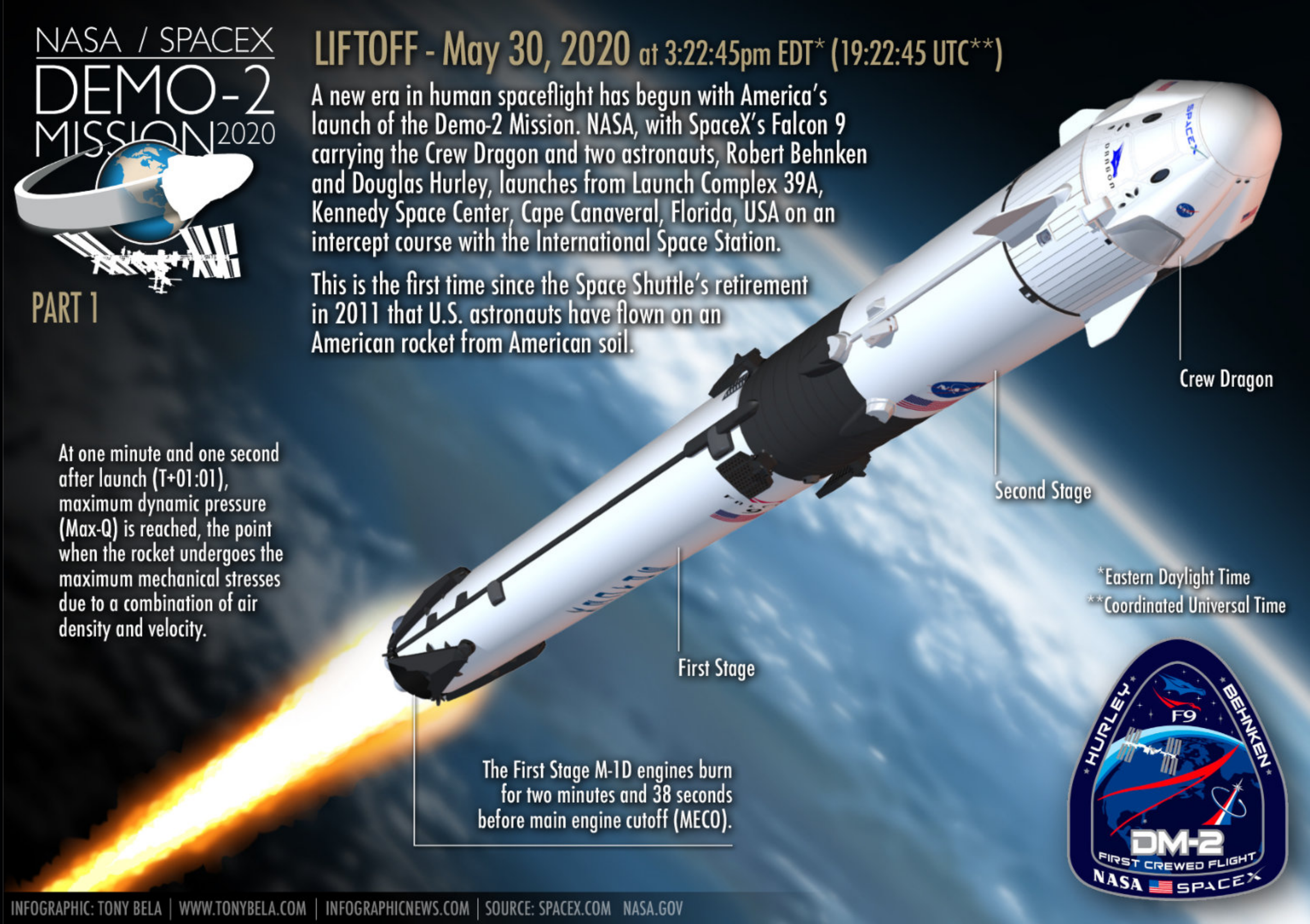
New Crew Dragon spacecraft on its first fully operational flight with astronauts on-board to the International Space Station.

NASA astronauts Mike Hopkins, Victor Glover and Shannon Walker, plus Japanese astronaut Soichi Noguchi

witnessing history

SpaceX Demo-2

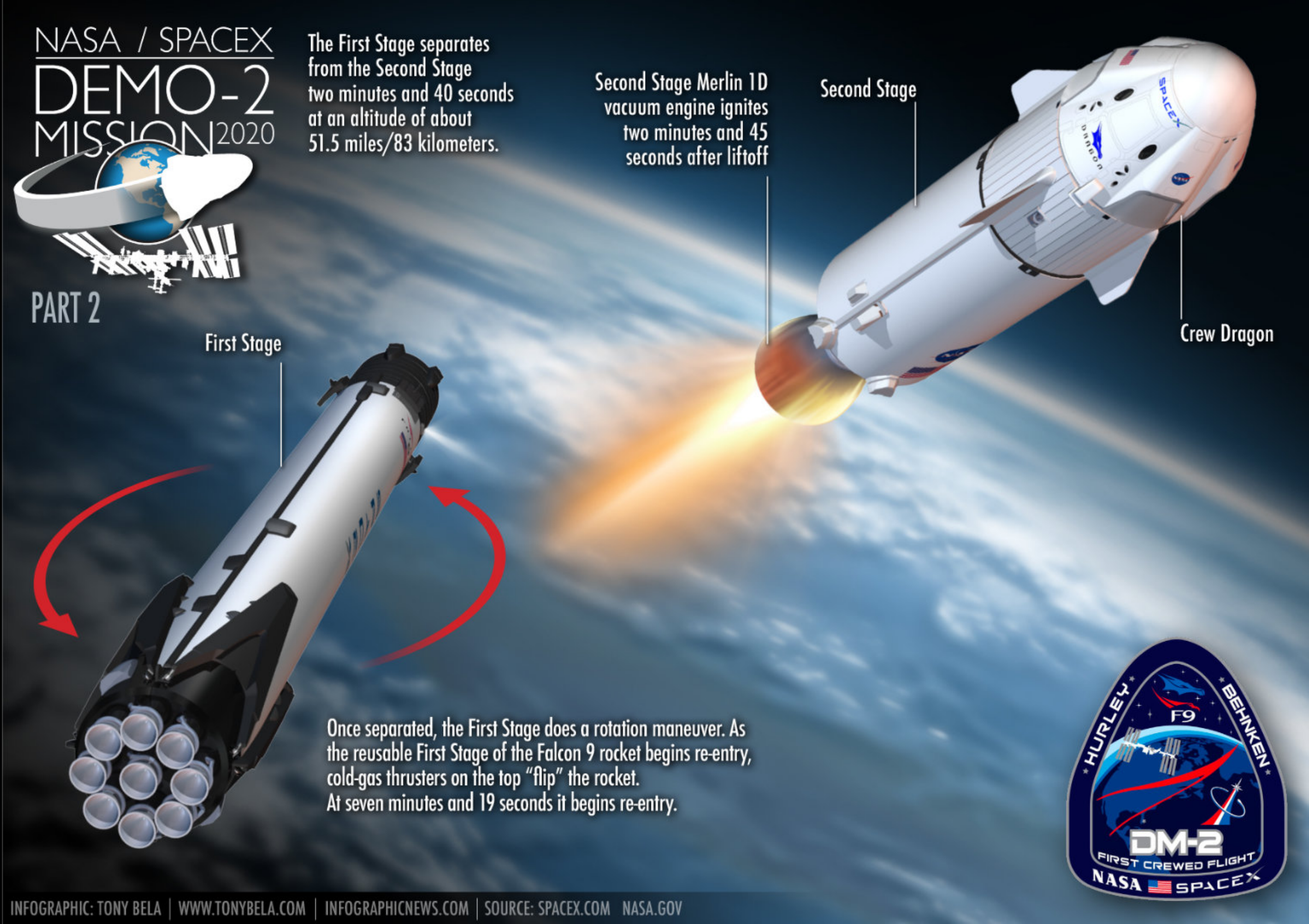
Courtesy Tony Bela



witnessing history

SpaceX Demo-2

Courtesy Tony Bela



witnessing history

SpaceX Demo-2

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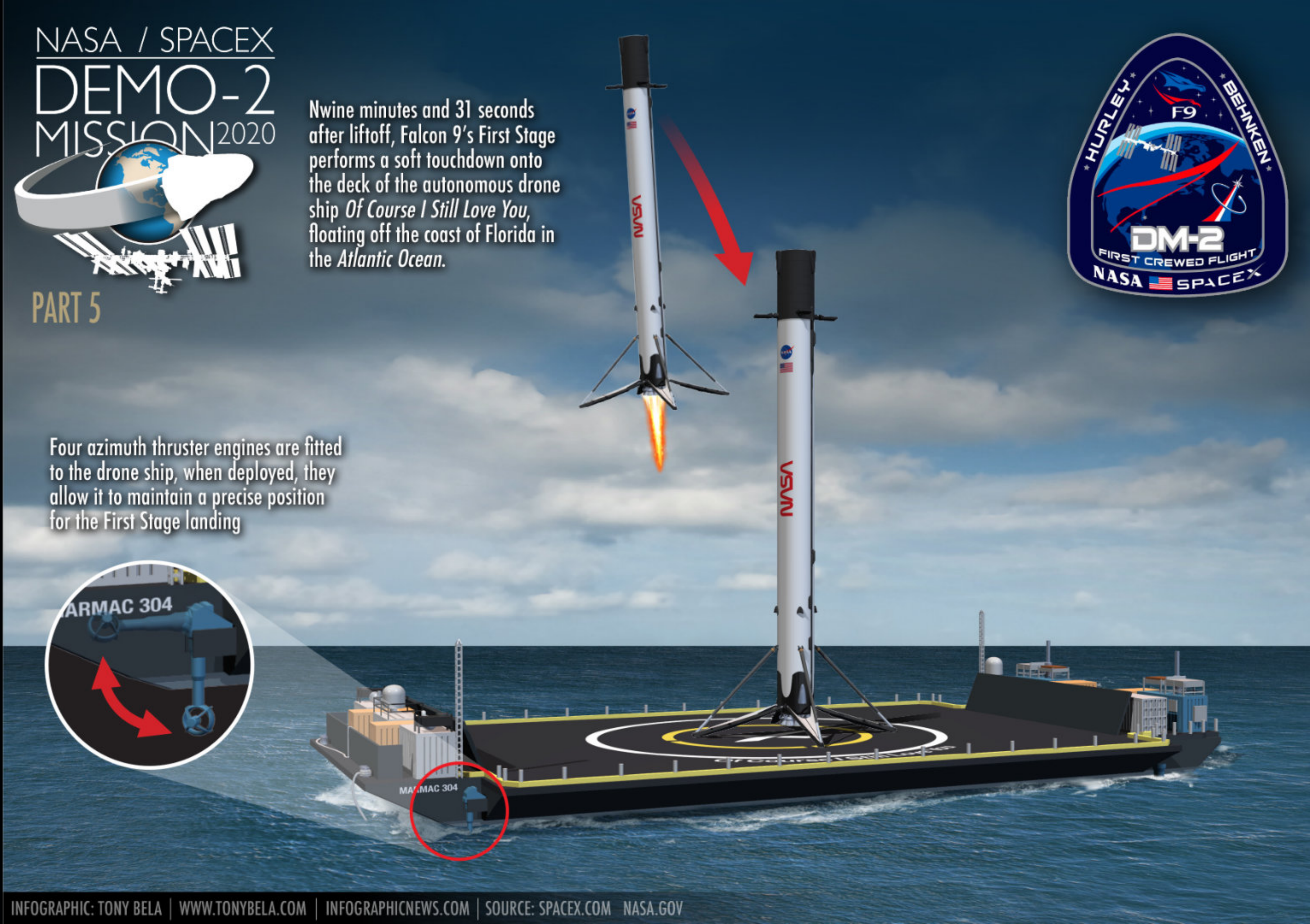

SpaceX Demo-2

Courtesy Tony Bela

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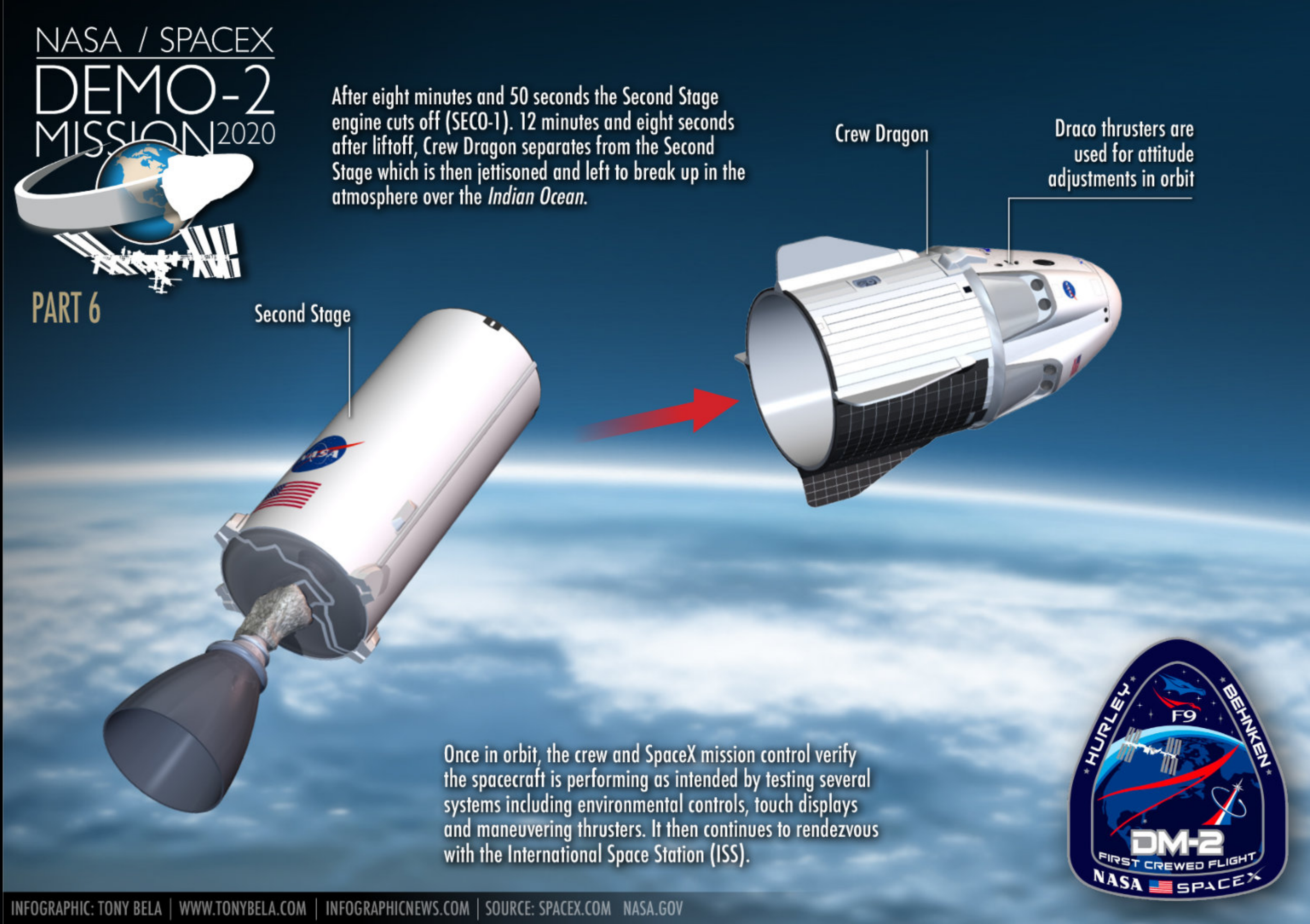

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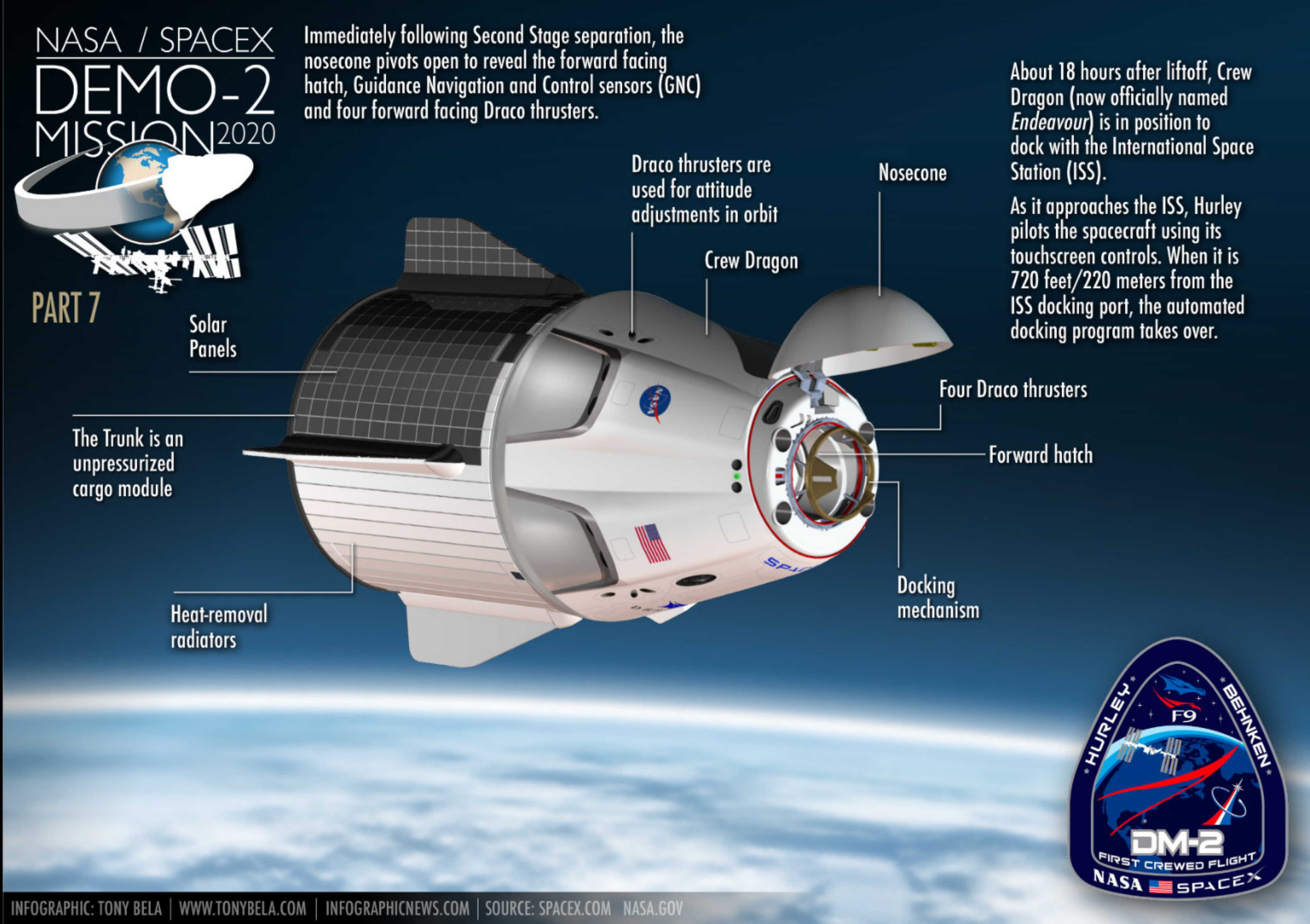
Courtesy Tony Bela

witnessing history



SpaceX Demo-2

Courtesy Tony Bela

witnessing history

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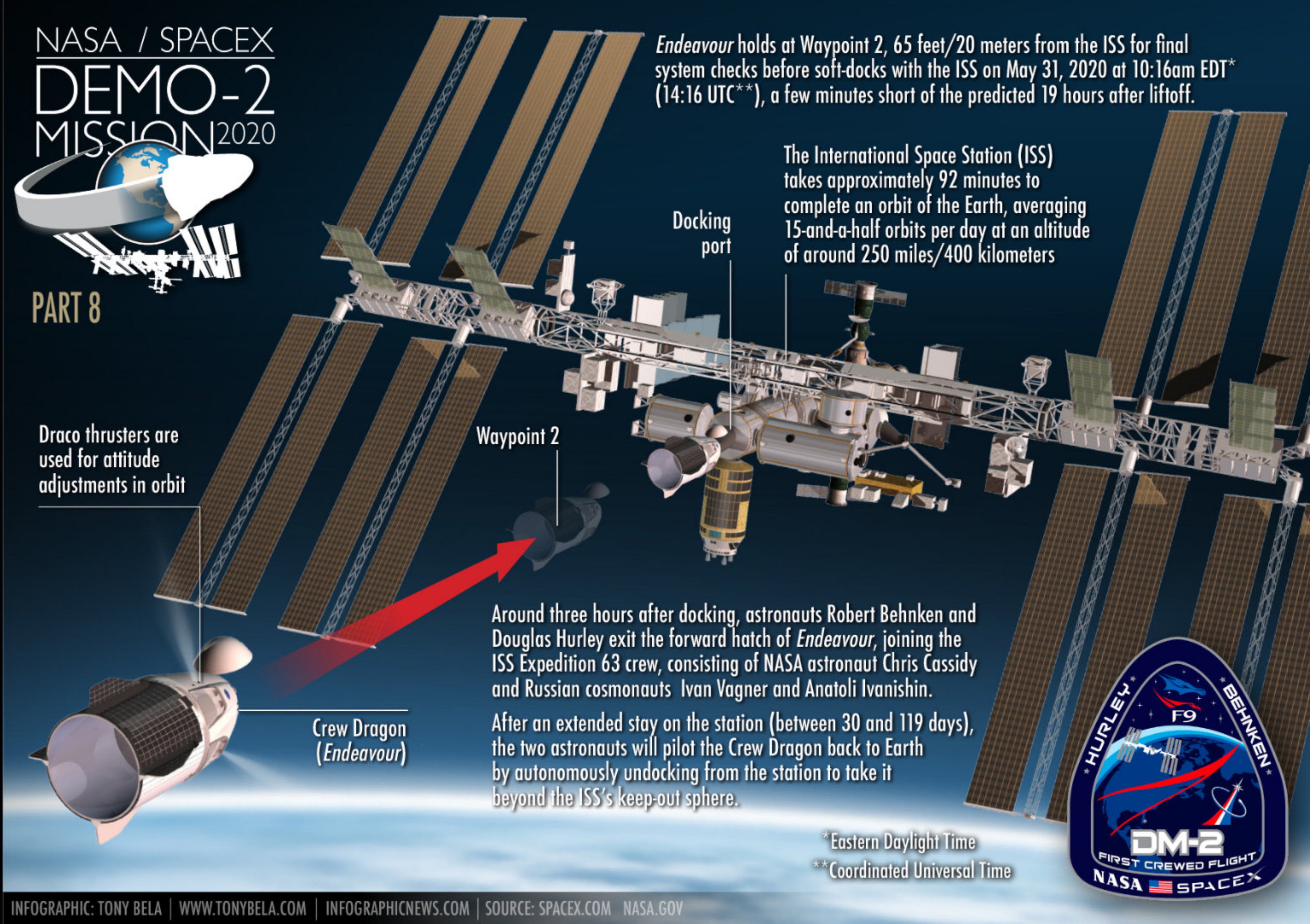


How Asteroids And Supernovae Are Named

As most people know, constellations, dwarf planets and natural satellites are commonly named using a mythology theme. Andromeda, Haumea and Enceladus are examples – but what about the millions of other objects? Here's how they number Asteroids and Supernovae.

Asteroids

Asteroids are all indexed with consecutive numbers in the order of their discovery. With half a million asteroids indexed, only 22,000 have names. Asteroids which have no name are just given a number e.g. Asteroid 487901.

Naming also uses mythology for some objects, such as 1 Ceres and 2 Pallas. However, many asteroids are named after worthy people, including astronomers like our good friend Prof. Fred Watson (Asteroid 5691 Fredwatson).
Other names are a mixture of fiction, geographic features and locations, observatories and whatever seems to take their fancy.

For many years the discoverer retained the privilege of naming the asteroid him or herself but nowadays the authority rests with the Minor Planet Centre, although the discoverer may submit a proposed name.

My two favourites asteroids are 920 Rogeria and 9739 Powell but unlike Fred, I cannot claim any credit.

Rogeria was a woman's name chosen by the prolific discoverer Karl Reinmuth, who is credited with discovering 395 asteroids between 1914 and 1957. He named a lot of them after women, so he must have been a popular guy with the ladies!

Asteroid 9739 Powell was named after James Powell, a geology professor at Oberlin College, US.

Supernovae

I recently imaged a supernova for the first time (in M61) and went looking for its designation: SN 2020 jfo. Wait a minute, I thought, what does "jfo" mean? When it comes to cataloguing huge numbers of sky objects, names generally consist of alphanumeric numbering systems with some creative methodology.

Historical supernovae are named after the year in which they occurred, for example SN 1572 occurred in the year 1572. There were not many supernovae observed until the advent of big telescopes, which brought intergalactic supernova within our reach. So changes to the naming system occurred in 1885 and 1988.
First one and then two capital alphabet numbers were added, so the first twenty-six supernovae of the year were suffixed A to Z, (SN 1885A to SN 1885Z) then the twenty-seventh and twenty eighth discoveries became SN 1986AA to 1988ZZ etc.
This allowed a maximum of 26x26=676 listings but the number of discoveries continues to increase, so since 2016, a lower case three-character designation system was introduced.

The first 26 supernovae of each year are still named using the same sequence, e.g. SN 2020A (with capital letters) and after SN 2020Z has been reached, the numbering system changes and pairs of lower case letters are employed instead: aa, ab, and so on. If that sequence runs out, a third letter is added.
Hence the M61 supernova SN 2020 jfo which I imaged is the 690th supernova discovery so far this year. (26x26) + 14 = the 690th supernova of 2020.

References

https://en.wikipedia.org/wiki/List_of_minor_planets
https://en.wikipedia.org/wiki/List_of_supernovae

Questions

Thanks for reading. If you have any comments or questions, you can find me at:
roger@macastro.org.au
and
cosmicfocus.wordpress.com

back to basics

NOEL "richard stargard" SHARPE

Hi there! First, some simple revision of the past articles.

- *Never look at the Sun through a telescope - severe eye damage or blindness WILL occur.*
- *Use a red torch - you can buy one for astronomy or simply cover a normal torch with several layers of red cellophane.*
- *Keep warm clothes in the car all year round, bring insect repellent.*
- *Take a chair, thermos of a hot beverage, your choice.*

When using your telescope, please use a 25mm eyepiece or similar. Use nothing else until you get more experience under your belt. Tighten all nuts and bolts.

I'm going to add into this mix the finder scope - the little telescope that sits on the tube. Make no mistake, what it lacks in size it makes up for by being a very essential part of using any telescope. I like to explain it like this: There's a coke can on top of a fence post at about 200 metres away. Imagine that you have a rifle and you need to take aim to shoot the can off the post. You only have the rifle and no sight tube or way to align the shot, so just shoot blindly and try to hit the can. It's nearly impossible, and that's what it's like with a telescope too. You just cannot aim a scope up to the night sky and hit Saturn. I know this from personal experience, so a way of aligning the telescope is needed. I can only talk about the optical finder scope as this is the only type of device I have ever used to find objects with my scope. But other devices like the "red dot" finder would have similarities.

Daytime is best for aligning the finder scope to the main telescope tube, so pick the top of a mobile phone tower, church steeple or telegraph pole, etc, but it needs to be far away. With a low-power eyepiece in the telescope move the telescope until the object is in the centre of the field of view of the eyepiece. This should be easy as you will have objects as a frame of reference in the daytime, like trees, hills and buildings etc. Make sure that the telescope doesn't move as you now adjust the screws on the finder. You need to place the object in the cross hairs of the finder and tighten everything. Re-check by moving the scope and then using the finder to place the object in the eyepiece,. A good trick is to open both eyes - it's very much a by feel thing to do, so just keep trying. Next time your scope is under starlight and you look through the finder first, the object should be in the telescope - front and centre.

The finder will dew,so as a quick fix is to place a carboard tube protruding out over the front lens. You may need a lens cloth to clear the remaining dew from the end you look through, and this is what I do, but many of members use dew heaters. From time to time you will need to realign the finder, sometimes I will use the moon to do this as its large and bright. I have learnt to follow the bright moon glow in the side of the eyepiece, just see if the glare increases as you hunt around. When you capture the moon and its well -entered then you can adjust the finder. Be careful not to move the telescope as this will defeat the purpose.

I've also mentioned about using a red torch. The darker the colour red, the better, But why? It's because our night vision is maintained when we use red torches to view our charts, or our equipment when we're set to pack up etc. It's called "dark adaptation", and without doubt we all use red light to go about our observations and photography. The red wavelength has a very limited effect on our eyes when we have become used to seeing in the dark. White light is a big issue, - it's like when you wake up at night to go to the bathroom and the room is dark. You don't have much of a problem finding the light switch and you turn on the light. That's not a problem, but exiting the bathroom after you turn off the light, fumbling your way back to bed as its so dark that you cant see,. Well, for a short while anyway, and the same thing happens on the field.

I hope that these tips over the last few issues of PRIMEfocus have been helpful. I have tried to write them in the most basic, easy-reading style that I could. Even if just one new telescope user has picked up just one tip then it's all worthwhile. I have this thing where I say to myself if I can just learn one new thing on each occasion when the club meets than I'm doing OK. So, that's one new bit of info from a guest speaker, one new object or a way to use a telescope or piece of equipment on a field night. I'm now coming up to 25 years of membership with the MAS, I guess that's a lot of things I've learned!

Good luck and clear skies
Noel Sharpe
The Novice Astronomer

tech stuff

CHRIS MALIKOFF

"Costs Aside, it's all a bit different..."

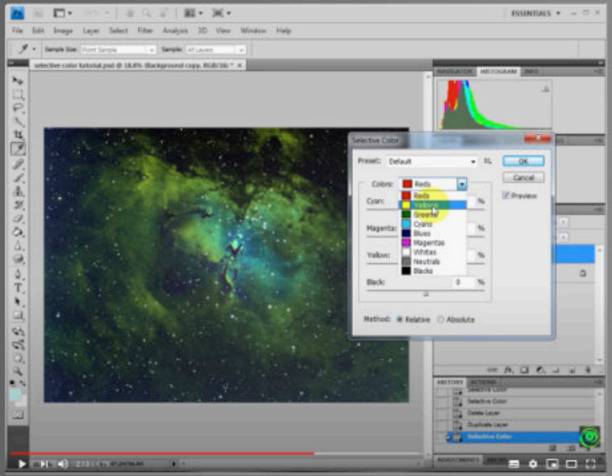
Carrying on from last issue, I'll attempt to describe the basic feautres in PixInsight (PI) which makes it the go-to image editor for astrophotography over the others. Whilst Adobe Photoshop, GIMP, MaxIm DL, Nebulosity, and a literal stack of others are all useful tools in their own right, they are reasonably disparate in their functionality and very few offer an end to end solution to processing astrnomical images as well as PI does. There are cheaper and easier alternatives that attempt to do it all, but none have the *overall* capability of PI.

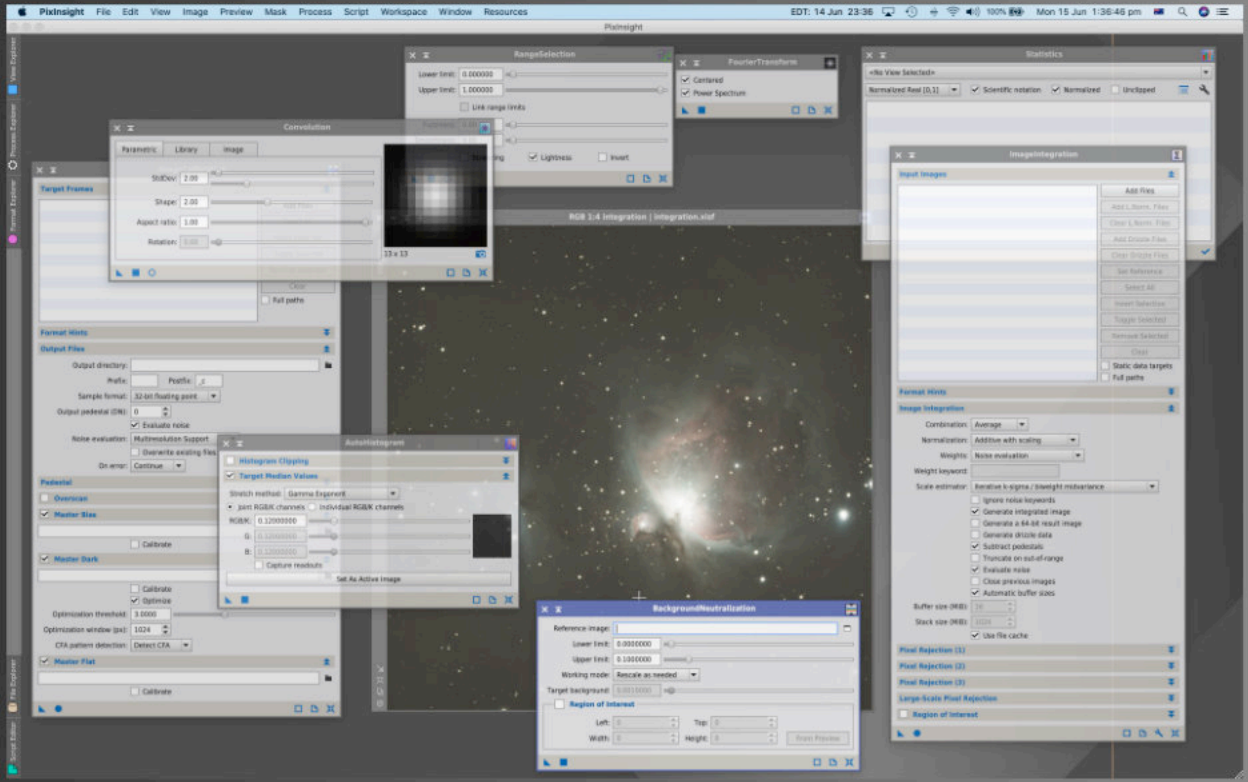
As a side-note, I'll also declare that from this point forward, when I refer to an "image", it is a .FITS file from an astr-specific camera, not RAW, JPG or anything else.

Some programs are fantastic at pre-processing - RegiStax is a good example. It does its job of aligning, stacking and averaging - and spits out a result. At the end of the day it's designed to remove noise from multiple images and add useful dynamic range to the resultant image so that you have room to move. That's it. That result is nowhere near ready to publish so it must be passed to something else to continue the process of refinement.

PI can be used to both pre-process and post-process your images for you. While not exactly cheap, a PI license does cost less than a legitimate Photoshop license. It is, however, purpose-designed for astrophotography duty and is chock-full of helpful functions to help you get the most out of your data. At this juncture, I'll tell you that a PI licence will cost you a one-off fee of AU$379.00. Compare that to a lifetime of paying Adobe for PhotoShop, it isn't bad value for what it is. Have a try, for free, for 45 days.

All that said, what is it, and how is it differnt to the others? Most other image processing programs follow a "*document or modal-oriented*" approach. This essentially means that once an image is opened, the entire process is based on its needs, and revolves around it. Once a function (brightness/contrast for example) is started on the open image, a dilogue box is automatically





CHRIS MALIKOFF

associated with the open image. Nothing else can be done with the image until that dialoue is terminated by "accepting" or "cancelling".

PI applies a different approach called "*object-oriented*". One could open a dozen functions, or dialogue boxes at once and operate within them ad-hoc. You're not required to perforn a function and immediately save or canel that operation. You can leave dialogues open all over the place if you wish, and apply tweaks between them before finishing.

This object-oriented approach enables PI to provide an abstract user experience, where the dialogue boxes are image-independent, and vice-versa.

One of the great things about the object-oriented approach is that you don't even require an open image to define or invite a process. Consequently, you can apply a dialogue, or process, to any number of open images - without needing to re-open and re-define the parameters of that process for each image you're working with. Magic! :)

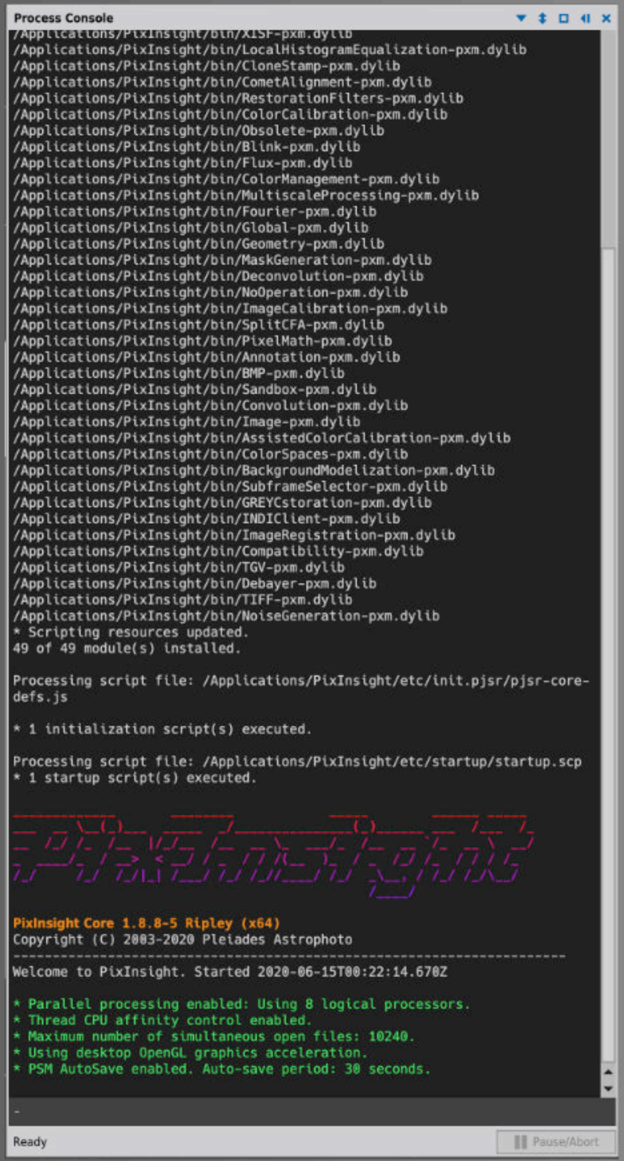
Another neat trick is to be able to fine-tune a process dialogue, depending on the type of image you're working with, and then physically "name" that process and store it on your desktop to use again on similar images in the future.

It's a far more elaborate, yet powerful way than being stuck with the OK/Apply/Cancel model. The first few times around it may seem over-complicated and unnatural, or even redundant, but after a few runs through you'll be wondering how the restrictions of the modal interface ever got a guernsey.

So, enough of the basic intro. We now understand that PI does things differently, and for good reason. No-one (especially me) is denying that the learning curve is near-vertical as you get your noggin around how PI approaches what should be the same task. By the same token, it still achives the end result - a workflow that takes one or more raw input files, and allows you to choose from a sheer plethora of available processes to apply to those files for the desired result.

The overall flow of that workflow is still familiar, however. You still take your light, dark, flat and bias images using your camera and store them somewhere. Once you have them there, you'll then need to sort out which frames are viable. You want to see wheich ones you'll need to reject before you add them to the mix. You can perform these tasks automatically, using "processes" which allow you to set the ground rules before processing the batch you've nominated. You can, if you like, also choose them manually by "blinking" trough them one by one, knocking out those with bad focus or a satellite running through them.

Next issue - I'll show you the basic first steps involved in taking a series of FITs images, rejecting those with issues, aligning them and then creating a base composite after averaging the stack.



the lazy astronomer

DAVE MANNING

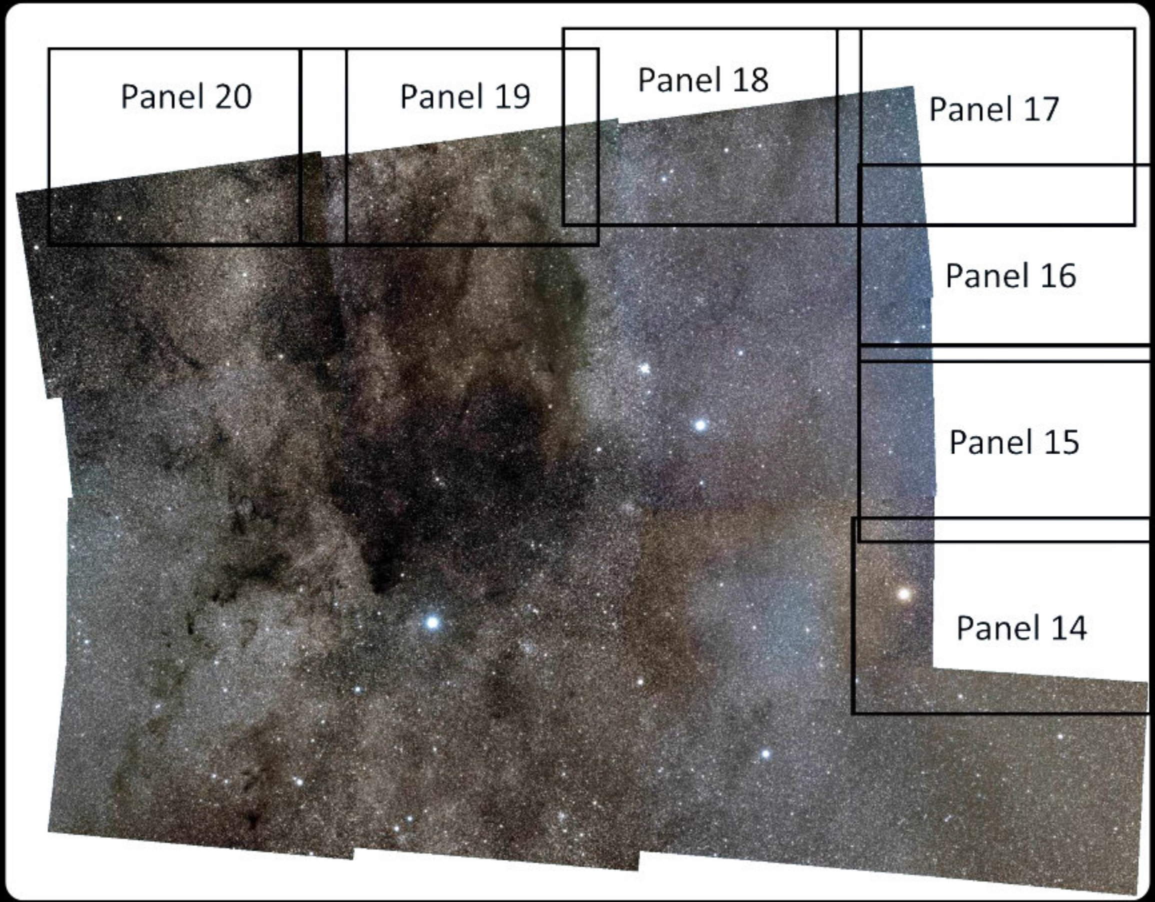
1 + 1 + 1 = A BIGGER ONE...

Have you ever complained to yourself that "I just can't see enough of that large nebula in my photographs?". Well, here's a fun way to do full-frame astrophotography on an APS-C sized budget.

Try putting together a series of photos into a mosaic, showing the whole object and the space around it. It's a lot easier than you might think.
To do this the way I do requires a bit of planning but once you start imaging the second and third panels you'll get into the routine and realise that using a "pattern" or grid you'll be breezing through the night.

For my example I'll be using my recent and incomplete mosaic of Caldwell 99, the Coalsack DarkNebula which also has our Southern Cross constellation in view. At present this mosaic has 13 separate panels with each panel comprising 5 x 120sec exposures, "Live-Stacked" with SharpCap Pro.

Exactly how long your exposures are for each panel, and the number of them will depend on your camera/telescope combination and of course, conditions.



Start by finding a suitably-obvious reference point to start your grid pattern of panels to image. In the case of my Caldwell 99 mosaic I chose the bright binary star system of Acrux, which is the bright star near the bottom left of the attached example. After taking my series of exposures (5x120sec) I then moved to an area just above Acrux making sure to include in my new field of view a sizeable "overlap" of stars from the first panel.

From here you take your exposures for panel #2, then continue to follow your chosen grid pattern for each subsequent panel, making sure to include a good overlap of stars for each and saving each resulting file with a consecutive number. For example "01_C99.Png" – "02 C99.Png", etc. This just makes the next step easier.

From here you open up Photoshop, or at least I open up Photoshop and go to "File", "Automate" then "Photo merge". Select each of the photo panels you've just imaged and let Photoshop do what It does best. Lightroom has a near identical function as well.

It's only after the photos have been seamlessly merged that I consider post processing with Pixinsight and/or Photoshop and crop to suit my whim.

Here are some I that I prepared earlier...

6-panel Eta Carinae Nebulae mosaic.

2-panel Trifid & Lagoon Nebulae mosaic.

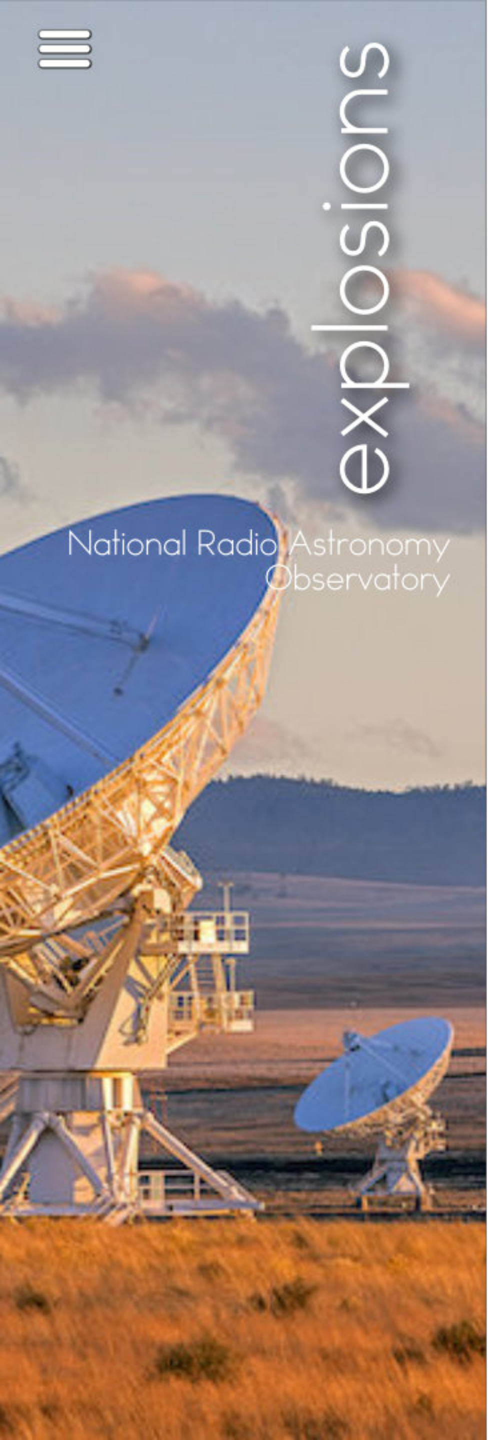
8 panel Tarantula Nebula & LMC mosaic.

If you'd like to know more details of how I put my mosaics together please don't hesitate to drop me a line at the following email address.

Clear skies everyone.

The Lazy Astronomer

Email: thelazyastronomerpf@gmail.com



Astronomers discover new class of cosmic explosions

Blasts differ from 'ordinary' supernovae, gamma-ray bursts.

Astronomers have found two objects that, added to a strange object discovered in 2018, constitute a new class of cosmic explosions. The new type of explosion shares some characteristics with supernova explosions of massive stars and with the explosions that generate gamma-ray bursts (GRBs), but still has distinctive differences from each.

The saga began in June of 2018 when astronomers saw a cosmic blast with surprising characteristics and behavior. The object, dubbed AT2018cow ("The Cow"), drew worldwide attention from scientists and was studied extensively. While it shared some characteristics with supernova explosions, it differed in important aspects, particularly its unusual initial brightness and how rapidly it brightened and faded in just a few days.

In the meantime, two additional blasts -- one from 2016 and one from 2018 -- also showed unusual characteristics and were being observed and analyzed. The two new explosions are called CSS161010 (short for CRTS CSS161010 J045834-081803), in a galaxy about 500 million light-years from Earth, and ZTF18abvkwla ("The Koala"), in a galaxy about 3.4 billion light-years distant. Both were discovered by automated sky surveys (Catalina Real-time Transient Survey, All-Sky Automated Survey for Supernovae, and Zwicky Transient Facility) using visible-light telescopes to scan large areas of sky nightly.

Two teams of astronomers followed up those discoveries by observing the objects with the National Science Foundation's Karl G. Jansky Very Large Array (VLA). Both teams also used the Giant Metrewave Radio Telescope in India and the team studying CSS161010 used NASA's Chandra X-ray Observatory. Both objects gave the observers surprises.

Anna Ho, of Caltech, lead author of the study on ZTF18abvkwla, immediately noted that the object's radio emission was as bright as that from a gamma-ray burst. "When I reduced the data, I thought I had made a mistake," she said.

Deanne Coppejans, of Northwestern University, led the study on CSS161010, which found that the object had launched an "unexpected" amount of material into interstellar space at more than half the speed of light. Her Northwestern co-author Raffaella Margutti, said, "It took almost two years to figure out what we were looking at just because it was so unusual."

In both cases, the follow-up observations indicated that the objects shared features in common with AT2018cow. The scientists concluded that these events, called Fast Blue Optical Transients (FBOTs), represent, along with AT2018cow, a type of stellar explosion significantly different from others. The scientists reported their findings in papers in the Astrophysical Journal and the Astrophysical Journal Letters.

FBOTs probably begin, the astronomers said, the same way as certain supernovae and gamma-ray bursts -- when a star much more massive than the Sun explodes at the end of its "normal" atomic fusion-powered life. The differences show up in the aftermath of the initial explosion.

In the "ordinary" supernova of this type, called a core-collapse supernova, the explosion sends a spherical blast wave of material into interstellar space. If, in addition to this, a rotating disk of material briefly forms around the neutron star or black hole left after the explosion and propels narrow jets of material at nearly the speed of light outward in opposite directions, these jets can produce narrow beams of gamma rays, causing a gamma-ray burst.

The rotating disk, called an accretion disk, and the jets it produces, are called an "engine" by astronomers.

FBOTs, the astronomers concluded, also have such an engine. In their case, unlike in gamma-ray bursts, it is enshrouded by thick material. That material probably was shed by the star just before it exploded, and may have been pulled from it by a binary companion.

When the thick material near the star is struck by the blast wave, it causes the bright visible-light burst soon after the explosion that initially made these objects appear so unusual. That bright burst also is why astronomers call these blasts "fast blue optical transients." This is one of the characteristics that distinguished them from ordinary supernovae.

As the blastwave from the explosion collides with the material around the star as it travels outwards, it produces radio emission. This very bright emission was the important clue that proved that the explosion was powered by an engine.

The shroud of dense material "means that the progenitor star is different from those leading to gamma-ray bursts," Ho said. The astronomers said that in the Cow and in CSS161010, the dense material included hydrogen, something never seen in in gamma-ray bursts.

Using the W.M. Keck Observatory, the astronomers found that both CSS 161010 and ZTF18abvkwla, like the Cow, are in small, dwarf galaxies. Coppejans said that the dwarf galaxy properties "might allow some very rare evolutionary paths of stars" that lead to these distinctive explosions.

Although a common element of the FBOTs is that all three have a 'central engine,' the astronomers caution that the engine also could be the result of stars being shredded by black holes, though they consider supernova-type explosions to be the more likely candidate.

"Observations of more FBOTs and their environments will answer this question," Margutti said.

To do that, the scientists say they will need to use telescopes covering a wide range of wavelengths, as they have done with the first three objects. "While FBOTs have proven rarer and harder to find than some of us were hoping, in the radio band they're also much more luminous than we'd guessed, allowing us to provide quite comprehensive data even on events that are far away," said Daniel Perley, of the Liverpool John Moores University.

The National Radio Astronomy Observatory is a facility of the National Science Foundation, operated under cooperative agreement by Associated Universities, Inc. The study of CSS161010 was partially supported by the Heising-Simons Foundation, NASA, and the National Science Foundation.

Saturn's Moon Titan Are Drifting Away Faster Than Previously Thought

The new research by scientists at NASA and the Italian Space Agency has implications for the entire Saturn system as well as other planets and moons.

Just as our own Moon floats away from Earth a tiny bit more each year, other moons are doing the same with their host planets. As a moon orbits, its gravity pulls on the planet, causing a temporary bulge in the planet as it passes.

Over time, the energy created by the bulging and subsiding transfers from the planet to the moon, nudging it farther and farther out. Our Moon drifts 3.8 centimeters from Earth each year.

Scientists thought they knew the rate at which the giant moon Titan is moving away from Saturn, but they recently made a surprising discovery: Using data from NASA's Cassini spacecraft, they found Titan drifting a hundred times faster than previously understood - about 4 inches (11 centimeters) per year.

The findings may help address an age-old question. While scientists know that Saturn formed 4.6 billion years ago in the early days of the solar system, there's more uncertainty about when the planet's rings and its system of more than 80 moons formed. Titan is currently 759,000 miles (1.2 million kilometers) from Saturn.

The revised rate of its drift suggests that the moon started out much closer to Saturn, which would mean the whole system expanded more quickly than previously believed.

"This result brings an important new piece of the puzzle for the highly debated question of the age of the Saturn system and how its moons formed," said Valery Lainey, lead author of the work published June 8 in Nature Astronomy. He conducted the research as a scientist at NASA's Jet Propulsion Laboratory in Southern California before joining the Paris Observatory at PSL University.

Making Sense of Moon Migration

The findings on Titan's rate of drift also provide important confirmation of a new theory that explains and predicts how planets affect their moons' orbits.For the last 50 years, scientists have applied the same formulas to estimate how fast a moon drifts from its planet, a rate that can also be used to determine a moon's age. Those formulas and the classical theories on which they're based were applied to moons large and small all over the solar system. The theories assumed that in systems such as Saturn's, with dozens of moons, the outer moons like Titan migrated outward more slowly than moons closer in because they are farther from their host planet's gravity.

Four years ago, theoretical astrophysicist Jim Fuller, now of Caltech, published research that upended those theories. Fuller's theory predicted that outer moons can migrate outward at a similar rate to inner moons because they become locked in a different kind of orbit pattern that links to the particular wobble of a planet and slings them outward.

"The new measurements imply that these kind of planet-moon interactions can be more prominent than prior expectations and that they can apply to many systems, such as other planetary moon systems, exoplanets - those outside our solar system - and even binary star systems, where stars orbit each other," said Fuller, a coauthor of the new paper.

To reach their results, the authors mapped stars in the background of Cassini images and tracked Titan's position. To confirm their findings, they compared them with an independent dataset: radio science data collected by Cassini. During ten close flybys between 2006 and 2016, the spacecraft sent radio waves to Earth. Scientists studied how the signal's frequency was changed by their interactions with their surroundings to estimate how Titan's orbit evolved.

"By using two completely different datasets, we obtained results that are in full agreement, and also in agreement with Jim Fuller's theory, which predicted a much faster migration of Titan," said coauthor Paolo Tortora, of Italy's University of Bologna. Tortora is a member of the Cassini Radio Science team and worked on the research with the support of the Italian Space Agency.

More information about Cassini can be found here:

https://solarsystem.nasa.gov/cassini

The Image

Larger than the planet Mercury, huge moon Titan is seen here as it orbits Saturn. Below Titan are the shadows cast by Saturn's rings.

This natural color view was created by combining six images captured by NASA's Cassini spacecraft on May 6, 2012.

Credit: NASA/JPL-Caltech/Space Science Institute astrophotography

Matt Watson

Eta Carinae
Skywatcher Esprit 100
Canon 5DMKIII
Celestron CGX-L
APT, PHD2, DSS, PSCS6.

astrophotography

Dave Manning

IC2948
Running Chicken Nebulae
Quad Band filter
33x120sec
SharpStar 76EDPH Triplet
0.82x Field Flattener & Reducer
Focal Ratio: f/4.5
Camera: ZWO ASI2600MC Pro
Guide: ZWO ASI290MM Mini
PrimaLuceLab Focuser
ZWO 2” Filter Wheel
Mount: CGX
Live Stacks using SharpCap Pro
Pixinsight and/or Photoshop

astrophotography

Tony Law

Sony A7s
Samyang 14mm f2.8

European Southern Observatory
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European Southern Observatory
ESO Science Newsletter June 2020

Update on La Silla Paranal Observatory
12 Jun 2020:

All ESO observatories continue to operate in safe mode and no science operation is taking place. All visitor mode runs until middle of July have been cancelled. La Silla Paranal Observatory has developed a ramp-up plan to transition the Paranal, La Silla and APEX Observatories from Safe State to Restricted Operations mode, with the ability to perform basic science operations with limited staffing on site. Once the ramp-up plan is initiated, we estimate a minimum of three weeks until first scientific data can be taken again, and about two more weeks until 'steady state' restricted operations would be reached.

Read more

Update on the Status of the ALMA Observatory
11 Jun 2020:

The COVID-19 pandemic continues to impact the global community, including ALMA users and staff. While ALMA operations remain suspended, we have been working actively on plans to restart operations at a time that they become feasible. In these unprecedented circumstances, ALMA's first priority is the health and safety of all our staff, many of whom travel long distances by bus and plane to reach the remote ALMA telescope site in the Atacama Desert of northern Chile. At this time, and given the current evolution of the COVID-19 outbreak in Chile, it is unclear when a ramp up to start operations could begin, or when a restart of science operations will be possible. ALMA is working on guidelines and considerations for the restart of operations and will provide a next update to the community in the coming weeks.

Read more

Workshop Postponed: Inward Bound - Bulges from High Redshifts to the Milky Way
09 Jun 2020:

ESO Headquarters, Garching, Germany 22-26 November, 2021

Due to the difficult circumstances due to the COVID-19 pandemic, the LOC and SOC agreed to postpone this conference to 2021. It will be held as planned at ESO Headquarters. The organisers have studied the possibility of going ahead with an online meeting, but this would have been very detrimental to one of the main goals, which is to foster discussions and collaborations between members of the four different communities (Galactic, extra-galactic, high-z and theory).

Read more

ESO Cosmic Dialogues

ESO is organising a web-based series of Cosmic Duologues aiming to cover the current state of some of the major questions in astronomy today in a lively way, via a duologue between two professional astronomers, each expert in their field. These events are streamed live via YouTube and are open to all members of the scientific community. The dedicated website will show how to access the last two duologues, including information on how to access past events. The next event on Substructure in Protoplanetary Discs will take place on Monday 29 June. The following duologue will be called Dust at High-z and will be held on Monday 6 July. Please see the event webpage for more details of the event.

Read more

Online Munich Joint Astrophysics Colloquia (JAC)
05 May 2020:

The Munich Astrophysics Colloquium (JAC) series is jointly organised by ESO, the Max Planck Institute for Astrophysics, the Max Planck Institute for Extraterrestial Physics and the Observatory of the Ludwig-Maximilians University in Munich. JAC presentations cover the most exciting topics and developments in astrophysics. A video archive of presentations given in 2020 and 2019 is available and earlier presentations can be found through the ESO Garching Seminar Web page.

Read more

Upcoming ESO or ESO-Related Workshops

H0 - Assessing Uncertainties in Hubble's Constant Across the Universe
Online, 22–26 June 2020

What's lurking behind the discord in the Hubble constant? This conference will discuss a wide range of observational methods, how to improve their systematics, and what H0 and other cosmological tensions tell us about cosmology and possible new physics beyond the Lambda-CDM model.

Summer Research Programme
Online, 2 July-11 August 2020

The very successful ESO Summer Research Programme continues in 2020. This programme provides a unique opportunity to students not yet enrolled in PhD programmes to carry out a six-week research project with ESO Fellows and staff. Students can choose between a wide range of research projects, covering many areas of astronomy from exo-planets to cosmology. The programme also provides opportunities beyond research, including lectures, a mini-workshop, and many social activities. This year the workshop will be conducted online.

Pitch your research for an ESO Press Release for a chance to make the news. ESO produces press releases based on research done with ESO telescopes or instruments, including those where ESO is a partner or that are hosted at an ESO site. At the Department of Communication, we are always searching for exciting and important research to feature in ESO press releases. If you have an interesting story of your own that you think could fit the criteria for an ESO press release, please send your paper to ESO's Public Information Officer Barbara Ferreira via e-mail at pio@eso.org.

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