Space News Update

— April 3, 2018 —

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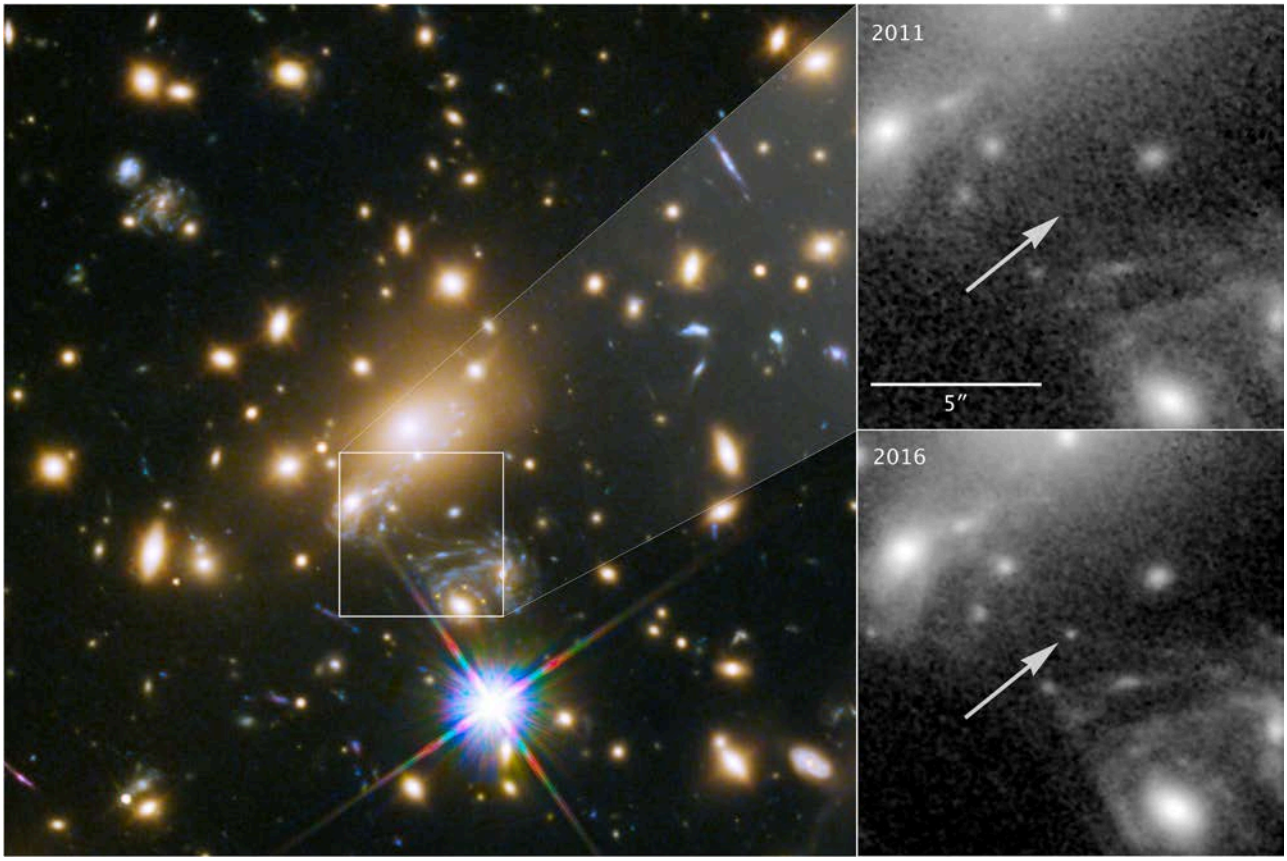
1. Hubble Uncovers the Farthest Star Ever Seen



More than halfway across the universe, an enormous blue star nicknamed Icarus is the farthest individual star ever seen. Normally, it would be much too faint to view, even with the world's largest telescopes. But through a quirk of nature that tremendously amplifies the star's feeble glow, astronomers using NASA's Hubble Space Telescope were able to pinpoint this faraway star and set a new distance record. They also used Icarus to test one theory of dark matter, and to probe the make-up of a foreground galaxy cluster.

The star, harbored in a very distant spiral galaxy, is so far away that its light has taken 9 billion years to reach Earth. It appears to us as it did when the universe was about 30 percent of its current age.

The discovery of Icarus through gravitational lensing has initiated a new way for astronomers to study individual stars in distant galaxies. These observations provide a rare, detailed look at how stars evolve, especially the most luminous stars.

"This is the first time we're seeing a magnified, individual star," explained former University of California at Berkeley postdoc and study leader Patrick Kelly now of the University of Minnesota, Twin Cities. "You can see individual galaxies out there, but this star is at least 100 times farther away than the next individual star we can study, except for supernova explosions."

Gravity as a Natural Cosmic Lens

The cosmic quirk that makes this star visible is a phenomenon called "gravitational lensing." Gravity from a foreground, massive cluster of galaxies acts as a natural lens in space, bending and amplifying light. Sometimes light from a single background object appears as multiple images. The light can be highly magnified, making extremely faint and distant objects bright enough to see.

In the case of Icarus, a natural “magnifying glass” is created by a galaxy cluster called MACS J1149+2223. Located about 5 billion light-years from Earth, this massive cluster of galaxies sits between the Earth and the galaxy that contains the distant star. By combining the strength of this gravitational lens with Hubble’s exquisite resolution and sensitivity, astronomers can see and study Icarus.

The team — including Jose Diego of the Instituto de Física de Cantabria, Spain, and Steven Rodney of the University of South Carolina, Columbia — dubbed the star “Icarus,“ after the Greek mythological character who flew too near the Sun on wings of feathers and wax that melted. (Its official name is MACS J1149+2223 Lensed Star 1.) Much like Icarus, the background star had only fleeting glory as seen from Earth: It momentarily skyrocketed to 2,000 times its true brightness when temporarily magnified.

Models suggest that the tremendous brightening was probably from the gravitational amplification of a star, similar in mass to the Sun, in the foreground galaxy cluster when the star moved in front of Icarus. The star’s light is usually magnified by about 600 times due to the foreground cluster’s mass.

Characterizing Icarus

The team had been using Hubble to monitor a supernova in the far-distant spiral galaxy when, in 2016, they spotted a new point of light not far from the magnified supernova. From the position of the new source, they inferred that it should be much more highly magnified than the supernova.

When they analyzed the colors of the light coming from this object, they discovered it was a blue supergiant star. This type of star is much larger, more massive, hotter, and possibly hundreds of thousands of times intrinsically brighter than our Sun. But at this distance, it would still be too far away to see without the amplification of gravitational lensing, even for Hubble.

How did Kelly and his team know Icarus was not another supernova? “The source isn’t getting hotter; it’s not exploding. The light is just being magnified,” said Kelly. “And that’s what you expect from gravitational lensing.”

Looking for Dark Matter

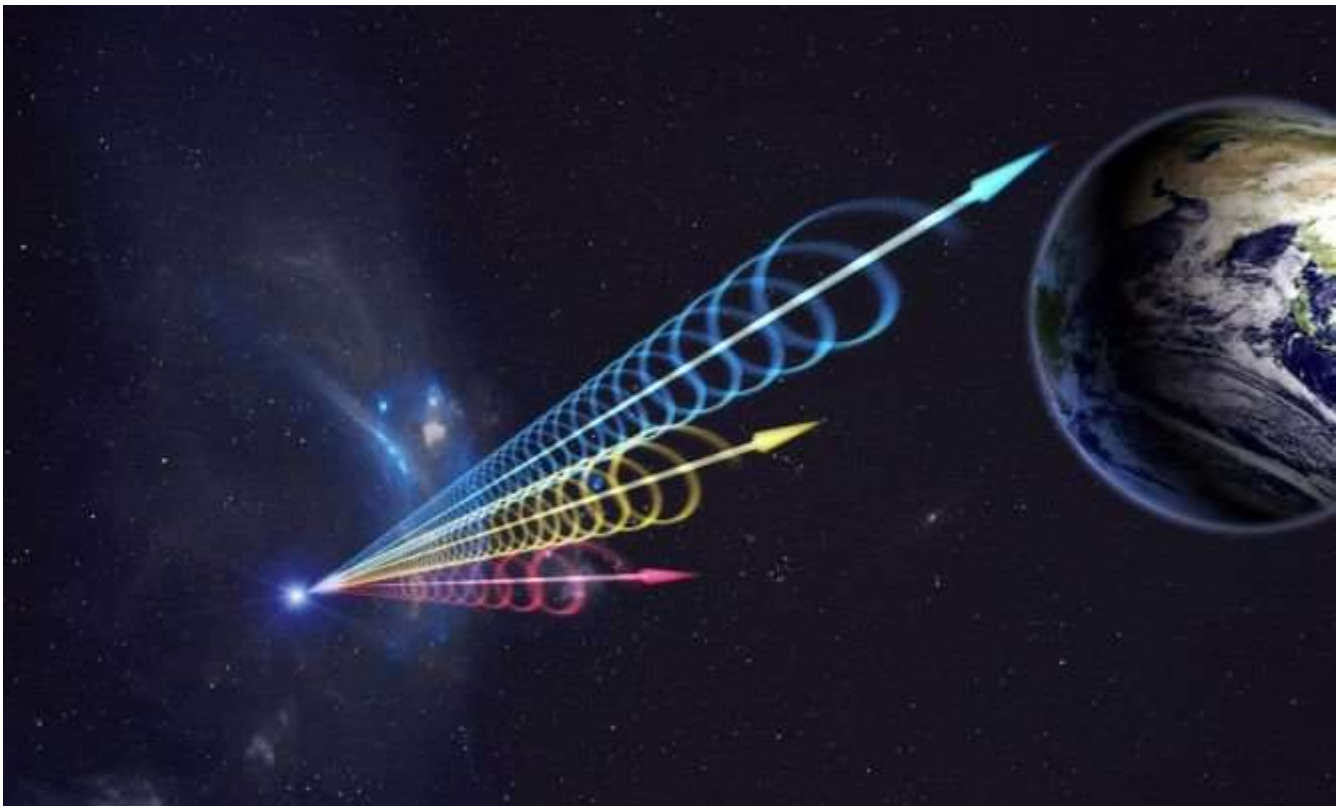
Detecting the amplification of a single, pinpoint background star provided a unique opportunity to test the nature of dark matter in the cluster. Dark matter is an invisible material that makes up most of the universe’s mass.

By probing what’s floating around in the foreground cluster, scientists were able to test one theory that dark matter might be made up mostly of a huge number of primordial black holes formed in the birth of the universe with masses tens of times larger than the Sun. The results of this unique test disfavor that hypothesis, because light fluctuations from the background star, monitored with Hubble for 13 years, would have looked different if there were a swarm of intervening black holes.

When NASA's James Webb Space Telescope is launched, astronomers expect to find many more stars like Icarus. Webb's extraordinary sensitivity will allow measurement of even more details, including whether these distant stars are rotating. Such magnified stars may even be found to be fairly common.

Source: NASA Return to Contents

2. Understanding fast radio bursts



Astronomers are detecting a mysterious, powerful form of radiation blipping across space, and nobody's quite sure why.

Fast radio bursts (FRBs) are flashes of light radiation from beyond our galaxy. They only last for a few milliseconds, but some bursts have as much power as the radiation of 500 million Suns.

The problem is, after one brief flash in the sky, they disappear forever. Until now.

Three years ago, a graduate student of McGill University named Paul Scholz noticed a fast radio burst first spotted in 2012—called FRB 121102—was repeating. This began a race to figure out the mystery behind FRB 121102 that last year began to show answers. This weird radio burst pulsing out from a dwarf galaxy about 3 billion light years away calls into doubt some theories researchers had on fast radio bursts.

The biggest problem with looking for fast radio bursts is you don't know when and where one will flash next. You have to watch the skies and hope you get lucky. FRB 121102 changes all that.

Hoping to get lucky

Now, observatories around the world are pointing at the repeating burst to uncover the hidden story of these strange flashes.

Researchers across the world are now guessing at the origins of fast radio bursts. Most guesses involve a neutron star plunked into the middle of some extreme conditions: black holes, supernovae remnants, colliding with another neutron star or even collapsing in on itself.

What can they teach us?

One reason scientists are so interested in learning more about fast radio bursts is they can act like a cosmic radar. Dr. Charlotte Sobey of the International Centre for Radio Astronomy Research (ICRAR) says we would only be able to receive the signal, but it would give us information about the space it passes through on its way to Earth.

The way this works isn't much different from a submarine's sonar. The radio signal is sent out from FRB 121102, and as it hits things in space, the signal changes, carrying the information with it. Once the signal gets picked out by our receivers, we can use that information to figure out what it encountered on its journey.

FRB 121102 is already taking scientists the first steps towards this cosmic radar. How? Well, this burst doesn't just repeat, it's also completely polarised.

Signal polarisation means the radio wave is being warped. Astronomers think this can only happen if the signal is travelling through a powerful magnetic field on the way to our planet.

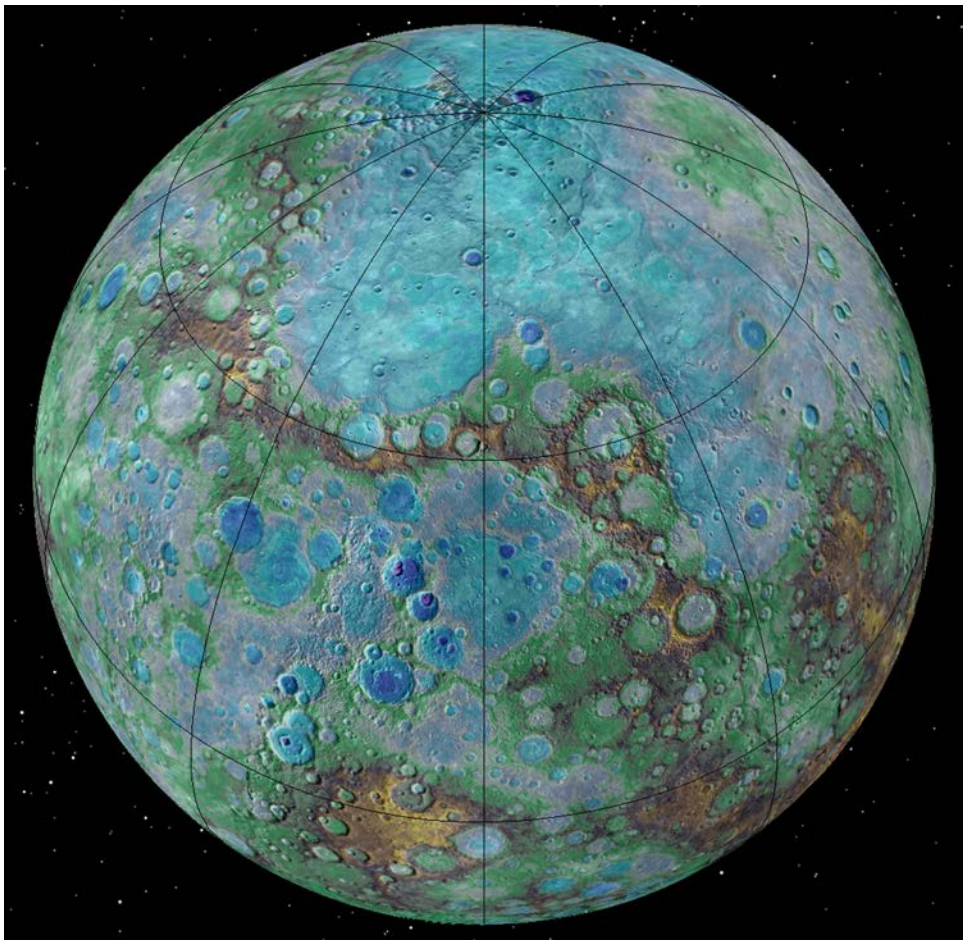
At the moment, astronomers at Aricebo Observatory, Puerto Rico, who are measuring FRB 121102 think it is coming from a strong young neutron star hanging on the edge of a black hole. Another possibility is if the signal is travelling through a plasma cloud on its way to Earth.

The polarisation is the same each time FRB 121102 repeats. This leads scientists to think whatever the signal is travelling through is staying put. So somewhere between FRB 121102 and Earth is a huge cosmic event hanging out in the sky.

Even if we figure out what created FRB 121102, it still might not mean all fast radio bursts happen the same way. But for each one we find and measure, we get another cosmic radar scan of some of the most destructive and powerful forces in the known universe.

Source: Phys.org Return to Contents

3. New Extrasolar Planet Has the Composition of Mercury, but 2.5 Times the Mass of Earth



In the course of searching for planets beyond our Solar System – aka. extra-solar planets – some truly interesting cases have been discovered. In addition to planets that are several times the size of the Solar System's largest planet (Super-Jupiters), astronomers have also found a plethora of terrestrial (i.e rocky) planets that are several times the size of Earth (Super-Earths).

This is certainly true of K2-229b, a rocky planet that was recently discovered by an international team of astronomers. Located 339 light years away, this hot, metallic planet is an exercise in extremes. Not only is it 20% larger than Earth, it is 2.6 times Earth mass and has a composition similar to Mercury. On top of that, its orbits its star so closely that it is several times hotter than Mercury.

The study which details their discovery recently appeared in the journal *Nature* under the title "An Earth-sized exoplanet with a Mercury-like composition". The study was led by Alexandre Santerne, a researcher from the Laboratoire d'Astrophysique de Marseille (LAM) at the Aix-Marseille Université, and included members from the the European Southern Observatory (ESO), the University of Warwick, the Universidade do Porto, and multiple universities and research institutions.

Using data from the *Kepler* space telescopes *K2* mission, the team was able to identify K2-229b, a Super-Earth that orbits a medium-sized K dwarf (orange dwarf) star in the Virgo Constellation. Using the Radial Velocity Method – aka. Doppler Spectroscopy – the team was able to determine the planet's size and mass, which indicated that it is similar in composition to Mercury – i.e. metallic and rocky.

They were also able to determine that it orbits its star at a distance of 0.012 AU with an orbital period of just 14 days. At this distance, K2-229b is roughly one one-hundredth as far from its star as the Earth is from the Sun and experiences surface temperature that are several times higher than those on Mercury – reaching a day side temperature 2000 °C (3632 °F), or hot enough to melt iron and silicon.

As Dr. David Armstrong, a researcher from the University of Warwick and a co-author on the study, explained:

"Mercury stands out from the other Solar System terrestrial planets, showing a very high fraction of iron and implying it formed in a different way. We were surprised to see an exoplanet with the same high density, showing that Mercury-like planets are perhaps not as rare as we thought. Interestingly K2-229b is also the innermost planet in a system of at least 3 planets, though all three orbit much closer to their star than Mercury. More discoveries like this will help us shed light on the formation of these unusual planets, as well as Mercury itself."

Given its dense, metallic nature, it is something of a mystery of how this planet formed. One theory is that the planet's atmosphere could have been eroded by intense stellar wind and flares, given that the planet is so close to its star. Another possibility is that it was formed from a huge impact between two giant bodies billions of years ago – similar to the theory of how the Moon formed after Earth collided with a Mars-sized body (named Theia).

As with many recent discoveries, this latest exoplanet is giving astronomers the opportunity to see just what is possible. By studying how them, we are able to learn more about how the Solar System formed and evolved. Given the similarities between K2-229b and Mercury, the study of this exoplanet could teach us much about how Mercury became a dense, metallic planet that orbits closely to our Sun.

Source: Universe Today Return to Contents

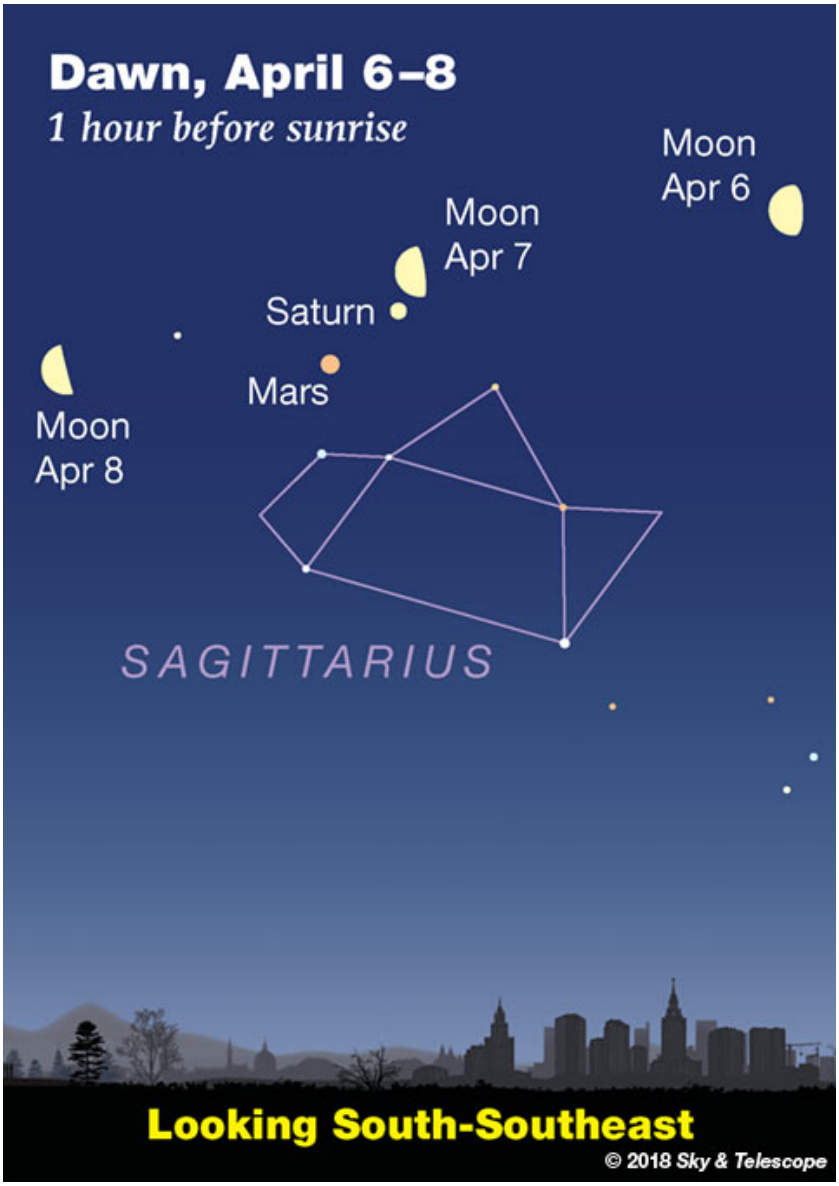
The Night Sky

Tuesday, April 3
• Capella is the bright star high in the west-northwest during and after dusk. Its pale-yellow color matches that of the Sun, meaning they're both about the same temperature. But otherwise Capella is very different. It consists of two yellow giant stars orbiting each other rather closely every 104 days.

Moreover, for telescope users, Capella is distantly accompanied by a tight pair of red dwarfs: Capella H and L, magnitudes 10 and 13. Article and finder charts.

Wednesday, April 4
• High above the Big Dipper late these evenings, nearly crossing the zenith for mid-northern skywatchers, are three pairs of dim naked-eye stars, all 3rd or 4th magnitude, marking the Great Bear's feet. They're also known as the Three Leaps of the Gazelle, from early Arab lore. They form a long line roughly midway between the Bowl of the Big Dipper and the Sickle of Leo.

According to Arab lore, the gazelle was drinking at a pond — the big, dim Coma Berenices star cluster — and dashed away when startled by a flick of Leo's nearby tail, Denebola. Leo, however, seems quite unaware, facing the other direction.



Thursday, April 5
• The Sickle of Leo stands vertical high in the south these evenings. Its bottom star is Regulus, the brightest of Leo. Leo himself is walking horizontally westward. The Sickle forms his front leg, chest, mane, and part of his head.

• As dawn approaches on Friday the 6th, look for Mars and Saturn to the left of the waning Moon, as shown here.

Friday, April 6
• Right after dark, Orion is still well up in the southwest in his spring orientation: striding down to the right, with his belt turning roughly horizontal. The belt points left toward Sirius and right toward Aldebaran and, farther on, the Pleiades.

• As dawn approaches on Saturday the 7th, you'll find the waning Moon bunching up with Mars and Saturn, as shown here.

Source: Sky & Telescope

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ISS Sighting Opportunities

For Denver:

Date	Visible	Max Height	Appears	Disappears
Tue Apr 3, 7:49 PM	1 min	10°	10° above NNW	10° above N
Tue Apr 3, 9:26 PM	1 min	15°	11° above NNW	15° above N
Wed Apr 4, 8:34 PM	3 min	12°	10° above N	10° above NE
Thu Apr 5, 9:17 PM	2 min	23°	11° above NNW	23° above NNE
Fri Apr 6, 8:25 PM	4 min	17°	10° above NNW	12° above ENE
Fri Apr 6, 10:02 PM	< 1 min	19°	19° above NW	19° above NW

Sighting information for other cities can be found at NASA's Satellite Sighting Information

NASA-TV Highlights

(all times Eastern Daylight Time)

4 p.m., 8 p.m., 10 p.m., Tuesday, April 3 - Replay of Low Boom Flight Demonstrator (LBFD) X- Plane Build News Conference (all channels)

5:30 a.m., Wednesday, April 4 - Coverage of the Rendezvous and Capture of the SpaceX CRS-14 Dragon Cargo Craft at the ISS (Capture scheduled at 7 a.m. EDT) (all channels)

8:30 a.m., Wednesday, April 4 - Coverage of the Installation of the SpaceX CRS-14 Dragon Cargo Craft to the ISS (all channels)

7 a.m., Friday, April 6 - ISS Expedition 55 In-Flight Event for JAXA with the Astro Kanai Project in Japan and Flight Engineer Norishige Kanai of the Japan Aerospace Exploration Agency (NTV-1 with interpretation; NTV-3 in native language) (starts at 7:15 a.m.) (all channels)

12 p.m., Friday, April 6 - ISS Expedition 55 Educational In-Flight Event with Queen's University in Kingston, Ontario and Flight Engineers Drew Feustel of NASA and Norishige Kanai of the Japan Aerospace Exploration Agency (starts at 12:05 p.m.) (all channels)

Watch NASA TV on the Net by going to the NASA website. Return to Contents

Space Calendar

- Apr 03 - Moon Occults Asteroid 16 Psyche
- Apr 03 - Asteroid 9995 Alouette Closest Approach To Earth (1.046 AU)
- Apr 03 - Asteroid 26732 Damianpeach Closest Approach To Earth (1.438 AU)
- Apr 03 - Asteroid 84566 VIMS Closest Approach To Earth (1.523 AU)
- Apr 03 - Asteroid 4804 Pasteur Closest Approach To Earth (2.024 AU)
- Apr 03 - Asteroid 163800 Richardnorton Closest Approach To Earth (2.106 AU)
- Apr 03 - Asteroid 12432 Usuda Closest Approach To Earth (2.160 AU)
- Apr 03 - Asteroid 1877 Marsden Closest Approach To Earth (3.102 AU)
- Apr 03 - 45th Anniversary (1973), Salyut 2 Launch (USSR's 2nd Space Station)
- Apr 04 - HOT [Mar 30] 50th Anniversary (1968), Apollo 6 Launch (Last Test Flight of Saturn V)
- Apr 04 - Asteroid 4 Vesta Occults 2UCAC 25373191 (11.8 Magnitude Star)
- Apr 04 - Apollo Asteroid 2018 EB Near-Earth Flyby (0.027 AU)
- Apr 04 - Asteroid 16543 Rosetta Closest Approach To Earth (1.534 AU)
- Apr 04 - Asteroid 2807 Karl Marx Closest Approach To Earth (1.607 AU)
- Apr 04 - Asteroid 391257 Wilwheaton Closest Approach To Earth (1.807 AU)
- Apr 04 - Asteroid 96193 Edmonton Closest Approach To Earth (1.898 AU)
- Apr 04 - NEW [Mar 28] Teleconference: Exoplanet Science Strategy
- Apr 04 - 35th Anniversary (1983), STS-6 Launch (Space Shuttle Challenger, 1st EVA)
- Apr 04 - Joseph Ashbrook's 100th Birthday (1918)
- Apr 05 - UPDATED [Mar 28] Superbird 8/DSN 1/ Hylas 4 Ariane 5 Launch
- Apr 05 - Comet C/2015 O1 (PANSTARRS) Closest Approach To Earth (3.233 AU)
- Apr 05 - Apollo Asteroid 2018 FW4 Near-Earth Flyby (0.025 AU)
- Apr 05 - Asteroid 5261 Eureka (Mars Trojan) Closest Approach To Earth (0.722 AU)
- Apr 05 - Atira Asteroid 2015 DR215 Closest Approach To Earth (0.970 AU)
- Apr 05 - Asteroid 4871 Riverside Closest Approach To Earth (1.464 AU)
- Apr 05 - Asteroid 1777 Gehrels Closest Approach To Earth (1.625 AU)
- Apr 05 - Asteroid 1071 Brita Closest Approach To Earth (1.913 AU)
- Apr 05 - Asteroid 2068 Dangreen Closest Approach To Earth (2.007 AU)
- Apr 05 - 45th Anniversary (1973), Pioneer 11 Launch (Jupiter & Saturn Flyby Mission)
- Apr 06 - Comet 316P/LONEOS-Christensen At Opposition (3.535 AU)
- Apr 06 - Comet P/2006 H1 (McNaught) At Opposition (3.943 AU)
- Apr 06 - Asteroid 35352 Texas Closest Approach To Earth (1.490 AU)
- Apr 06 - 10th Anniversary (2008), Berduc Meteorite Fall (Hit Building in Argentina)
- Apr 06 - Franck Marchis' 45th Birthday (1973)

Source: JPL Space Calendar Return to Contents

Food for Thought

'2001: A Space Odyssey': Book celebrates 50th anniversary of sci-fi movie masterpiece

It's the 50th birthday of a film that was supposed to be — and definitely is — "the proverbial 'really good' science fiction movie," and Michael Benson's exhaustive new book about the making of *2001: A Space Odyssey* stars the two men at the center of an influential powerhouse.

In 1968, *2001* changed the game for the sci-fi genre. Until that point, science fiction movies were mainly considered trash. Then a couple of cultural giants — novelist Arthur C. Clarke and filmmaker Stanley Kubrick — got together and created an astounding, philosophical and downright Homeric work that explored evolution, artificial intelligence and the existence of alien life in the universe.

Space Odyssey: Stanley Kubrick, Arthur C. Clarke and the Making of a Masterpiece(Simon & Schuster, 512 pp., ★★★ out of four) effectively chronicles all of it, down to the smallest spaceship details and the most petty business decisions.

The book presents in a fairly straightforward manner the four years between director Kubrick and author Clarke's initial meeting and *2001*'s release. Both were fans of each other's work: Kubrick, coming off *Dr. Strangelove*, yearned to make a groundbreaking sci-fi epic, and the older Clarke, a sci-fi icon even then, wanted to break into Hollywood. They became a cinematic equivalent to McCartney and Lennon, two talented visionaries who became friends and created something epic, while also navigating the friction between them.

And something as mind-blowing and esoteric as *2001*, which begins with early man-apes discovering a black monolith object and then blasts into the future with astronauts dealing with an AI on the verge of a breakdown (the antagonistic HAL-9000), is going to have its setbacks.

Benson skillfully digs into the budget-busting actions and plot problems, because the script was constantly changing during filming and it took forever for Kubrick to figure out the trippy ending. It's enlightening stuff, especially for casual fans of the movie, about how Kubrick got struggling actors to learn their lines and the near-mutiny of the special-effects department when the filmmaker considered having his main characters travel to Saturn instead of Jupiter.

Hardcore *2001* nerds will dig the nuts and bolts of the designs of the "Dawn of Man" opening and the memorable "Star Gate" sequence. There's loads of trivia (the movie's costumer plotted the assassination of Nazis!) and Benson weaves in supporting personalities who put readers on ground zero of the filming chaos. But, like a good Beatles tune when those two songwriters are clicking, *Space Odyssey* is fueled by the dynamic between Kubrick and Clarke.

Both had their egos, sure, yet powered through differences to make something great. Clarke had to deal with other personal business during the making of *2001* and also worried that Kubrick would be bothered by his homosexuality (he wasn't). And the filmmaker himself, who had a reputation for being brilliant but cold, is given a fair amount of warmth by Benson: One passage finds Kubrick directing his young daughter for a voice-over that's more than a little adorable.

Source: USA Today

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Space Image of the Week

Moons, Rings, Shadows, Clouds: Saturn (Cassini)
Image Credit: NASA, JPL-Caltech, Space Science Institute

Explanation: While cruising around Saturn, be on the lookout for picturesque juxtapositions of moons, rings, and shadows. One quite picturesque arrangement occurred in 2005 and was captured by the then Saturn-orbiting Cassini spacecraft. In the featured image, moons Tethys and Mimas are visible on either side of Saturn's thin rings, which are seen nearly edge-on. Across the top of Saturn are dark shadows of the wide rings, exhibiting their impressive complexity. The violet-light image brings up the texture of the backdrop: Saturn's clouds. Cassini orbited Saturn from 2004 until September of last year, when the robotic spacecraft was directed to dive into Saturn to keep it from contaminating any moons.

Source: APOD

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