AOH Newsletter

Summer 2020

News and Notes

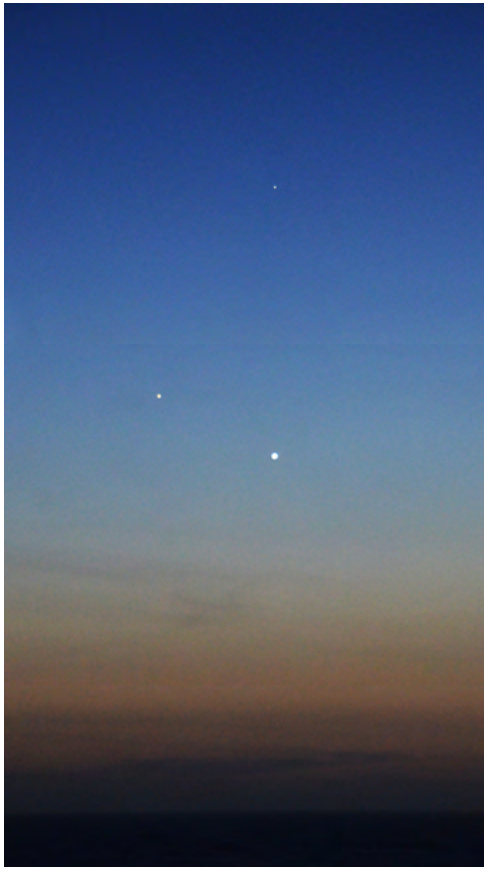
It's been a long Winter and Spring, and it is looking like it will be a long Summer. We started out the year with a string on consecutive rainouts of our observing sessions, and now we're in a stretch of Covid-19-generated cancellations. The Club officers have posted the following statement:

> A note about outreach programs. Most if not all of our usual summer outreach programs and public observing sessions are canceled because of the Covid-19 pandemic. Regardless of "official" recommendations, the Astronomers of Humboldt feel that it is impossible to carry out our usual hands-on activities and shared telescopic observations in a socially responsible way. We encourage our members to go observing with their own equipment and to observe appropriate distancing protocols. Stay safe!

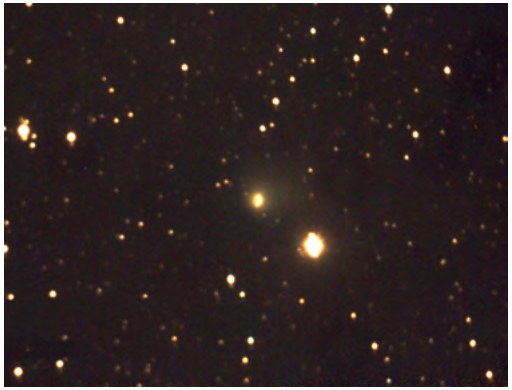
Meanwhile, however, we are continuing our monthly meetings via Zoom. We get together and swap stories, share pictures, watch videos, and enjoy our individually-served hot chocolate and cookies. Instructions for joining each Zoom session get sent out by email to all dues-paid AOH members about a week before the meeting. Get paid up on your dues and watch out for the announcement!

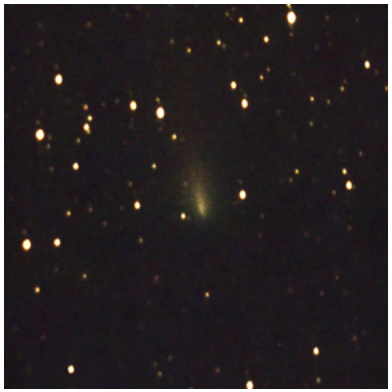
We are also doing whatever observing we can. In the absence of organized get-togethers, individuals are setting up scopes, binoculars, and camera tripods in backyards, driveways, and vacated public places. Attached are a few photos; send us whatever else you have, or send us a description of what you have seen.

Ken Yanosko
ken@astrohum.org



Above: Grace Wheeler's photo of Venus taken on 5/22/2020—about 12 days before inferior solar conjunction. On that day, Venus was 5% illuminated and had an apparent diameter of 53.8 arc seconds. Left: Ken Yanosko's picture of Venus (brightest object) and Mercury (above and left), taken on 5/22/2020. The two were about two degrees apart. The day before they had been less than a degree apart.





Comets! Left: Panstarrs (C/2017 T2). It's the fuzzy thing next to the triple star system Gamma Camelopardalis. Right: Atlas (C/2019 Y4). Both Photos taken on 4/13/2020 by Grace Wheeler. Each is a 300 second exposure.

Screen shots of the AOH Spring Zoom meetings.

Above: April 25. Left: May 23.

Messier Sprint?

We always schedule a Messier Marathon in the spring, and we frequently wind up canceling it. If it's not bad weather, it's coronavirus. So how about trying a Messier Sprint, instead? Actually we can do a Messier Sprint every month of the year!

Astronomer Tony Cecce has compiled a list, for each month, of selected Messier objects visible in the evening that month. For example, here are his July selections, with his comments:

M3: This globular cluster in Canes Venatici is one of the brightest objects in the sky. In binoculars this object is definitely not star like, but more of a bright, small snowball easy to see. Small telescopes will begin to resolve M3 into individual stars. The hardest part of this object is locating it in a portion of sky that contains few bright landmarks.

M53: Another globular cluster in Canes Venatici. While not quite as big or bright as M3 it is still an obvious binocular object. Resolvable in small telescopes, it as easy object to find sharing the same low power telescope field as fifth magnitude Alpha Coma Berenices.

M5: A big, bright globular cluster located in Serpens Caput. M5 is as nice as M3 but lies near a fifth magnitude naked eye star (5 Serpentis) making it an easy object to find.

M68: An eighth magnitude globular cluster in Hydra, M68 is a difficult binocular object for Northern observers. It appears as a faint fuzz spot in binoculars, you may need to use averted vision or large binoculars to find this one. Appearing as a round fuzzy patch in a 8" telescope, you will need a much larger aperature to really resolve it.

M83: A face on spiral in Hydra. M83 is fairly easy in binoculars as a faint, fuzzy patch of light. In a telescope look for a large patch of light with a bright center.

M4: A big bright globular in Scorpius, easily located near Antares. This is an easy binocular object appearing as a round snowball. Partially resolvable in a telescope, the trade mark of this globular is a line of bright stars crossing the center.

M80: This is the smallest and faintest globular cluster this month. Located in Scopius, M80 is a very tough binocular object appearing as a faint star with slight fuzziness around the edges. This is confirmed with a telescope, M80 has a bright central condensation in the middle of faint fuzz. It is one of the Messier objects that even through a medium telescope still looks like a comet.

For the other months of the year go to http://www.messier.seds.org/xtra/12months/12months.html. Sprinters, on your mark, get set, go!

ESO Instrument Finds Closest Black Hole to Earth

Invisible object has two companion stars visible to the naked eye

A team of astronomers from the European Southern Observatory (ESO) and other institutes has discovered a black hole lying just 1000 light-years from Earth. The black hole is closer to our Solar System than any other found to date and forms part of a triple system that can be seen with the naked eye. The team found evidence for the invisible object by tracking its two companion stars using the MPG/ESO 2.2-metre telescope at ESO's La Silla Observatory in Chile. They say this system could just be the tip of the iceberg, as many more similar black holes could be found in the future.

"We were totally surprised when we realised that this is the first stellar system with a black hole that can be seen with the unaided eye," says Petr Hadrava, Emeritus Scientist at the Academy of Sciences of the Czech Republic in Prague and co-author of the research. Located in the constellation of Telescopium, the system is so close to us that its stars can be viewed from the southern hemisphere on a dark, clear night without binoculars or a telescope. "This system contains the nearest black hole to Earth that we know of," says ESO scientist Thomas Rivinius, who led the study published today in Astronomy & Astrophysics. The team originally observed the system, called HR 6819, as part of a study of double-star systems. However, as they analysed their observations, they were stunned when they revealed a third, previously undiscovered body in HR 6819: a black hole. The observations with the FEROS spectrograph on the MPG/ESO 2.2-metre telescope at La Silla showed that one of the two visible stars orbits an unseen object every 40 days, while the second star is at a large distance from this inner pair. Dietrich Baade, Emeritus Astronomer at ESO in Garching and co-author of the study, says: "The observations needed to determine the period of 40 days had to be spread over several months. This was only possible thanks to ESO's pioneering service-observing scheme under which observations are made by ESO staff on behalf of the scientists needing them."

The hidden black hole in HR 6819 is one of the very first stellar-mass black holes found that do not interact violently with their environment and, therefore, appear truly black. But the team could spot its presence and calculate its mass by studying the orbit of the star in the inner pair. "An invisible object with a mass at least 4 times that of the Sun can only be a black hole," concludes Rivinius, who is based in Chile.

Astronomers have spotted only a couple of dozen black holes in our galaxy to date, nearly all of which strongly interact with their environment and make their presence known by releasing powerful X-rays in this interaction. But scientists estimate that, over the Milky Way's lifetime, many more stars collapsed into black holes as they ended their lives. The discovery of a silent, invisible black hole in HR 6819 provides

clues about where the many hidden black holes in the Milky Way might be. "There must be hundreds of millions of black holes out there, but we know about only very few. Knowing what to look for should put us in a better position to find them," says Rivinius. Baade adds that finding a black hole in a triple system so close by indicates that we are seeing just "the tip of an exciting iceberg."

Already, astronomers believe their discovery could shine some light on a second system. "We realised that another system, called LB-1, may also be such a triple, though we'd need more observations to say for sure," says Marianne Heida, a postdoctoral fellow at ESO and co-author of the paper. "LB-1 is a bit further away from Earth but still pretty close in astronomical terms, so that means that probably many more of these systems exist. By finding and studying them we can learn a lot about the formation and evolution of those rare stars that begin their lives with more than about 8 times the mass of the Sun and end them in a supernova explosion that leaves behind a black hole."

The discoveries of these triple systems with an inner pair and a distant star could also provide clues about the violent cosmic mergers that release gravitational waves powerful enough to be detected on Earth. Some astronomers believe that the mergers can happen in systems with a similar configuration to HR 6819 or LB-1, but where the inner pair is made up of two black holes or of a black hole and a neutron star. The distant outer object can gravitationally impact the inner pair in such a way that it triggers a merger and the release of gravitational waves. Although HR 6819 and LB-1 have only one black hole and no neutron stars, these systems could help scientists understand how stellar collisions can happen in triple star systems.

For more information about this story, and a link to a video, see the ESO press release at https://www.eso.org/public/news/eso2007/

For more information about the ESO, visit https://www.eso.org/public/about-eso/esoglance/

IDA and IES Join Forces to Protect the Night from Light Pollution

The International Dark-sky Association and the Illuminating Engineering Society have issued a joint resolution supporting the Five Principles for Responsible Outdoor Lighting. The principles can be summarized as:

USEFUL. All light should have a clear purpose.
TARGETED. Light should be directed only to where needed.
LOW LIGHT LEVELS. Light should be no brighter than necessary.
CONTROLLED. Light should be used only when it is useful.
COLOR. Use warmer colors where possible.

A joint statement was issued April 17, 2020 by Ruskin Hartley, Executive Director, IDA, and Brian Liebel, Director of Standards and Research, IES:

Too often, outdoor electric lighting installations at night are over lit, left on when not needed, and are harmful to the environment. As a result, light pollution is a growing global issue that can negatively effect our environment and impact our quality of life. By joining forces, our shared goal is to prevent and reduce light pollution through the proper application of quality outdoor electric lighting.

By applying these principles, properly designed electric lighting at night can be beautiful, healthy, and functional. Projects that incorporate these principles will save energy and money, reduce light pollution, and minimize wildlife disruption.

Get more information about these principles, and about the commitment of IDA and IES to work collaboratively, at https://www.darksky.org/joining-forces-to-protect-the-night-from-light-pollution/

This article is distributed by NASA Night Sky Network. The Night Sky Network program supports astronomy clubs across the USA dedicated to astronomy outreach. Visit nightsky.jpl.nasa.org to find local clubs, events, and more!

Hubble at 30: Three Decades of Cosmic Discovery

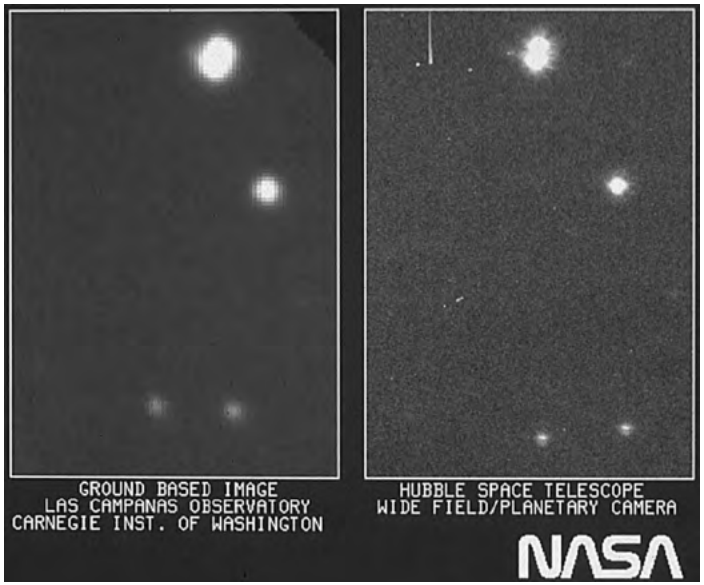
by David Prosper

The Hubble Space Telescope celebrates its 30th birthday in orbit around Earth this year! It's hard to believe how much this telescope has changed the face of astronomy in just three decades. It had a rough start—an 8-foot mirror just slightly out of focus in the most famous case of spherical aberration of all time. But subsequent repairs and upgrades by space shuttle astronauts made Hubble a symbol of the ingenuity of human spaceflight and one of the most important scientific instruments ever created. Beginning as a twinkle in the eye of the late Nancy Grace Roman, the Hubble Space Telescope's work over the past thirty years changed the way we view the universe, and more is yet to come!

We've all seen the amazing images created by Hubble and its team of scientists, but have you seen Hubble yourself? You actually can! Hubble's orbit—around 330 miles overhead—is close enough to Earth that you can see it at night. The best times are within an hour after sunset or before sunrise, when its solar panels are angled best to reflect the light of the Sun back down to Earth. You can't see the structure of the telescope, but you can identify it as a bright star-like point, moving silently across the night sky. It's not as bright as the Space Station, which is much larger and whose orbit is closer to Earth (about 220 miles), but it's still very noticeable as a single steady dot of light, speeding across the sky. Hubble's orbit brings it directly overhead for observers located near tropical latitudes; observers further north and south can see it closer to the horizon. You can find sighting opportunities using satellite tracking apps for your smartphone or tablet, and dedicated satellite tracking websites. These resources can also help you identify other satellites that you may see passing overhead during your stargazing sessions.

NASA has a dedicated site for Hubble's 30th's anniversary at bit.ly/NASAHubble30. The Night Sky Network's "Why Do We Put Telescopes in Space?" activity can help you and your audiences discover why we launch telescopes into orbit, high above the interference of Earth's atmosphere, at bit.ly/TelescopesInSpace. Amateur astronomers may especially enjoy Hubble's images of the beautiful objects found in both the Caldwell and Messier catalogs, at bit.ly/HubbleCaldwell and bit.ly/HubbleMessier. As we celebrate Hubble's legacy, we look forward to the future, as there is another telescope ramping up that promises to further revolutionize our understanding of the early universe: the James Webb Space Telescope!

Discover more about the history and future of Hubble and space telescopes at nasa.gov.



Hubble's "first light" image. Even with the not-yet-corrected imperfections in its mirror, its images were generally sharper compared to photos taken by ground-based telescopes at the time. Image Credit: NASA

The Birds of Summer

by Ken Yanosko

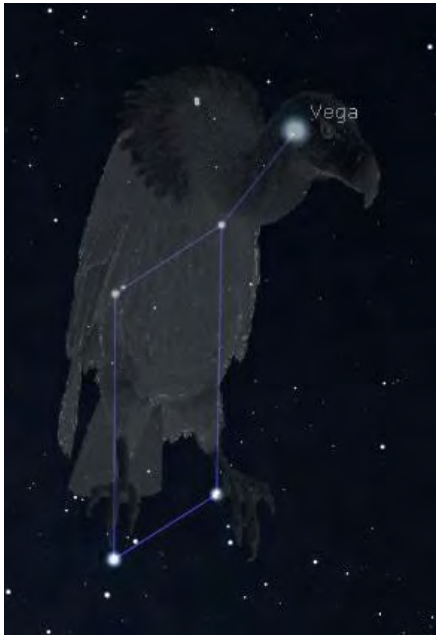
Look up during the summer months; you can't miss the Summer Triangle: the stars Deneb, Altair, and Vega. It turns out you are also looking at the Three Birds of Summer.

Deneb, which means "tail" in Arabic, is the tail of Cygnus, the Swan, flying to the south along the Milky Way. [You are probably familiar with another "tail" star: Denebola, the "tail of the lion" in Leo.] At the beak of the Swan is Albireo, the striking gold and blue binary.

Southeast of the Swan is Altair, Arabic for "the flyer" and the alpha star of Aquila, the Eagle. There seems to be some disagreement about which direction the Eagle is flying. Most constellation maps show a bird heading north, in the opposite direction to which Cygnus is flying. But the Arabs must have pictured it some other way, since the stars at the tip of the western wing, Zeta and Epsilon Aquilae, are collectively named Deneb al Olkab, "the tail of the eagle."

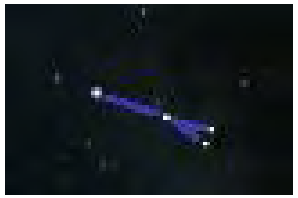
The Summer Triangle, with Cygnus and Aquila. *Stellarium*

But what about the third bird? I'm not thinking about Corvus, the Crow, or Columba, the Dove, both low in the south in the winter; nor any of the far southern avian constellations that are perpetually below our horizon [Apus, Grus, Pavo, Phoenix, Tucana]. I'm referring to Vultur Cadens, the Falling—or maybe Perching—Vulture. It was well-known



Vultures. Left: *Stellarium,* modified by KY. Above: Johann Bode, *Uranographia*, 1801, Public Domain.

to the medieval Arabs, who thought of it as "falling" because, unlike Cygnus and Aquila, it has its wings folded rather than extended. Of course, the Greeks didn't see a vulture there, they saw Lyra, Orpheus's lyre, which was made out of a tortoise shell with some sinews attached for strings. [Another ancient name for this constellation is "Chelus Olige" which is Greek for "Little Tortoise."] Modern artists are likely to draw a nicely framed wooden instrument; in the nineteenth century the astronomer Johann Bode depicted both worlds by drawing a vulture holding a lyre and labeling it "Vultur et Lyra."



Sagitta. *Stellarium.*

But wait. There's more. Among the birds is Sagitta, the Arrow. Someone's shooting at our summer flock! But who? Not Sagittarius, the Archer. He's down on the southern horizon and clearly aiming at Scorpius. It must be somebody else. Traditional star lore is silent on this mystery. But I have a suspect in mind.

It's Hercules. He's usually drawn with a club over his head and, variously, a shield or stick or the head of Medusa in the other hand. [These are all items that feature in his mythological exploits.] But I see

Hercules. *Stellarium*.

him holding a bow in the hand that is outstretched toward the birds, and holding another arrow, just out of his quiver, in his upraised hand. Why he's mischievously shooting at birds is beyond me. But I suppose boys will be boys.

So look for the arrow inside the Summer Triangle; it's in the corner closest to Altair. And look at Hercules, off to the west. Decide for yourself whether he's holding a shield and club, or a bow and arrow. And let me know what you think.

(Still More) Moon Stories from Around the World

Storytelling is a human tradition

[Continued from last issue.]

These stories, and a blank worksheet to draw and write your own moon stories can be downloaded from bit.ly/moonstories.

Polynesia
Moon Woman

Have you ever seen a rainbow at night formed by moonlight instead of sunlight? Legend has it that Hina, a Polynesian woman who was on her way to get some fresh water, did. She had always wanted to live in the heavens, so she walked along the rainbow and didn't stop until she reached Moon. She lives there now and can be seen beating her tapa board to make cloth. Can you find her?

Mexico
Rabbit Moon

In ancient times, an Aztec god chose to set himself on fire and jump into the sky to light the cold, dark world. He became the Sun. A second god, jealous of the praise that the new Sun was getting, did the same. All of that light angered a third god who threw a rabbit at the second Sun's face to dim his light, making him the Moon. Can you see the dark rabbit on the Moon?

Free Astronomy Books

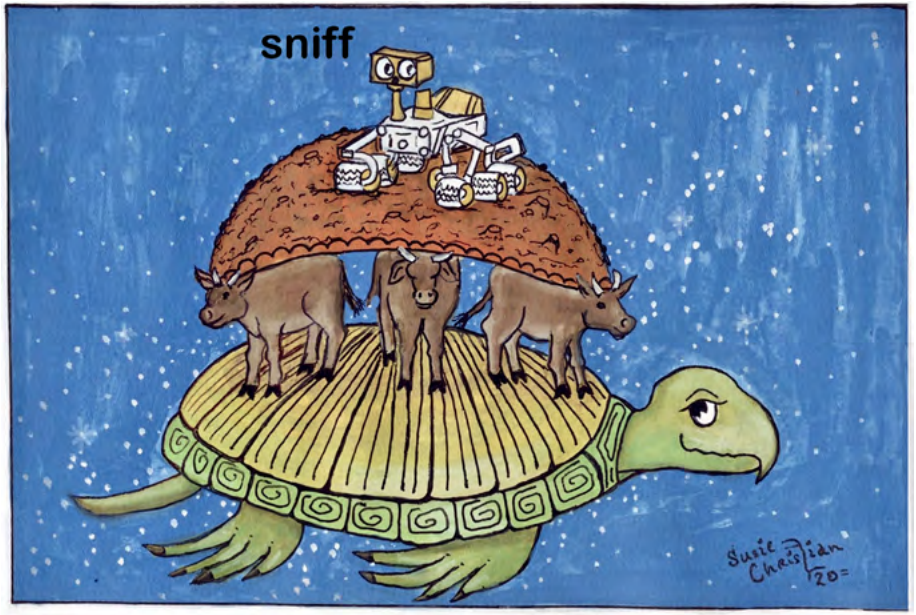
Here's a list of free books; you can read them all online; some are in pdf or e-reader format that you can download to your desktop, tablet, or e-reader; some are interactive web pages (html) with activities, lectures, and videos. They range from elementary-school level to college level; all are accessible to the curious amateur.

1. American Museum of Natural History. *Ology/Astronomy*. html. https://www.amnh.org/explore/ology/astronomy
2. Anon. *A Review of the Universe*. 2015. html. http://universe-review.ca/
3. Beigel, Carol. *A Simple Guide to Backyard Astronomy Using Binoculars or a Small Telescope*. pdf. 61pp. http://carolrpt.com/astroguidev9complete.pdf
4. Chaisson, Eric J. *Cosmic Evolution: An Interdisciplinary Approach*. 2013. html. https://www.cfa.harvard.edu/~ejchaisson/cosmic_evolution/docs/splash.html
5. Ducksters Education. *Astronomy for Kids*. html. https://www.ducksters.com/science/astronomy.php
6. Fraknoi, Andrew et al. *Astronomy*. 2020. pdf, e-readers. 1206 pp. https://openstax.org/details/astronomy
7. Hawley, John F. and Holcomb, Katherine A. *Foundations of Modern Cosmology*. 2005. 569 pp. pdf. https://epdf.pub/foundations-of-modern-cosmology673c84da064d700a9831b49d824677b754288.html
8. Impey, Chris. *Teach Astronomy*. 2020. html. https://www.teachastronomy.com/textbook/
9. Pasachoff, Jay M. *The Complete Idiot's Guide to the Sun*. 2003. 376pp. pdf by chapters or can be downloaded whole. http://ads.harvard.edu/books/2003cigs.book/
10. Patil, Uday. *Story of Astronomy*. 2008. 53pp. illustrated. pdf. https://epdf.pub/the-story-of-astronomy.html
11. Schenk, Marcus. *Telescope 101: An Introduction to the World of Telescopes*. 2014. pdf. 66 pp. https://www.astroshop.eu/advice/telescope/telescope-knowledge/ebook-download/c,9154
12. Science Kids. *Astronomy for Kids*. html. https://www.sciencekids.co.nz/astronomy.html
13. TUIMP. *The Universe in my Pocket*. html. http://www.tuimp.org/

Free Astronomy Music

1. Composer Edward Givens has made his album *Constellations* freely available for download. Go to https://edwardgivens.bandcamp.com/album/constellations where you can "purchase" the album for $0.
2. The European Southern Observatory's "Products" page contains a list of 461 (as of this writing) pieces of music, inspired by astronomy. They are all free to stream or download. https://www.eso.org/public/products/music/
3. What about Gustav Holst's orchestral suite *The Planets*? The music is in the public domain, but most performances of it are not. The USAF Heritage of America Band has recorded 5 of the 7 movements; you can get them for free at https://en.wikipedia.org/wiki/The Planets discography

Heavenly Bodies by Susie Christian



The Real Source of the Methane on Mars

with a nod to "World Turtle": https://www.atlasobscura.com/articles/world-turtle-cosmic-discworld/