Temecula Valley Astronomer
The monthly newsletter of the Temecula Valley Astronomers November 2021

Events: General Meeting, Monday, November 1, 2021, at the Ronald H. Roberts Temecula Library, Room B, 30600 Pauba Rd, at 6:00 PM.

- IFI & Gallery by Clark Williams
- LUCY Mission... a Different Kind of Roadtrip!! by Mark Baker
- BOD Election
- Refreshments by TBD

Star Parties at South Coast Winery every Friday evening in November.

For upcoming school Star Parties check the Calendar on the web page.

WHAT'S INSIDE THIS MONTH:

Send newsletter submissions to Paul Kreitz <pkreitz@sbcglobal.net> by the 20th of the month for the next month's issue.

Lucy Launches from Cape Canaveral

General information:
Subscription to the TVA is included in the annual $25 membership (regular members) donation ($9 student; $35 family).

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Cosmic Comments
by President Mark Baker

In lots of Star Party dialogs this year, much ado has been made of the three missions to Mars this year. China, UAE, and the USA launched their craft toward Mars, and all have been very successful… what a great year for space exploration!!
And yet, harkening back to last month's Cosmic Comments, part of my inspiration to be involved fifty years ago, were the FIVE attempts to reach Mars in 1971…!!!

- Mariner 8 (USA) orbiter launched 8 May 1971 but failed at launch…
- Kosmos 419 (USSR) launched 10 May 1971 and achieved Earth orbit but suffered a fatal issue…
- Mars 2 (USSR) orbiter / lander launched 19 May 1971 and acquired Mars orbit on 2 November 1971. However, the Mars 2 Lander crashed during EDL and was inoperable…
- Mars 3 (USSR) orbiter / lander launched on 28 May 1971 and achieved Mars orbit 3 December 1971. The lander survived EDL but only survived 14 seconds before failing – some thought Martians unplugged it!!! The orbiter did continue to function and completed its mission…
- Mariner 9 (USA) orbiter launched 30 May 1971 and arrived in orbit on mine and Sharon Flemings birthday, 13 November 1971, so you knew good things were going to happen!!! Upon arrival, the entire planet was engulfed in a dust storm and something mysterious was poking above the plumes of dust. When the debris settled to the surface, scientists discovered those unusual features were the tops of dormant volcanoes. Mariner 9 also discovered a huge rift across the surface of Mars, later called Valles Marineris — after the spacecraft that discovered it. Mariner 9 spent nearly a year orbiting the Red Planet, and returned 7,329 photos.

Five missions were attempted in such a very short time in 1971, unlike the plodding process we see nowadays… and it wasn't so much the level of success that mattered, but the desire to make it so!!! Six more attempts to reach Mars were made in the next 4 years, again with varying levels of success, with Viking 1 and 2 leading the way… and then we just stopped trying for a while!!!
The point of all this is that space exploration and pioneering is NOT a new endeavor. But with the desire to "make it so" being rekindled, it falls on groups like ours to fan those flames and ensure our posterity doesn't lose its fervor again… and that's what we at TVA do so well. Every ooh and aah at a Star Party adds kindling to the fire. Every Look Up begets wonder and questions that need answers…
So keep up the great work… you may have a small part on the quest, but not one of you is insignificant!!!

Clear, Dark Skies my Friends…

Looking Up Redux – November 2021

Compiled by Clark Williams
from these sources:
SeaSky.org
Wikipedia.com
in-the-sky.org
The American Meteor Society, Ltd.
cometwatch.co.uk
NASA.gov
TVA App (2.0.1296)
FullAndNewMoon App (2.0)
Starry Night Pro Plus 8
SkySafari 6 Pro
Stellarium
timeanddate.com/astronomy
https://www.fourmilab.ch/earthview/pacalc.html

ALL TIMES ARE LOCAL PACIFIC TIME (PDT / PST) UNLESS NOTED OTHERWISE

Times are given in 24-hour time as: (hh is hours, mm minutes, ss seconds)
hh:mm:ss or hhmmss
hhmm**+** (time of the next day)
hhmm**−** (time of the previous day)
hhmm (seconds not shown)
yyyymmddThhmmss (Full date as: year month day Time separator hours minutes seconds)

Moon Phases for the month by date:

Friday	**the 19th**	@ **0058 FULL in TAURUS**
Saturday	**the 27th**	@ **0428 THIRD QTR in LEO**
Thursday	**the 4th**	@ **1415 NEW in LIBRA**
Thursday	**the 11th**	@ **0447 First QTR in CAPRICORNUS**

Apogee comes on 2021-11-20 @ **1815 – 406,275 km (252,448 mi)**
Perigee comes on 2021-11-05 @ **1524 – 358,844 km (222,975 mi)**

2021 has: (12) new moons, (13) 1st Qtr moons, (13) Full moons, (12) 3rd Qtr moons
(1) Blue moon and (0) Black moons

Daylight Savings: Starts: 2021-Mar-14 : Ends: 2021-Nov-07

Luna: Luna is Waning Crescent on the first of the month, headed for NEW on the 4th rising at **0325**, transiting at **0909** and setting by **1454**. Luna by mid-month is 92% illuminated, Waxing gibbous. Rising at **1431** and transiting at **2130** and setting at **0436+**. By the-end-of-the-month Luna is in the 3rd Quarter, as a waxing crescent 4% illuminated, rising at **0437-** transiting at **0944** and setting by **1452**.

Highlights: (distilled from**: SeaSky.org** and **Clark's planetary Orrey** program[s]**)**

November 4 - New Moon. The Moon will be located on the same side of the Earth as the Sun and will not be visible in the night sky. This phase occurs at **1415**. This is the best time of the month to observe faint objects such as galaxies and star clusters because there is no moonlight to interfere.

November 4, 5 - Taurids Meteor Shower. The Taurids is a long-running minor meteor shower producing only about 5-10 meteors per hour. It is unusual in that it consists of two separate streams. The first is produced by dust grains left behind by Asteroid 2004 TG10. The second stream is produced by debris left behind by Comet 2P Encke. The shower runs annually from September 7 to December 10. It peaks this year on the night of November 4. The new moon will leave dark skies this year for what should be an excellent show. Best viewing will be just after midnight from a dark location far away from city lights. Meteors will radiate from the constellation Taurus, but can appear anywhere in the sky.

November 5 - Uranus at Opposition. The blue-green planet will be at its closest approach to Earth and its face will be fully illuminated by the Sun. It will be brighter than any other time of the year and will be visible all night long. This is the best time to view Uranus. Due to its distance, it will only appear as a tiny blue-green dot in all but the most powerful telescopes.

November 17, 18 - Leonids Meteor Shower. The Leonids is an average shower, producing up to 15 meteors per hour at its peak. This shower is unique in that it has a cyclonic peak about every 33 years where hundreds of meteors per hour can be seen. That last of these occurred in 2001. The Leonids is produced by dust grains left behind by comet Tempel-Tuttle, which was discovered in 1865. The shower runs annually from November 6-30. It peaks this year on the night of the 17th and morning of the 18th. Unfortunately, the nearly full moon will dominate the sky this year, blocking all but the brightest meteors. But if you are patient, you should still be able to catch a few good ones. Best viewing will be from a dark location after midnight. Meteors will radiate from the constellation Leo, but can appear anywhere in the sky.

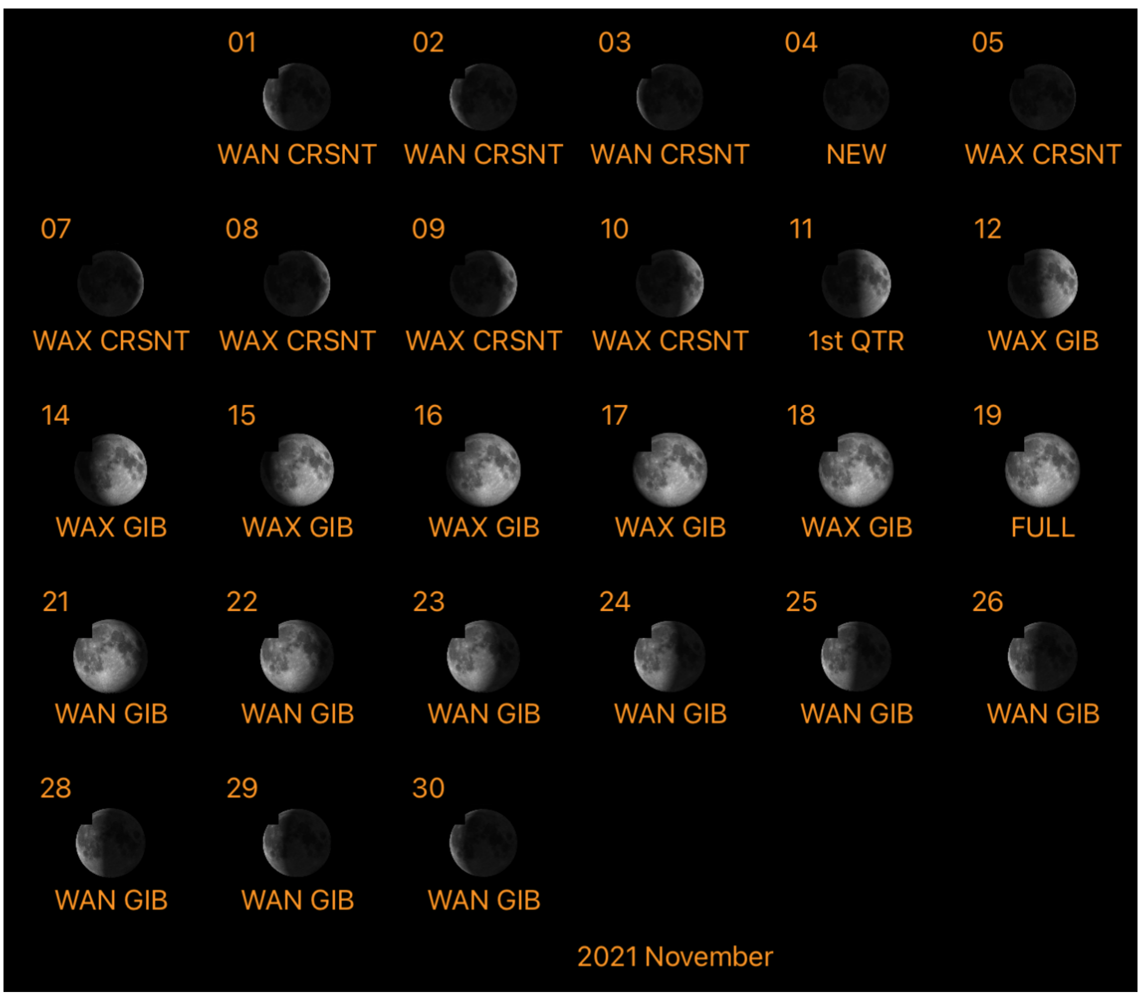
November 19 - Full Moon. The Moon will be located on the opposite side of the Earth as the Sun and its face will be fully illuminated. This phase occurs at **0058**. This full moon was known by early Native American tribes as the Beaver Moon because this was the time of year to set the beaver traps before the swamps and rivers froze. It has also been known as the Frosty Moon and the Dark Moon.

November 19 - Partial Lunar Eclipse. A partial lunar eclipse occurs when the Moon passes through the

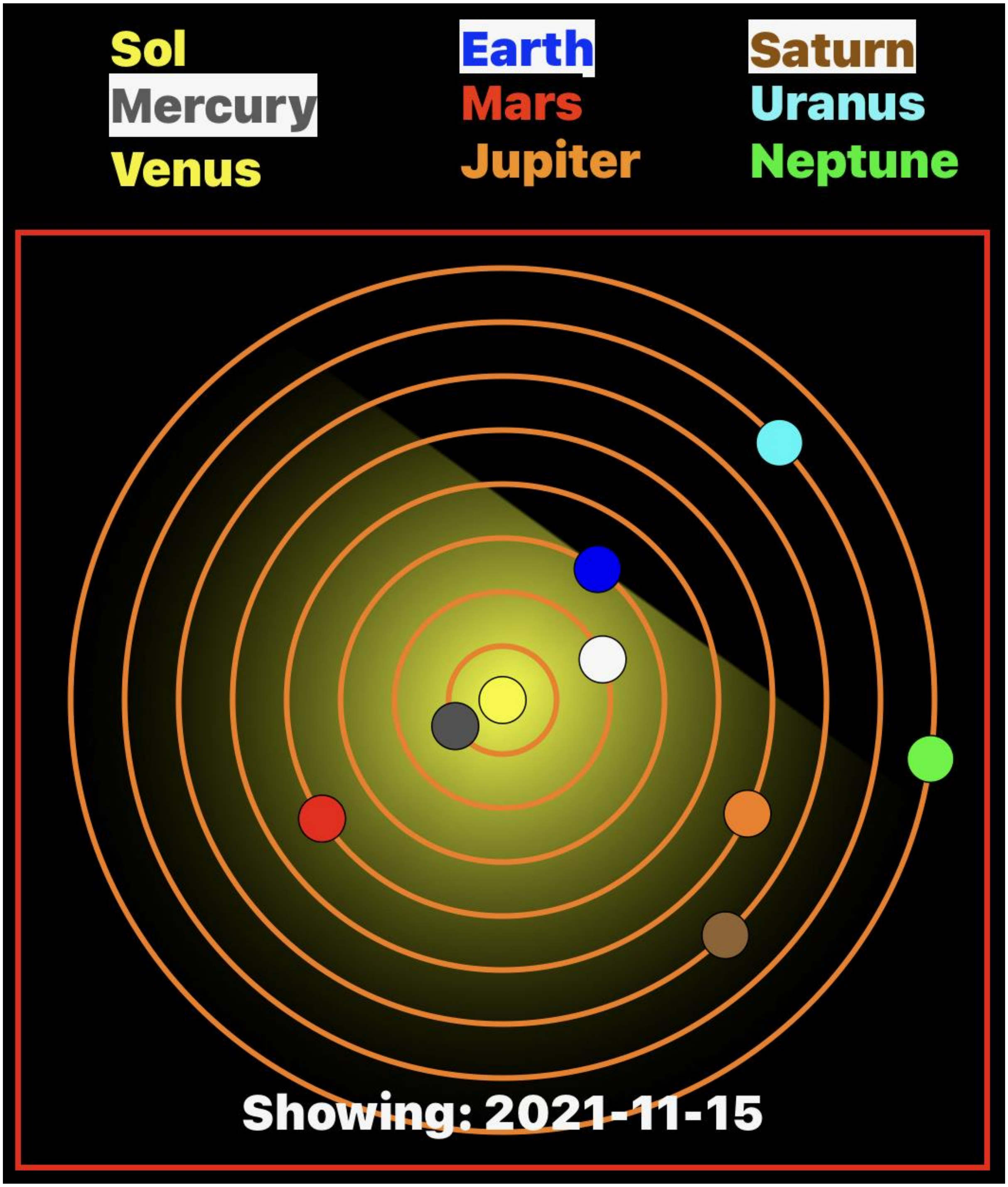
Earth's partial shadow, or penumbra, and only a portion of it passes through the darkest shadow, or umbra. During this type of eclipse a part of the Moon will darken as it moves through the Earth's shadow. The eclipse will be visible throughout most of eastern Russia, Japan, the Pacific Ocean, North America, Mexico, Central America, and parts of western South America. (NASA Map and Eclipse Information)

Algol minima: (All times Pacific Time)

11/03/2021	**1121**
11/06/2021	**0810**
11/09/2021	**0458**
11/12/2021	**0147**
11/14/2021	**2236**
11/17/2021	**1925**
11/20/2021	**1614**
11/23/2021	**1303**
11/26/2021 **11/29/2021**	**0952** **0641**



Planets:
Planetary Positions November 2021: (from TVA App iOS version)



- **Mercury:** Mercury is a morning object in the beginning of the month, rising at **0548**, followed by sunrise at **0706**. Mercury by mid-month is still a morning object but getting close to the sun. Mercury rises at **0541** followed by sunrise at **0619**. By the 30th Mercury is lost to the Sun.

- **Venus:** Is the Evening Star on the first of the month, setting by **2033**, preceded by sunset at **1957**. By mid-month Venus is setting at **1936** preceded by sunset at **1647** with a waxing gibbous moon following 98°20**'** and setting at **0351+**. By the 30th Venus is setting at **1932** preceded by sunset at **1642**.
- **Mars:** Mars is still close to the Sun. Mars is a morning Object on the first, rising at **0629**. It is followed by sunrise at **0706**. By mid-month Mars is rising at **0519** followed by sunrise at **0619**. End-of-month finds the Warrior rising at **0510** and followed by sunrise at **0633**.
- **Jupiter:** Jupiter is transiting at **2043** and setting at **0106+**. By mid-month Jove is transiting at **1753** and setting at **2316**. Come the end of the month Jupiter is transiting by **1834**. and transiting at **1700**.and setting at **2225**.
- **Saturn:** Saturn rises about **1333**, transits about **1842** and not setting until **2352**. Saturn by mid month is setting by **2200**. By the end-of-the-month Saturn is setting at **2106**.
- **Uranus:** On the first of the month Uranus is rising by **1758**, transiting at **0044+** and not setting until **0729+**. By the ides Uranus is rising at **1602**. Uranus will transit at **2246**; setting at **0531+**. End-of-month finds Uranus transiting at **2145** and setting at **0429+**.
- **Neptune:** Neptune is transiting at **2129** in the beginning of the month. Neptune sets at **0320+**. By the 15th Neptune transits at **1934** and sets by **0124+**. By the end of the month Neptune is transiting at **1834** and sets at 0025**+.**
- **Pluto:** Pluto transits at **1749** on the first of the month, setting by 2248**.** By mid-month Pluto transits by **1555;** setting at **2054**. By the 30th Pluto transits at **1458**, setting by **1957.**

. **Asteroids:**

- Still a dearth of asteroids. I searched for asteroids in 2021 with a reasonable magnitude; say less than or equal to +10 in November there is nothing except the regulars: Juno, Vesta. Hebe, Eros and Herculina. So consult your local planetarium software or try: **https://www.asteroidsnear.com/year?year=2021**

Meteors:

- Perseids Meteor Shower is back! **See *Highlights* (above).**

Comets: come in various classifications:

- 1) Short Period comets – further broken down into:
  - Halley Type: The Halley Types are believed to come from the Kuiper Belt and have periods in excess of 20-years.
  - Jupiter Type: The Jupiter types have a period less than or equal to 20-years.
  - Short period comets November have a near circular orbit or an elliptical orbit. The latter being far more common.
- 2) Long Period comets – thought to originate from the Oort cloud these comets have periods of over 200 years and have random inclinations around the celestial sphere.

Not much this month in comets.

Deep Sky:

Notes:

L/Z abbreviation for ALT/AZ
R/D abbreviation for Right Ascension/Declination
α is right ascension
δ is declination
In each case, unless otherwise noted, you should look for the following on or about the 15th Day of November 2021 at 2100 PDT and you will have about 20 minutes of viewing time total.

One especially for Paul this month; an interesting cluster.

- NGC 869**:**
- NGC 869 (also known as h Persei) is an open cluster located 7600 light years away in the constellation of Perseus. The cluster is most likely around 13 million years old. It is the westernmost of the Double Cluster with NGC 884.
  NGC 869 and 884 are often designated h and χ Persei, respectively. Some confusion surrounds what Bayer intended by these designations. It is sometimes claimed that Bayer could not have resolved the pair into two patches of nebulosity, and that Chi refers to the Double Cluster and h to a nearby star. Bayer's Uranometria chart for Perseus does not show them as nebulous objects, but his chart for Cassiopeia does, and they are described as Nebulosa Duplex in Schiller's Coelum Stellatum Christianum, which was assembled with Bayer's help. The clusters are both located in the Perseus OB1 association, a few hundred light years apart from each other. The clusters were first recorded by Hipparchus, but have likely been known since antiquity.

  The Double Cluster is often photographed and observed with small telescopes. The clusters are visible with the unaided eye between the constellations of Perseus and Cassiopeia as a brighter patch in the winter Milky Way. In small telescopes the cluster appears as an assemblage of bright stars located in a rich star field. Dominated by bright blue stars, the cluster also hosts a few orange stars. (Wikipedia)

Illustration 1: By Andrew Cooper acooper@pobox.com - Own work, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=1449407

- Alpha Ursa Minoris - Polaris

  Polaris is a star in the northern circumpolar constellation of Ursa Minor. It is designated α Ursae Minoris (Latinized to Alpha Ursae Minoris) and is commonly called the North Star or Pole Star. With an apparent visual magnitude that fluctuates around 1.98,[2] it is the brightest star in the constellation and is readily visible to the naked eye at night.[14] The position of the star lies less than a degree away from the north celestial pole, making it the current northern pole star. Historically, the stable position of the star in the northern sky has made it useful for navigation.

Illustration 2: By NASA/HST - http://hubblesite.org/newscenter/newsdesk/archive/releases/2006/02/image/a (Image: STScI-2006-02), Public Domain, https://commons.wikimedia.org/w/index.php?curid=1392815

  The revised Hipparcos parallax gives a distance to Polaris of about 433 light-years (133 parsecs), while calculations by some other methods derive distances up to 35% closer. Although appearing to the naked eye as a single point of light, Polaris is a triple star system, composed of the primary, a yellow supergiant designated Polaris Aa, in orbit with a smaller companion, Polaris Ab; the pair is in a wider orbit with Polaris B. The outer pair AB were discovered in August 1779 by William Herschel. (Wikipedia)

November is great for both viewing and imaging.
Spend some time outside with your scope. Autumn is here.

For now – Keep looking up.

RANDOM THOUGHT

By Chuck Dyson

ARE WE ALONE?

First off I am changing the name of the column not because I am getting Alzheimer's and, at best, can only remember one thing at a time but because I am starting to give talks to the Astro Club students every month and will need some time to prepare those talks; so, content of the column will still be random but I will strive to stick to only one thought and a thousand words or less.

That being said, In Neil deGrasse Tyson's book "Welcome to the Universe" there is a chapter titled "The Search For Life In Our Galaxy". The search for life needs answers to two questions before we can get a resolution. The first is the number of planets circling long lived stars in our galaxy and the second is what are the planetary conditions that must be met for life to form. Or, in terms that I can understand, how many planetary homes for life are there and how many of those homes is life likely to occupy?

Being a classical astronomer Neil deGrasse Tyson takes a fairly deep and thorough dive into the first question that is usually expressed as the Drake equation. The Drake equation attempts to quantify the different elements that can give us a handle on the average number of communicating civilizations there could possibly be in our galaxy. The Drake equation starts off with the number of stars in our galaxy and right away we get into trouble, even though astronomers have been doing counts on the number of stars in our galaxy for over a century there is not a really tight consensus of the actual number, estimates vary from 100 billion up to 700 billion, so we will go with Professor Tyson's estimate of 300 billion stars. Next the equation asks that we determine the number of stars with habitable planets in orbit around them. Here we need to do a little judicious star pruning because as of the 1950's we have known that large stars burn up their fuel quickly and only live for hundreds of millions of years, not enough for what we want, and although small stars live for tens to hundreds of billions of years the planets in order to be warm enough to support life must be so close to the sun that they get tidal lock like the moon has with Earth and then only ½ of the planet gets sunlight and the other ½ is in perpetual darkness, most planetary scientists think that this arrangement would not be favorable for life except for possibly a small strip in the twilight zone . Even though this selection process has removed 80% of the stars from consideration 20% of 300 billion is still 60 billion candidates for another home for Walt Disney theme park.

Despite the fact that our planet is in orbit around a suitable star we are still not guaranteed that life can exist on our planet because the Drake equation has yet another round of elimination tests. The planet must be large enough to retain an atmosphere and have plate tectonics. We need an atmosphere dense enough, at least 7 millibars (Earth is 1000 and Mars is 0.6 millibars), to have liquid water on the surface. Humans require at least 570 millibars to live semi-comfortably. Assuming we have an adequate atmosphere on our planet just why do we then want plate tectonics? After all could living on a planet without earthquakes be so bad? And the answer would be "yes" because on Earth the tectonics are a result of the liquid metal moving in the Earth's core and this creates a bit of a magnetic field, the spinning Sun also creates a magnetic field, twice as strong as Earth's, and these two fields combine to protect us from harmful space radiation, mutations, cancer, cataracts and other fun things. To give you an idea just how important these things are, Mars creates a magnetic field 1/40th the strength of Earth's and you should expect to live on the surface of Mars for an average of 40 years before dying of cancer. Is more magnetic field always better? Fast spinning Jupiter generates a magnetic field 20,000 times greater than Earth's this strong magnetic field accelerates particles to relativistic speeds. Should you decide to go to the moon Europa, that is in Jupiter's strong magnetic torus, for one day and look for signs of life on the ice surface you will receive the same amount of radiation that you would in 1,800 years on Earth; and, on average, you will live for 30 days before dying of radiation sickness. I think we can all agree that we want some magnetic field around our planet, but not too much.

Three more things we may want our planet to have are a large moon, a globally connected ocean, and a circular orbit. The large moon will minimize our planet's range of obliquity (tilt). Unlike Mars that has only two micro moons and has an obliquity from 10 degrees to 50 degrees, the Earth with its large moon our obliquity range of 22.1 degrees to 25.4 degrees. The greater change in obliquity the greater the climate change. Think really huge ice ages. On Earth the ocean currents are the prime movers of heat around the planet and greatly reduce the temperature extremes between the poles and the equator. Off of California the September water temperature off of Scripps pier is 66^0 F because the California current is moving water from Canada to Baja California while water off of Charleston South Carolina is 82^0 F because the gulf stream is moving water from the Caribbean to Greenland and England and each of these ocean currents are moving 100X more water than all the rivers on Earth. The orbit of the Earth is almost circular and because of this we do not have periods of intense heat followed by periods of intense cold. The more eccentric a planets' orbit is the more extreme the seasonal variations will become. An admittedly extreme example of this: the orbits of comets, even short period comets that "only" go out to the orbit of Jupiter freeze solid before returning to the inner solar system to have material boiled off at the closest approach to the sun.

The location requirement of the Drake equation, for life, is that our prospective planet be in its sun's habitable zone. The habitable zone is loosely defined as the distance from a sun where water can exist not frozen, less than 32^0F, or boiling, 212^0F (at one atmosphere of pressure). The actual habitable zone of a sun is somewhat dependent of the size and chemical makeup of the planet in question. To make this point let's look at Mars and Venus. Both are on the edge of the habitable zone and one is an ice box and one is a hot oven. The question has been asked, and explored by computer simulation, "what would happen if Mars and Venus switched places?" For Mars there is a general consensus that because the surface gravity is so small the heated and energetic molecules in the atmosphere, with a little help from an increased solar wind, would rapidly strip all atmosphere from the planet. With Venus the answer is: depending on how you setup the simulation your results will vary, a lot. The Venus problem is one source of major criticism of the Drake equation, because if we cannot predict how a planet that we have orbited, landed on, and studied close-up with telescopes, will change in our habitable zone; just how can we predict if a planet is suitable for life in another solar system? One Venus program does predict that in Mars orbit Venus will become a mecca for skiing on dry, CO2, ice snow.

The final question that the Drake equation tries to answer is "How many life-friendly planets have communicating civilizations on them?" This section of the equation should be labeled "the great eliminator" because if we look at Earth we see that although there has been life on this planet for 3.6 to 3.8 billion years it was not until December 23, 1900 the first voice radio transmission went out and across our 100 lightyear sized galaxy. Only those communicating civilizations that are within 121 light years of us can know that we are here. So, what are the chances that a communicating civilization has gotten to listen to an early Earth radio show? In his chapter Neil deGrasse Tyson does his own calculations, and guestimates, of what the chances are. Neil estimates, that if we look at a 40 lightyear bubble around Earth there will be about one thousand stars in that bubble and up to six stars will have a planet that could support life. Neil's next question is how many communicating civilizations are there in our galaxy? Using Drakes equation and his own guestimates Neil arrives at 1000 communicating civilizations in our galaxy. In a 100,000 lightyear galaxy this means that every 1,000 lightyears or so there is a communicating civilization. Very small chance any of the nine habitable planets in our 40 lightyear bubble are listening to "I love Lucy" or "Howdy Doody", sorry Lucy and Buffalo Bob.

Although today much of the Drake equation is guess work, on December 18th, the weather willing, we launch the James Webb Space Telescope and one of the mission goals is to study exoplanet atmospheres in order to reduce the guesstimates in the Drake equation.
Next month I will look at how life could have developed on favorable planets.

Cheers,
Chuck

Another Look

By Dave Phelps

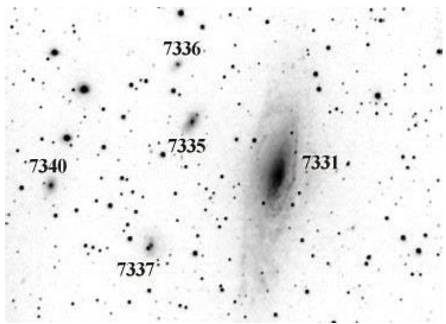
Go outside in the evening during the first week in November and look up. Our old friend Cepheus is still high overhead next to his Queen Cassiopeia. Their daughter Andromeda is near at hand still chained to the rock while Perseus is racing towards Pegasus, the winged horse, to save her from the sea monster, Cetus. The Milky Way spans east to west from Perseus to Aquila, while the Pleiades and Hyades have slipped up over the horizon.

From north to south we also have Lacerta, the circlet of Pisces and NGC 253 in Sculptor. Alas, we have no mythology to associate with Sculptor, maybe because it's a southern constellation, difficult to see from Paris. Lacaille named it for an artist's studio.

NGC 253 is a large bright galaxy that you should be able to see even in decent binoculars. Its magnitude 8 and big at almost 1/3rd of a degree. Just south, check out NGC 289, featured in last month's APOD. NGC 289 is smaller and fainter, but close. It is also a steppingstone to the Sculptor dwarf; further south and much fainter and as big as a full moon. It is as faint as Pluto. You will need a very good southern horizon and a big telescope to catch it. In Idyllwild at just about a mile elevation we had a very good negative southern horizon which allowed us to go down into Fornax and even Piscis Austirinus. Unfortunately, the lights have all but taken that star party place away.

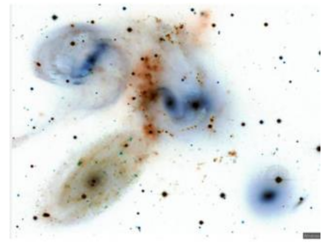
Close overhead is the Andromeda galaxy, M31. Big and bright, visible to the naked eye and quite nice in your 7x50's. I have spent hours tracing spiral arms, the core, the lanes and its satellite galaxies M32 and M110. Its full dimensions, Per Burnham, are 160'by40' and 5th magnitude. In M31 is NGC 206, a dense knot of stars embedded in one of the arms not too far from the edge. Also, not too far, in the rift, near NGC 206 is one of the Cepheids used to calculate its distance. I have tried to identify particular Cepheids in M31 but charts, equipment and skill failed me.

Follow Alpha Andromedae to Beta Pegasi to Eta Pegasi. That's how I star hopped to NGC 7331. A really nice galaxy somewhat resolvable and easily visible at 9th magnitude.



NGC 7331 has its own family of galaxies that weren't mentioned much so I don't recall ever having seen any of them, especially since they are in the 14th to 15th magnitude range. Their designations are NGC 7335, NGC 7336, and NGC 7337. There are also a few outliers as the negative image shows.

They are going on my bucket list. And no, I will not call it the Deer Lick Group.



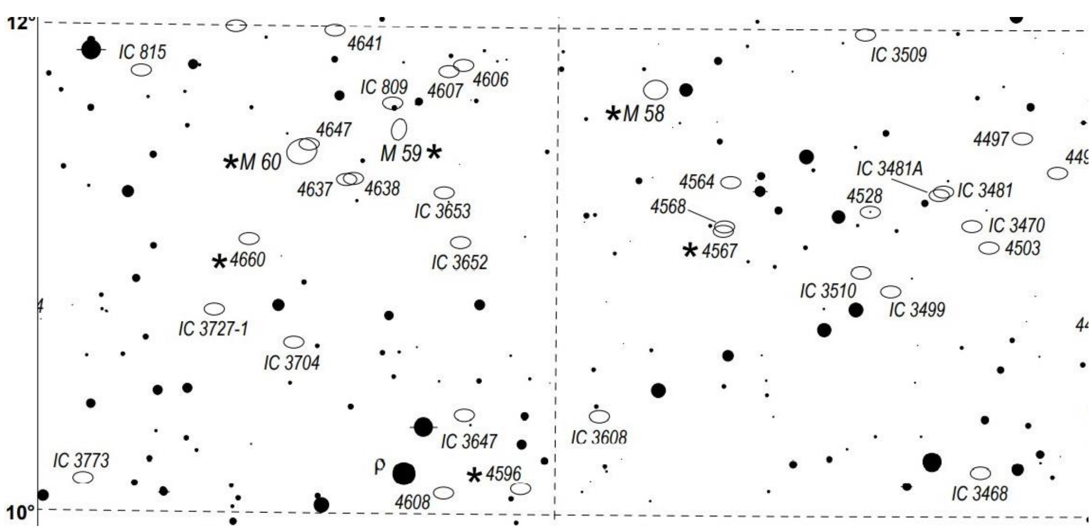
I used NGC 7331 also as a steppingstone to Pegasus' most famous object(s): Stephan's Quintet. Do not expect to see it in your 12" Newtonian like the Professional image at right. Stephen's Quintet is pretty small about 4'x4' per side and faint at nearly 15th magnitude. Hard to see but well worth the effort if you have a larger telescope. One reference gives a distance of 40 million light years. None of the companions are brighter than 13th magnitude. I saw individual galaxies in the 17.5" but too faint for my drawing skills. Under high power you will see two or three distinct shapes. At least two are interacting and there may be more gravitationally bound. The cluster is very compact, and astronomers have been debating the actual number of associated galaxies since the beginning of time. We probably won't know for sure until USS Enterprise (NCC 1701) goes out there to look. Image by: NASA/CXC/CfA/E. O'Sullivan/ Canada-France-Hawaii-Telescope/Coelum

Another nice galaxy in Pegasus is NGC 7741. It was a goal for me because it is a bright distinct barred spiral. It's about 4 by 4 minutes, so maybe a little small for your 8 inch. I don't remember ever actually resolving the bar and arms. NGC 7741 is a few degrees south and just minutes east of Alpheratz, Alpha Andromeda. You will find it with a chart, some star hopping and a little sweeping. While there, in the vicinity are Two Abell galaxy clusters, Abell 2634 and Abell 2666. Abells were new back then, two more for my bucket list.

There is not much to say about Aries. Gamma is a double and Alpha is 2nd magnitude. Alpha's name is Hamal, the Head of the Sheep and Gamma's is Mesarthim. Gamma's components are nearly identical magnitudes and can be seen in a smaller telescope. I used it to star hop into Pisces, a constellation worthy of its own column. Still, about 200 years BCE, a fellow by the name of Hipparchus called it the "First point of Aries" because the sun, at that time, was in Aries at the Spring Equinox. Another history lesson in the sky.

This Month's Challenge

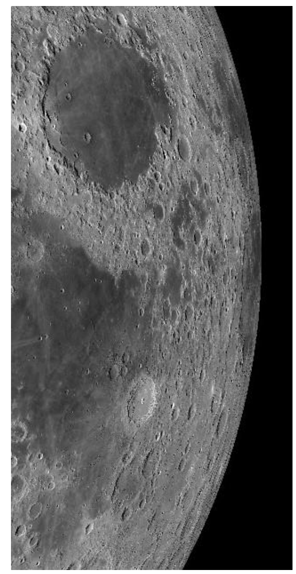
This is going to be a fun challenge this month, suitable for just about any size telescope. You will be scanning both the Coma Berenices galaxy cluster and the Virgo galaxy cluster. Use Arcturus to find your place in the sky and sweep east towards Leo to find the Coma Berenices galaxies right near the North Galactic Pole. While there be sure to look for NGC 4559, NGC 4565, M64 and M53.



Just south is the Virgo Cluster, a real beauty. Look for M87, M89, M58, M59, M60 and a half dozen or more Messiers. Now your problem here is an embarrassment of riches. This part of the sky is crammed with galaxies and sprinkled with stars, see how many you can identify. Now for the challenge. Find M58, M59 and M60. On a nearly right angle made up of M58 and Rho Virginis at the corner of the base of the triangle you will find NGC's 4567 and 4568. These are the Siamese Twins, famous interacting galaxies about 11th magnitude. They will be a real feather in your cap.

This column is not a What's Up but a What's Was. That being said, I have always loved the moon and enjoyed searching for comets.

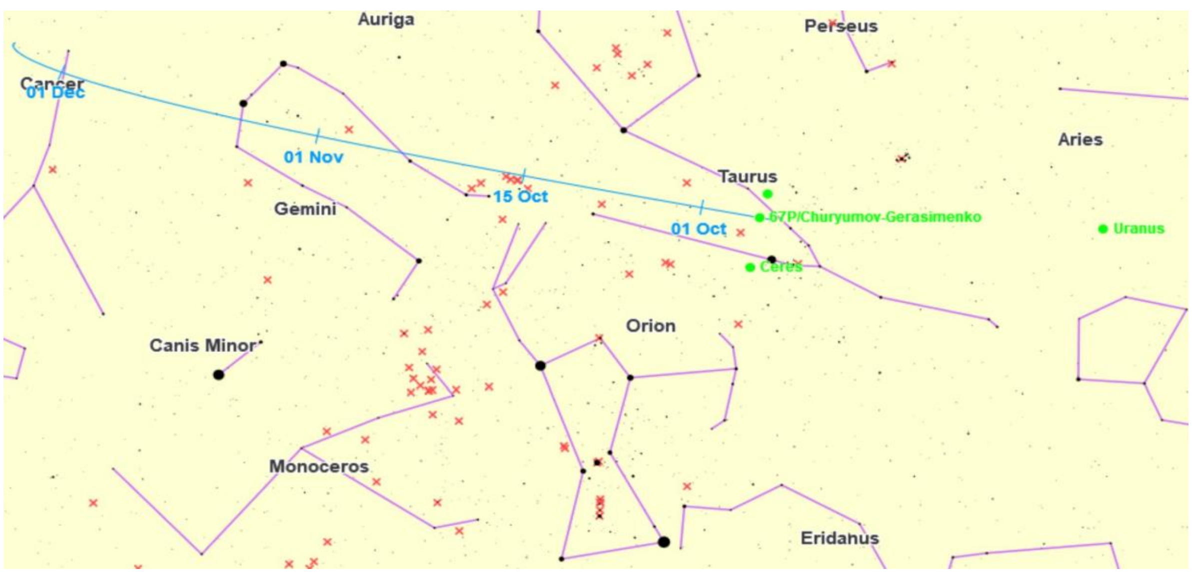
So, we have a lunar eclipse on the 19th UT (18th at 10:00 pm PST) during the full "Beaver" moon. They are calling it a penumbral eclipse and I didn't understand why since the charts looked total. A closer look, however, and you will see that the moon is only 97% eclipsed. Wow. That will be spectacular visually with that thin crescent of light on a dark disk maybe illuminated by earth-shine or maybe a brick red. Totality at 0102. Thanks to timeanddate.com



On Nov. 3rd the lunar libration should be favorable for Mare Crisium, Mare Undarum, Mare Sputum and the craters Langrenius and Petavius. Check the attached image. If you're up late, or early, three days after full moon, these same features will be highlighted from 180 degrees east or west depending on your telescope. Thanks to cyberspace for the image.

67P/Churyumov-Gerasimenko: So comet C-G should be less than 10th magnitude, maybe even a bright as 8 or 9th. It has a 6.5 year or so orbit which made it attractive for a visit from the Rosetta spacecraft. Visually the comet will be closest about 6:00 pm Nov. 12. Look for it near Castor and Pollux.

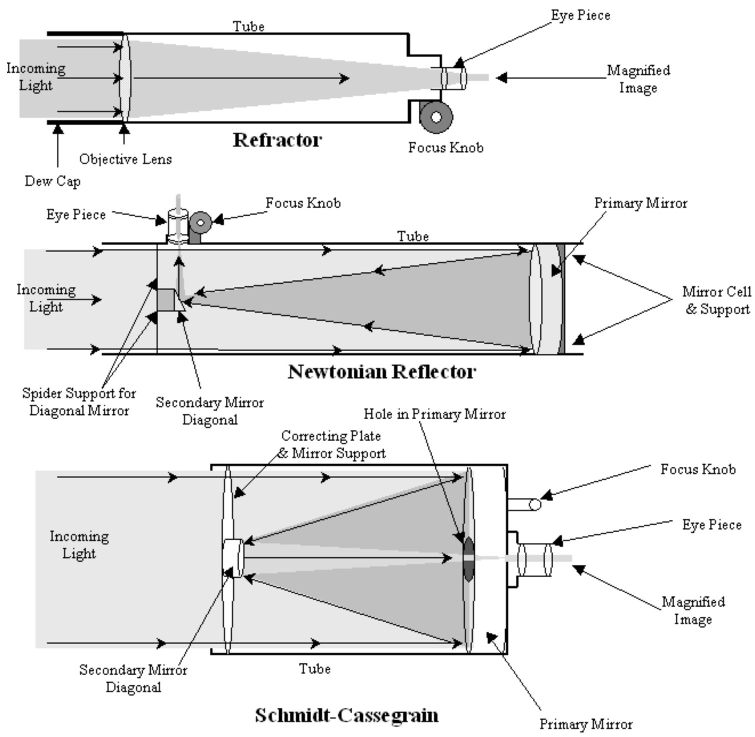
Thanks to In-the-Sky.org for the finder chart.



Dark Skies
Dave Phelps

Telescopes - Advanced
By Sam Pitts

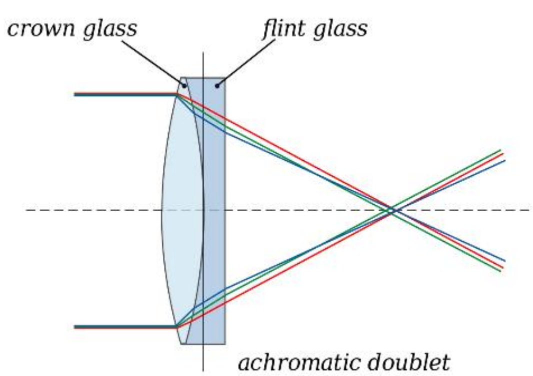
The same basic telescope designs apply to the more advanced larger telescopes; Refractors, Newtonian Reflectors, Catadioptric and Cassegrain. The Schmidt Cassegrain falls into a category referred to as Catadioptric, an optical system using both reflective and refractive elements.



Refractor telescope for amateurs fall into three basic categories:

Achromatic Refractor

Many telescope (refractor) designs use extra low dispersion (ED) to reduce residual chromatic aberration, the difference between green and red/blue focus. These are sometimes incorrectly referred to as Apochromatic refractors, but they do not adhere to the strict definition of Apochromatic or APO refractors.

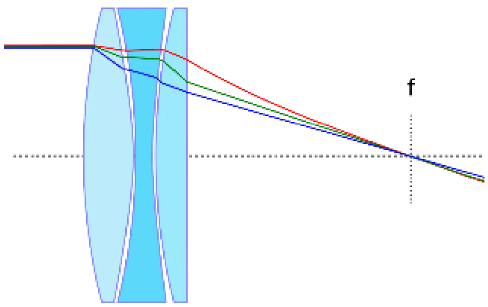


Simple lens design, focuses wavelengths of light at slightly different points. Red light is focused farther from the lens then blue light. The eye is more sensitive to Green and if focused on green then Red & Blue colors will appear out of focus. Modern Achromatic refractors use two pieces of glass of differing properties to focus two colors to the same point. Most common design uses a positive lens of crown flint glass with lower dispersion. The second flint glass, higher dispersion, is used as a negative element. The figuring and matching is critical for the lens to focus both Red & Blue light at the same point. The green is still slightly different, but the difference is relatively small. This can be seen as violet fringing around bright objects.

Apochromatic ED refractors

Thanks to modern design and use of Extra Low dispersion (ED) glass, the correction on some of these scopes is truly exceptional with a much reduced cost of a true APO. Highly useful for visual and some imaging applications. There are some true bargains at f/7.5 - f/9 !

Apochromatic APO refractor



Strict definition of an APO is having three wavelengths of light focusing at the same point. no violet fringing and pinpoint stars. The elements are usually, air spaced or oil spaced. Some use pure fluorite or elements with a high percentage of fluorite like FPL 53, FPL51, FPL 55 or new Hoya FCD100. Fluorite glass is very expensive and very hard to get in apertures over 4 inches. It takes lots of expertise to figure the glass and to put a three-element lens together which results in high prices. New glass design like FCD 100 may bring the prices down on some really well corrected APO refractors.

In general refractors & most telescopes can use a magnification 30-50 times the objective's diameter in inches. Seeing conditions and the quality of the lenses/mirrors will affect this ratio. Some high quality Optics can achieve magnifications 60-100 times the objective size in inches, under ideal seeing conditions. Most viewing will be done at magnifications of 50x to 100x (Deep Sky), with higher magnifications for the Moon and planets. This design is collimated at the factory and usually lasts the lifetime of the user with proper care.

I recommend a quality ED doublet in 80mm to 127mm range for visual and imaging on an appropriate mount. Recommended manufactures include: Orion Telescopes, William Optics, Takahashi, iOptron, Sky Watcher, APM, Explorer Scientific, Meade, Teleskop Photoline, Sky Watcher, etc.. Remember that Refractors past 4" require a substantial mount, which will be discussed next month. 80mm to 130mm doublets will range from $ 550 to $2,000. Triplets of the same size will be substantially more, $ 1,200 to $6,000

Newtonian Reflectors

Newtonians were invented by Sir Isaac Newton (1668), using a concave primary and flat secondary mirror system. Today most use a Parabolic or Parabola primary mirror with a flat secondary. Due to this design they are free of chromatic aberrations. Newtonian telescopes are usually less expensive to manufacture and offer a lot of great viewing in the 6" to 10" models,

The larger the secondary the more obstructed the view which results in less contrast. One rule of thumb with the Newtonian design, the faster the f ratio the larger the secondary which leads to a larger obstruction and less contrast but wider FOV. The shorter the focal length the more difficult it is to get a perfect parabola which increases the cost. They are best at f/6 to f/8, however the longer the focal length the longer the tube. Take a 10" f/8, the tube would be close to 8' long, very cumbersome.

Up until the late sixties they were used on large equatorial mounts. This really limited a portable setup to an 8" f/6 scope. Then around 1968 John Dobson came up with a new way to mount a Newtonian; it's became a Dobsonian Telescope. John took a Newtonian telescope and put it in a simple box mount. This made it portable and easy to use. Dobsonians today come in 6" to 40" sizes. The 8" to 12" models with f ratios of f/6 to f/4.5 are readily available, inexpensive and easy to use and transport. They offer tremendous potential for all night sky viewing at a reasonable cost and short learning curve. Remember, all reflecting telescopes need to be properly collimated to perform at their peak.

Mirrors are made of varying materials which affect the thermal qualities of the mirror. The larger the mirror the more time it needs to cool down and acclimate to ambient temperatures. Most mirrors are made of plate glass, Pyrex or quartz, there are some other exotic materials. Plate-glass being the least expensive and most adversely affected by temperature change. Quartz is more expensive and harder to grind and figure but resists temperature fluctuations. One can also add fans to the back of the primary mirror holder to help move air around to aid in cooling. Mirror quality varies widely and the costs of the telescope reflects this.

Dobsonian telescopes in the 8 to 10 inch size offer the amateur the most for their money ($400-$600). This size telescope is easily transportable. Setup only takes a few minutes and you are observing the night sky.

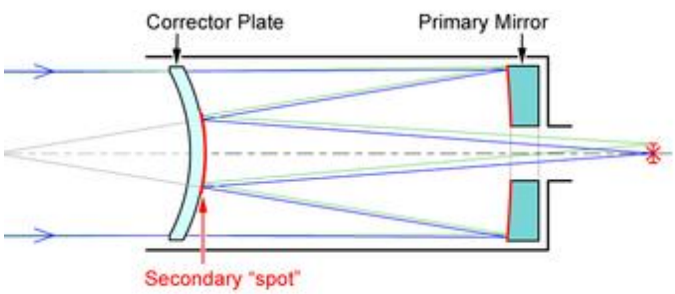
Catadioptric- Schmidt-Cassegrain (SCT)

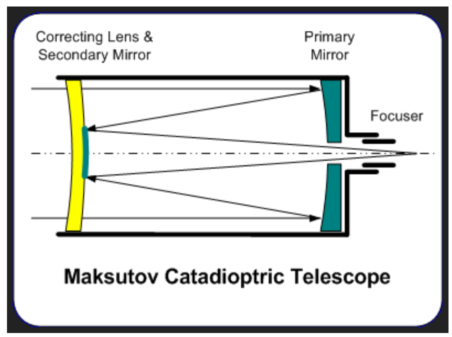
Catadioptric telescopes use both refraction and reflection in an optical system. The Schmidt corrector plate is an aspheric lens which corrects the spherical aberration introduced by the spherical primary mirror of the Schmidt or Schmidt-Cassegrain telescope designs. It was invented by Bernhard Schmidt in 1931. This design of astronomical telescopes is very popular due to the folded optics and large apertures at a very reasonable price compared to APO refractors. These designs require collimation, some more than others. The mode of transportation and handling can really influence the need for collimation. I have seen many Schmidt-Cassegrain telescopes, most popular Catadioptric design, perform poorly because they were not collimated properly.

Celestron and Meade are the predominate manufactures of this popular design. They have been readily available since the 1960's. They come in apertures from 5" to 16", although Celestron did make some 22" models in the mid-60's which listed for $29,500.

Schmidt-Cassegrain designs in the 8" to 9.25" are hugely popular and offer a wide array of viewing opportunities without breaking the bank. This size is also easier to transport and mount. The optics are a little soft but they gather enough light for Deep Sky objects as well as close-up views of the Moon and Planets. Due to their popularity some real good buys can be had on the used market. The 8" and 9.25" standard models are f/10 while some variations have f/6.3 and f/8. The primary mirror moves to reach focus so there is some image shift during focus. A two-speed aftermarket focuser is available for that fine focus while not moving the primary. Some models from Celestron like the Edge, have mirror locks that reduce mirror flop. Correcting & reducer lenses are also available for a wider and flatter FOV. 8" SCT OTA's weigh in around 14 pounds (XLT $ 1,100; Edge $1,400) Celestron 9.25" SCT OTA $ 1,550 at 20 lbs. 10" Meade SCT OTA $ 1,870 at 26 Lbs. Celestron 11" SCT OTA $ 2,600, Edge OTA at $ 3,700, both around 28 lbs. Many of these are available in altazimuth go to systems that are fun to use and easy to transport in the 8" to 9.25" size. The 10" and 11" models start to be a lot more to deal with, test them out before you commit. The 12" and up models are quite substantial to setup and transport.

The Maksutov-Cassegrain design in the 150mm to 180mm are also very good telescopes. They have a longer focal length with a smaller secondary obstruction which improves contrast. The Maksutov-Cassegrain is a catadioptric telescope with a main spherical mirror and a negative meniscus lens. These are great on solar system objects and some bright deep sky objects and have less collimation issues. These telescopes have small obstruction and have great contrast. Usually found in focal ratios of f/15-f/20. Think of Questar introduced in 1954.
Sky Watcher 180mm f/15 Maksutov-Cassegrain $ 1,275, Celestron 7" f/15 $ 1,150 (19 Lbs.).





Cassegrain

Classical Cassegrain and modified CDK and RC optical tubes. Classical Cassegrain come in focal ratios of f/12 to f/20 with portable scopes range in size from 8" f/12 to 10" f/15. They have smaller secondary obstruction and perform well on solar systems objects, double stars and bright planetary nebulae. They use a secondary Crayford focuser with no mirror shift.
GSO models 8" f/12 around $ 920 (20 Lbs.), 10" f/12 Truss tube $ 2,800 (38 Lbs) Parallax models: 10" f/15 or 10" DK f/20 $ 5,900 (40 lbs.)

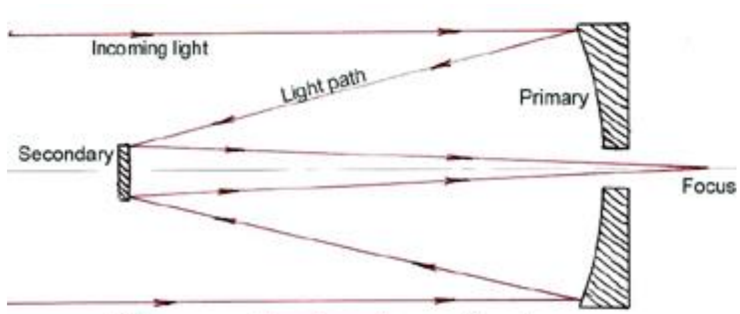
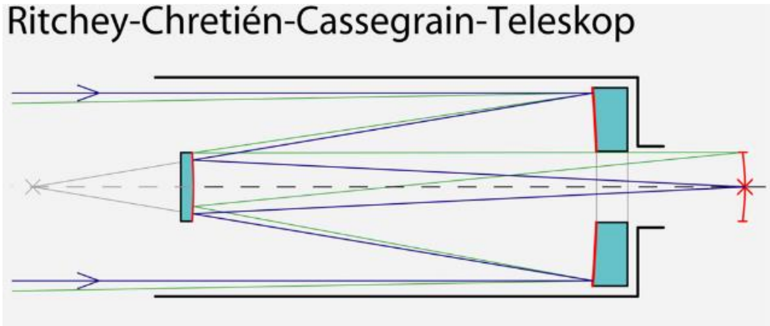


Diagram showing the optical arrangement of the Cassegrain

CDK designs add corrective lenses between the secondary mirror and point of focus, which may adjust the focal length, flatten the image and correct image imperfections. The main mirror is fixed and this design maintains collimation well. Such telescopes deserve a permanent observatory. PlaneWave CDK 12.5 OTA $ 8,500 (50 Lbs.) they are great for imaging.



RC telescopes offer good value fixed primary mirrors with large central obstructions, designed for imaging. Collimation is critical and must be spot on for the telescope to perform well. This telescope should be permanently mounted in an observatory for this reason. TPO 8" f/8 Ritchey Chrétien Steel Astrograph with TPO 2" Focuser $ 1200 (18,5 Lbs.) TPO10" f/8 RC $ 2,600 (35 Lbs.)

Advantages of Refracting Telescope
Because of their simple design, they are generally easy to use and more reliable as their optics are permanently fixed and aligned.

Disadvantages of Refracting Telescopes
They can be heavy, especially larger aperture telescopes, because of their need for large lenses. They can also have a longer body which may impact on transportation and storage. They may also be more expensive, as large high quality lenses are more costly to produce. Cheaper lenses are more susceptible to aberrations.

Advantages of Reflector Telescopes
Fairly compact and portable which is great for transportation and storage. Generally more affordable. Mirrors can produce less optical aberrations.

Disadvantages of Reflector Telescopes
Mirrors need regular re-alignment as they can easily slip out of alignment due to knocks and bumps or temperature changes. They can be susceptible to spherical aberrations.

Advantages of Catadioptric Telescopes
Most catadioptrics are extremely compact and portable. The optics provide the advantages of both lenses and mirrors, so they make a great all purpose telescope.

Disadvantages of Catadioptric Telescopes

They may suffer a slight loss of light because of the positioning of the secondary mirror. Also catadioptrics may suffer from image shift, or a jump in focus, due to the primary mirror being moved when focusing.

Next we'll cover accessories like eyepieces, diagonals, finders and focusers, which can really affect observations and enjoyment.

Measure the Night Sky

By David Prosper – NASA / JPL

Fall and winter months bring longer nights, and with these earlier evenings, even the youngest astronomers can get stargazing. One of the handiest things you can teach a new astronomer is how to measure the sky – and if you haven't yet learned yourself, it's easier than you think!

Astronomers measure the sky using degrees, minutes, and seconds as units. These may sound more like terms for measuring time - and that's a good catch! – but today we are focused on measuring ***angular distance***. **Degrees** are largest, and are each made up of 60 **minutes**, and each minute is made up of 60 **seconds**. To start, go outside and imagine yourself in the center of a massive sphere, with yourself at the center, extending out to the stars: appropriately enough, this is called the **celestial sphere**. A circle contains 360 degrees, so if you have a good view of the horizon all around you, you can slowly spin around exactly once to see what 360 degrees looks like, since you are in effect drawing a circle from inside out, with yourself at the center! Now break up that circle into quarters, starting from due North; each quarter measures 90 degrees, equal to the distance between each cardinal direction! It measures 90 degrees between due North and due East, and a full 180 degrees along the horizon between due North and due South. Now, switch from a horizontal circle to a vertical one, extending above and below your head. Look straight above your head: this point is called the *zenith*, the highest point in the sky. Now look down toward the horizon; it measures 90 degrees from the zenith to the horizon. You now have some basic measurements for your sky.

Use a combination of your fingers held at arm's length, along with notable objects in the night sky, to make smaller measurements. A full Moon measures about half a degree in width - or 1/2 of your pinky finger, since each pinky measures 1 degree. The three stars of Orion's Belt create a line about 3 degrees long. The famed "Dig Dipper" asterism is a great reference for Northern Hemisphere observers, since it's circumpolar and visible all night for many. The Dipper's "Pointer Stars," Dubhe and Merak, have 5.5 degrees between them - roughly three middle fingers wide. The entire asterism stretches 25 degrees from Dubhe to Alkaid - roughly the space between your outstretched thumb and pinky. On the other end of the scale, can you split Mizar and Alcor? They are separated by 12 *arc minutes* - about 1/5 the width of your pinky.

Keep practicing to build advanced star-hopping skills. How far away is Polaris from the pointer stars of the Big Dipper? Between Spica and Arcturus? Missions like Gaia and Hipparcos measure tiny differences in the angular distance between stars, at an extremely fine level. Precise measurement of the heavens is known as ***astrometry***. Discover more about how we measure the universe, and the missions that do so, at nasa.gov.

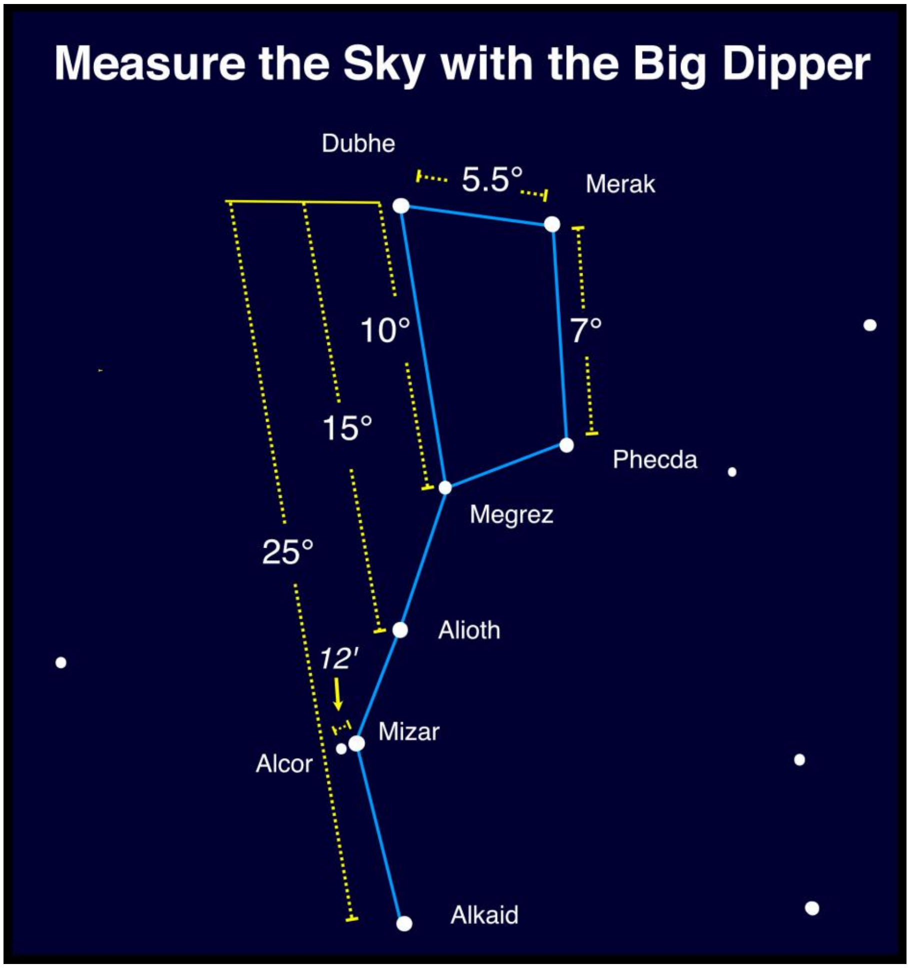


Image created with assistance from Stellarium

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