

# Idaho Skies

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**Idaho Skies is a column for beginning amateur astronomers and those interested in astronomy. Suggestions about the column are gladly accepted by the columnist, at [paul.verhage@boiseschools.org](mailto:paul.verhage@boiseschools.org)**

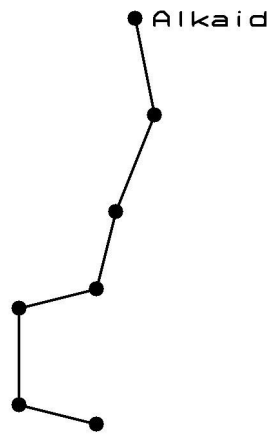
This month look for the star Alkaid in Ursa Major. Alkaid is known to astronomers as Eta Ursae Majoris. Alkaid, the star at the end of the Big Dipper's handle, is Arabic for "the leader". Its name is a reference to being the lead daughter (the three stars of the handle are sisters) at a funeral bier. If you know someone who is 100 years old this year, then Alkaid is their birthday star. The light of Alkaid you see tonight left in 1906 (the year of the great San Francisco earthquake).

The Big Dipper is not a constellation. Instead, it's an asterism, or popular pattern of stars (a pattern that is not officially recognized by professional astronomers). The Big Dipper is part of a much larger constellation called Ursa Major, the Big Bear. The dipper portion of Ursa Major just represents the bear's body and a very long tail. The rest of Ursa Major is fainter and not as well known. But in dark skies you can make out three legs, head, and snout of the bear.

Alkaid is a hot star. It's about four times hotter than the sun and 700 times brighter. It's hotter and brighter because it has a mass six times greater than our sun's. The greater a star's mass the greater the pressure crushing down on its core. The extra compression heats up the core increasing its rate of fusion. On the down side, the star will burn out far sooner than our sun.

Five of the stars in the Big Dipper formed from the same cloud of dust and gas. Astronomers know this because they move at the same speed and direction across the sky. Alkaid is not one of these stars and in time its movement will distort the Big Dipper until we no longer recognize it as a dipper.

Look for Alkaid tonight almost overhead in the north during June.



## June Overview

- During the first half of the month, Saturn passes through the Beehive star cluster.
- The moon passes less than one degree from Spica on the 7<sup>th</sup>.
- Mars passes through the Beehive on the 17<sup>th</sup>.
- Summer begins on the 21<sup>st</sup>.
- Mercury makes a difficult appearance on the first day of summer.

## June 1 – 7

Watch the planet Saturn as it passes through the edge of the Beehive star cluster during the first half of the month. Once it's dark, you'll find Saturn looking like a pale yellow star low in the west.

The two man Gemini 9 spacecraft was launched 40 years ago on the 3<sup>rd</sup>. The astronauts onboard were Thomas Stafford and Gene Cernan and both would go to the moon in Apollo. The goal of Gemini 9 was to practice docking and making space walks, or extravehicular activities (EVAs). Both activities were vital to the success of Apollo. For a docking target, an unmanned upper stage named Agena was launched shortly before Gemini 9. Unfortunately, a covering over the front of the rocket failed to separate properly, giving their docking target the appearance of an angry alligator. After being unable to dock, Cernan spent over two hours outside the Gemini 9 performing his EVA (this was the second American space walk and the third in history). One of his tasks was to test a jet pack (the astronaut maneuvering unit or AMU) for the Air Force. But the Gemini EVA spacesuits were cumbersome. During his struggle to don the AMU, Cernan ripped the insulation layers of his space suit and dangerously overheated. American astronauts were totally unprepared to perform EVAs at this point and this EVA could have ended in disaster. You can read more about the spacewalk in his book, *The Last Man on the Moon*.

The moon is at first quarter moon on the 3<sup>rd</sup> at 4:06 PM. So take advantage of warmer June nights to do some moon gazing. Even if all you have is a pair of field binoculars you'll still see a lot of terrain detail along the moon's terminator.

The moon is at apogee on the 3<sup>rd</sup> at 5:00 PM. Its distance, its greatest for this month, is 251,084 miles. In terrestrial standards that's pretty far, but in solar system standards, that's very close.

As it gets dark on the 5<sup>th</sup>, look for Saturn because it's at its closest to the Beehive star cluster tonight. In your field binoculars Saturn will look like the brightest member of this cluster. Saturn is located low in the western sky.

The moon approaches Virgo's lucida, Spica, on the evening of the 6<sup>th</sup> and morning of the 7<sup>th</sup>. They'll be less than one degree apart as they set at 3:00 AM of the 7<sup>th</sup>. Use your binoculars for the best view.

On the 7<sup>th</sup>, the Kuiper Belt Object (KBO) Quaoar is at its closest to earth. Now get this, it will be 3.9 billion miles away at its closest. A radio signal sent to Quaoar will take 13 hours and 45 minutes to get there. That's over half a day! Solar system object 50000 Quaoar has a name pronounced like kwaa'-waar. Quaoar has a diameter 1/10<sup>th</sup> the size of earth, or around 800 miles across. This makes it one of the largest minor bodies in the solar system. It's a giant comet that orbits in the freezing cold outer limits of the solar system and its big brother is Pluto. Since it's so distant from the sun, a year on Quaoar lasts 286 years. Recently telescopes on earth discovered that crystalline ice covers the surface of Quaoar. Crystalline ice cannot form at the incredibly temperatures Quaoar experiences, so a warm source of water must be responsible. Perhaps volcanoes or geysers are erupting ice on the surface of this tiny ice world. Of course that begs the question, how could a body that small retain internal heat for so long. Interesting.

## June 8 – 14

On June 10<sup>th</sup> an unusual asteroid makes its closest approach to earth. It will miss the earth by five and a half million miles. While this sounds pretty far, it's pretty close compared to most objects in the solar system. From its brightness, astronomers believe the asteroid has a diameter between 30 and 100 feet. Its orbit closely follows earth's, so it's considered to be a quasi-satellite of our planet. How did such a small chunk of rock get into an orbit that closely matches earth's? Astronomer Paul Chodas believes it's a chunk of the moon that was blasted off the lunar surface after a large impact. If we every visit this rock we'll learn for sure.

The moon is full on the 11<sup>th</sup> at 11:03 AM. The full moon in June is often called the Rose Moon. I hope you weren't planning to find faint galaxies in your telescope around this time.

# June 15 – 21

Pluto is at opposition on the 16<sup>th</sup>. At opposition, a superior planet (those planets outside earth's orbit) rise at local midnight, are at their brightest, and are at their closest for the year. In Pluto's case, being at opposition doesn't help a whole lot. The planet is over 30 times farther from the sun than we are and it's about 250 times too faint to be seen with the unaided eye. Most people will need a telescope of at least 10 inches diameter to see the faint speck of light that is Pluto. Currently the News Horizons spacecraft is on its way to this world.

The moon is at its closest to earth (perigee) on the 16<sup>th</sup> at 10:00 AM. The distance between the centers of earth and the moon is 229,235 miles. A Space Shuttle orbiting the earth at a speed of 17,500 miles per hour would need 13 hours to fly to the moon. But as it climbed out of the gravity well of earth, the shuttle would slow down and fall back to earth. A spacecraft needs a speed closer to escape velocity (25,000 miles per hour) to reach the moon.

Mars passes through the Beehive star cluster on the night of the 17<sup>th</sup>. This ought to be a spectacular photo opportunity if you have a clock drive. In binoculars, Mars will be the bright orange star in the middle of a misting of stars. The other bright star next to the Beehive is Saturn. And on the night of the 17<sup>th</sup> the two of them are only a moon's diameter apart, or ½ degree. So get your binoculars out and look very low in the west-northwest for the two brightest stars, Saturn and Mars. In binoculars you'll see this.



The week of June 17<sup>th</sup> to the 24<sup>th</sup> is the annual Grand Canyon Star Party. If you plan to visit the Grand Canyon during this week then be sure to stop by and see all the telescopes. You can learn more at their website, <http://www.tucsonastronomy.org/gcsp.html>.

The moon is at last quarter on the 18<sup>th</sup> at 7:08 AM. If you're planning to go moon watching you'll have to wait until after midnight to see it.

Hurray!! Summer begins on the 21<sup>st</sup> at 6:26 AM. Today the sun climbs to its greatest elevation above the horizon and the day is at its longest. But wait a minute! That also

means the night is its shortest. Well, at least it's warm. Pity poor Australia, it's the first day of winter down under.

Also today, Mercury is at its greatest eastern elongation. Mercury sets 90 minutes after the sun. But the ecliptic is pretty low on June evenings, so Mercury won't be very high above the horizon. Try looking for Mercury at 10:15 PM. It will be the brightest star very low in the west-northwest. By low, I mean less than the width of your palm when your arm is fully extended. You ought to use binoculars at first. Then after you locate the planet, use your naked eye.

Between June 21<sup>st</sup> and 24<sup>th</sup> there's a star party at Bryce Canyon in southern Utah. Bryce Canyon is located on the Aquarius Plateau. So it's at a high elevation and far away from city lights. You'll see some of your darkest skies there. But it also means it gets chilly also. There's more information at the Bryce Canyon website, [http://www.nps.gov/brca/astronomy\\_programs.html](http://www.nps.gov/brca/astronomy_programs.html).

## June 22 – 30

Thirty years ago on the 22<sup>nd</sup>, the Soviets launched their second, and last, spy space station, Salyut 5. The space station orbited the earth for a little over one year and in that time, had two visits from Soviet cosmonauts. They planned to launch a total of four crews, but Soyuz 23 failed to dock under automatic control and Soyuz 25 was cancelled because the space station was too close to the end of its life. The crews of Soyuz 22 and Soyuz 24 spent time spying on the United States but they found that station upkeep took too much time and left them too little time for spying. On August 8<sup>th</sup>, 1977, the space station was sent on a destructive reentry of the atmosphere.

The moon is new on the 25<sup>th</sup> at 9:05 AM. Because of the low inclination of the ecliptic this month, it will be difficult to see the moon again until the evening of the 28<sup>th</sup> when the moon is three days old. If you do see the moon, Mars will be to its lower right. Look low in the west-northwest for this pair.

A space tragedy took place 35 years ago on the 30<sup>th</sup>. The cosmonauts of Soyuz 11 spent 22 days onboard the Salyut 1 space station, the first space station. There's a rumor they initially planned to spend six weeks onboard the space station, but returned only after three. When their return capsule was located on the 30<sup>th</sup>, the three cosmonauts were found dead. The recovery crew first assumed they had collapsed after returning to gravity after spending three weeks in weightlessness. Instead the three cosmonauts had suffocated due to an air leak in their return capsule. No other crews visited the Salyut 1 space station and all Soyuz spacecraft were grounded while modifications were made to it.

## This Month's Topic

## Saturn's Rings

Saturn is the last of the planets known to the ancients. The next planet out, Uranus, is often above naked eye visibility, but its faintness means it never stands out from the fixed stars. If the Babylonians had produced accurate star charts (down to sixth magnitude), we may be speaking of six planets known to the ancients.

Galileo discovered the rings of Saturn through his telescope in 1610. However, his telescope was of poor optical quality that he couldn't resolve the rings clearly. Galileo believed that instead of rings, he saw a planet accompanied by two massive moons, one on each side. Two years later the two moons disappeared leaving Galileo to believe Saturn had eaten the moons just like the Greek god Saturn had done to his offspring. Later, to his consternation, the moons reappeared, but this time looking like handles on a tea cup. Galileo died never knowing the explanation for his surprising, unlooked for, and novel discovery.

It was the Dutch natural philosopher Christiaan Huygens who discovered the true nature of Saturn's rings in 1659. Huygens's telescopes were of such high quality that he could clearly make out the rings and described Saturn as surrounded by rings that nowhere touches the planet.

Astronomers soon discovered that Saturn wasn't surrounded by a single ring. Instead the ring was divided in two by a dark gap in it. Most people can see two rings divided by the Cassini Division. The Cassini Division divides the ring into an outer A ring and inner B ring. Particles orbiting Saturn within the nearly empty Cassini Division make two revolutions of the planet for every one orbit on Saturn's moon, Mimas. Mimas is therefore the moon responsible for clearing out the Cassini Division. The clearing is probably occurring because ring particles are pulled out of their circular orbits and into elliptical ones by Mimas. A particle in an elliptical orbit is bound to collide with a second particle in the rings. The collision slows the particles down causing them to slowly spiral into Saturn.

Physicist James Maxwell was the first to determine that the rings of Saturn could not be a solid body. To remain in orbit, a moon must rotate faster when it's closer to its planet. If solid, then the rings of Saturn could be thought of as a multitude of moons connected by rigid rods that prevent them from moving in relation to each other. Maxwell determined that the difference in the rotation rates between the moons making up the inner edge of the ring and the moons in the outer edge would generate a shear force greater than any material could withstand. So even if the rings started out as a solid body, they would rip apart into a billion smaller moons over time.

Tidal forces prevent the rings from collapsing into a single moon (and the ability of a single moon to remain in one piece). If a moon orbits too closely to a planet, then the difference between the gravity pulling on the point closest to the planet and the point farthest from the planet is greater than the moon's own gravity. As a result, the tides pull the moon apart. The minimum distance a moon can orbit a planet without being pulled

apart is called the Roche Limit. Based on the material making up Saturn's rings (water ice), the Roche Limit for Saturn is outside the boundary of its rings.

If Saturn and its moons are creating the rings, then we should expect the rings to spread out over time. The edges of the rings would be fuzzy at best, as ring material gradually thinned out. But a funny thing was discovered. There are many abrupt edges in Saturn's rings. Near some of the sharp edges, spacecraft have discovered tiny moons. The gravity of these tiny moons is pushing ring particles back into the ring, creating a sharp ring boundary. The moons act like shepards who keep their flocks together, so they are called Shepard moons.

Not all of Saturn's moons orbit in the same plain with the rings. The gravity of these moons is lifting ring particles up out of the ring plain. The particles are pulled back into the ring where they create disturbances that look like spirals in the rings.

Some of the latest images from Cassini show propeller shaped masses within the rings. The propellers are concentrations of ice forming from the break up of small moons. This is an indication that the rings of Saturn are forming from the break up of a moon, rather than from a moon that never formed. The dynamics of a ring in orbit around a planet indicate the rings are no older than ?? million years old. We are lucky to be watching the wonderful rings of this planet.

## June's Website

This month check out John Duncan's Apollo Saturn Reference page.

Interested in America's moon rocket? Here's an online source of information on the Saturn 1b and Saturn V moon rockets. On the left side of the homepage is a nice image, a Saturn V on its launch pad with gantry in place. You'll find the page's links on the right side. The eight links on this page, Saturn V, Saturn 1b, The Apollo Spacecraft, Launch Complex 39, Space Modeling, About Us, Acknowledgements, and Links.

Under the Saturn V link is information and images from museums, contractors, and NASA. The site has line diagrams of each stage along with their dimensions. You can read scanned images from the Saturn V Flight Manual for Apollo 11 (a NASA document). And it's not just of each stage, but also the interstages. Interstages are the short sections that connect the main stages together. NASA produces a media informational packet for each launch. And you'll find copies about the Saturn moon rocket on line, but in HTML format rather than scanned. Even the F-1 engines have their links. The F-1 engines are still the most powerful liquid fueled engines ever flown.

The Saturn 1b link covers the smaller, earlier version of the Saturn V. The Saturn 1b is the rocket that launched the earth-orbiting Apollo missions. There were five of these, Apollo 7, three Skylab missions, and the Apollo Soyuz Test Project. Just like the Saturn V link, you'll find lots of line drawings and dimensions on Saturn 1b. There's a link for

Launch Complex 34, the launch pad where the Apollo 1 astronauts died while preparing for their mission. There are several in flight photographs of the Saturn 1b second stage from the flight of Apollo 7. The photos are nice and show the Saturn 1b second stage (called the S-IVb stage) above the earth with its petals opened (the petals are attached to the Lunar Module Adapter and would have covered the Lunar Module (LM) had Apollo 7 carried one.

The Apollo Spacecraft link covers the command and service modules of the Apollo capsule. There's also a link on the Lunar Module. Both links are mostly photos rather than technical details. Did you know there were two models of the Apollo spacecraft? Both designs are documented here as well as the boost protective cover (BPC), a cork and fiberglass shell that covered the command module during at launch. Under the LM link are images of about both stages of the LM, the descent and ascent stage. There's also a little information about the spacesuits and life support equipment that the LM astronauts used on the moon. The Apollo Soyuz Test Project (ASTP) page is a bit short. It only has a few line drawings and images of the docking adapter and the Russian Soyuz.

The Launch Complex 39 link talks about the crawler that carries the completed Saturn V from the vehicle assembly building (VAB) to the A or B launch complex. Again, you'll find more diagrams, photographs, and technical manuals.

The Space Modeling link is a series of photographs covering almost the entire Saturn V. Here's where you'll find those tiny details that will make your plastic Saturn V model more accurate. There are even images of the thermal blankets covering the F-1 engines.

The About Us link is where John Duncan explains why he created this webpage. Back in 1996 he discovered that there wasn't much information on the Saturn rockets. So he created the page to fill a need.

The Acknowledgements link gives a thank you to people who brought information for the webpage. There's also links to NASA documents relating the Saturn program.

The Links link is a webpage dedicated to space related links. There are links to personal space web pages, space news, modeling companies, museums, supplies, and NASA pages related to the moon program.

You can find the Apollo Saturn Reference page at, <http://www.apollosaturn.com/>

## This Month's Sources

Observer's Handbook 2006, The Royal Astronomical Society of Canada  
Space Calendar, <http://www.jpl.nasa.gov/calendar/>  
Night Sky Explorer (software)  
Stars, <http://www.astro.uiuc.edu/~kaler/sow/>  
The New Solar System, 4<sup>th</sup> edition, Sky Publishing

<http://science.ksc.nasa.gov/history/gemini/gemini-ix-a/gemini-ix-a.html>

<http://www.answers.com/topic/50000-quaor>

[http://en.wikipedia.org/wiki/2003\\_YN107](http://en.wikipedia.org/wiki/2003_YN107)

<http://www.friends-partners.org/partners/mwade/details/salyut5.htm>

Dark Skies and Bright Stars,

*Your Interstellar Guide*