Snake River Skies

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President's Message

Here it is February already. I am looking forward to what Bob Niemeyer has to say. He is the JPL Planetary Ambassador for Idaho and he works for Bruneau Dunes State Park. Therefore he will have a lot of information, maybe not with him but will know how to get to it. His talk will be on one of many planetary subjects as well as an update to what is going on at the Park this year and what building projects are in the works.

At the top of our list of goals this year we would like to get the Share system up and running. We received this to help people learn about astronomy. I fell we need to get it up and running. We can use it at star parties to let handicapped people see the stars where we don't have the CSI facilities to do that. There will be a cost to do this. There will be more information at the monthly meeting.

Clear Skies

Ken Thomason
President

Editor's corner

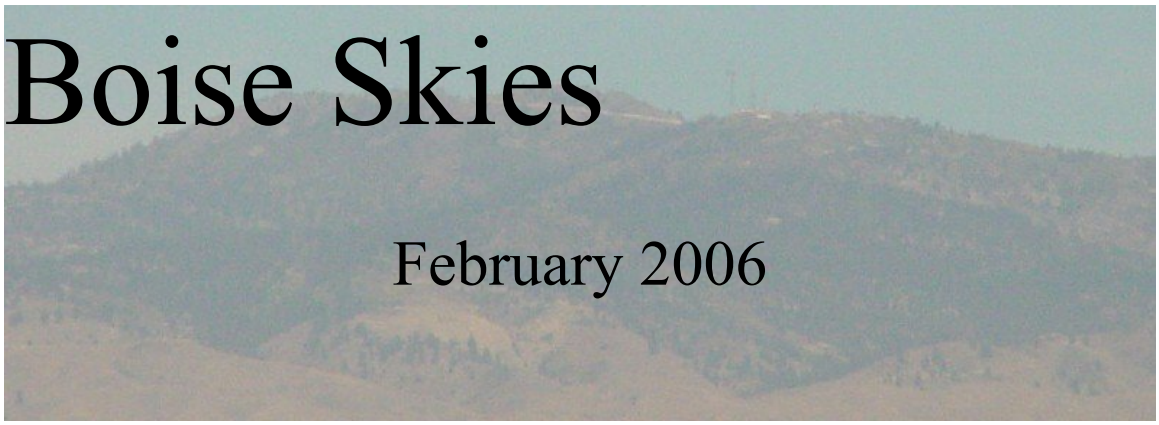
The January newsletter has been posted on the web site, sorry for the delay.

Starting with this issue we will be sending a reduced .pdf file to all members. A larger version will be posted on the MVAS web site. The smaller email version should look fine on your monitor but you will get better printed image quality with the downloaded file.

http://www.mvastro.org/mememberss/newsletter.php

If you have any of the missing newsletter files, please email it to the Secretary so I can add it to the archive. I would like to have all of them available on the web site some day.

This image was taken October 2nd, 2004, with the Shotwell camera on the 5" Meade finder telescope. The camera is so sensitive we had to use a solar filter to get the exposure time up to 4 seconds. Even the shortest possible exposure of 0.02 seconds was over exposed without it.



Boise 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

This month look for the star Bellatrix in the constellation Orion the Hunter.

In Greek mythology, Orion was the son of Poseidon and a mighty hunter. Orion loved Merope, the daughter of king Oenopion. To impress her, Orion hunted down every wild animal on her father's island and brought them to Merope. But Merope wasn't impressed with Orion's feat. So Orion tried making Merope his wife by kidnapping her. In his anger, the king punished Orion by having him blinded. Orion then wandered the earth searching for help. He did eventually find some help from the god, Hephaestus. Hephaestus told Orion where to find the sun god, the one god who could restore his sight. Later in life, Orion fell in love with, and was loved by, the goddess Artemis, sister of the god Apollo. Apollo was very unhappy with his sister's love of a mere mortal and constantly ridiculed her. Giving his sister a hard time didn't change her feelings for Orion, so Apollo developed a scheme to get rid of Orion once and for all. Apollo tricked his sister into shooting Orion with her bow. Being an expert markswoman, Artemis bulls eyed Orion, killing him. When she realized what had happened, Artemis placed Orion into the sky as the constellation that we see today.

In a separate story, the Greek gods sent a scorpion to dispatch Orion before the mighty hunter could kill every wild beast in the world. The scorpion's sting to Orion's heel was fatal. Afterward Orion's death, both Orion and the scorpion were placed in the sky as a constellations, but in the opposite locations from each other. As Orion sets, the scorpion rises. That constellation is the summer constellation, Scorpius.

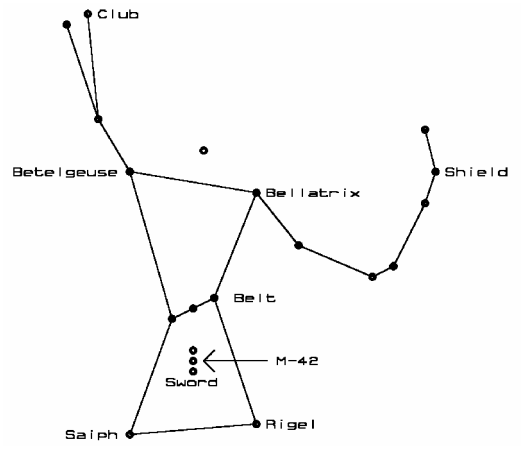
Orion is filled with a multitude of bright stars. One of these beacons is Bellatrix, or Gamma Orionis, the third star of Orion. Bellatrix represents the left shoulder of Orion. The name Bellatrix is Latin for female warrior and so the star is sometimes called the

Amazon Star. Having a star called the Amazon Star is a bit surprising when you recall that Orion is a male hunter.

Bellatrix is a very hot blue-white giant star. Its surface is over three times hotter than the sun and 6,400 times more luminous. Bellatrix has a diameter six times greater than the sun and a mass eight times greater. Tonight when you look at Bellatrix, you're seeing light that left the star back in the year, 1766. This is the year that the chemist Henry Cavendish discovered the gas hydrogen, what he called flammable air. Today we know hydrogen is the source of power for the stars.

Bellatrix is old enough that it's beginning to fuse the helium in its core into carbon and oxygen. Even though it's massive, Bellatrix won't explode as a supernova. Over the next few million years, Bellatrix will shed enough of its mass to prevent a violent death. So instead of exploding, the star will contract into a tiny white dwarf star and slowly cool over the eons.

You'll find Orion and Bellatrix in the south on February evenings. You can't miss this distinctively shape constellation with its many bright stars.



February Overview

Saturn is your guide to seeing the Beehive star cluster all month.

Late on the 5th the moon and Pleiades create a very small grouping that's suitable for binoculars.

During the middle of the month, Mars will sail pass the Pleiades star cluster.

The Zodiacal Light is visible during the last half of the month.

Mercury is visible in the evenings during the last half of the month.

February 1 – 7

Saturn begins the month very close to the Beehive cluster. Saturn will slowly drift east but will still remain close to the Beehive for the rest of the month. In May Saturn will turn around and begin approaching the cluster again.

Forty years ago on the 3rd, the unmanned Soviet spacecraft Luna 9 landed on the Moon after a four day journey from Earth. Luna 9 was the first spacecraft to successfully land on the moon and return images of its surface. The spacecraft landed on the moon in the Ocean of Storms. That's the dark maria (lava flood plain) on the left side of the moon, as seen from Earth. What makes this story so interesting is that English astronomers at the radio telescope at Jodrell Bank received the radio signal transmitted by Luna 9 and figured out the signal was a fax image. So they connected their telescope's radio receiver to a fax machine and printed the image of the lunar surface that Luna 9 was transmitting. Jodrell Bank published this image first, scooping the Soviets on their own space mission! I guess that's what you get for transmitting unencrypted data from spacecraft. Along with several images of the lunar surface, Luna 9 also transmitted information on the moon's background radiation. On the 6th the batteries in Luna 9 died and the spacecraft ceased operation.

The moon is at first quarter on the 5th at 12:29 AM (11:29 AM for the Oregon coast, 1:29 PM for the Midwest). If you've got a telescope or binoculars, this will be your best time to look at the moon. Be sure to concentrate your observations along the terminator, or the boundary between day and night. It's here that the shadows bring out the greatest amount of surface detail. Even thin wrinkles in the lunar maria become visible by the long shadows they create. Something else to look for are tall mountain peaks on the dark portion of the moon. Some are so high that the sun rises over them hours before it rises over their base. You'll see these tall peaks as spots of light in the dark of the moon and close to the terminator.

Also during the 5th, the moon is positioned between the ever fainter Mars and the Pleiades (the Seven Sisters). All three will barely fit within the field of view of popular 7X50 binoculars. The moon will continue to approach closer to the Pleiades all night and into morning on the 6th. This should make for a pretty sight in your binoculars, since the separation between them will shrink to less than one lunar diameter.

February 8 – 14

Beginning nightly on the 10th, watch Mars as it passes the Pleiades. Over the next two weeks, watch Mars make a beeline past the stationary cluster. Mars is closest to the Pleiades on the night of the 15th, when it's just over 2 degrees away, or four lunar diameters. You may want to make nightly drawings of the relative positions between Mars and the Pleiades and then compare your drawings after two weeks.

On the 12th at 10:44 PM (9:44 PM for the Oregon coast, 11:44 PM for the Midwest), the Moon becomes full. The full moon in February is called the Snow Moon. Expect the

bright moon to change the black skies of night into a faint blue-gray and washing out all the faint stars in the sky.

The moon reaches the apogee of its orbit around Earth on the 13th at 7:00 PM (6:00 PM for the Oregon coast, 8:00 PM for the Midwest). This month, the lunar apogee occurs at a distance of 252,499 miles. It would take you nearly three years to bicycle this distance at a speed of 10 mph. You'll burn over 5 million calories doing this, so you should bring a lunch (a big one).

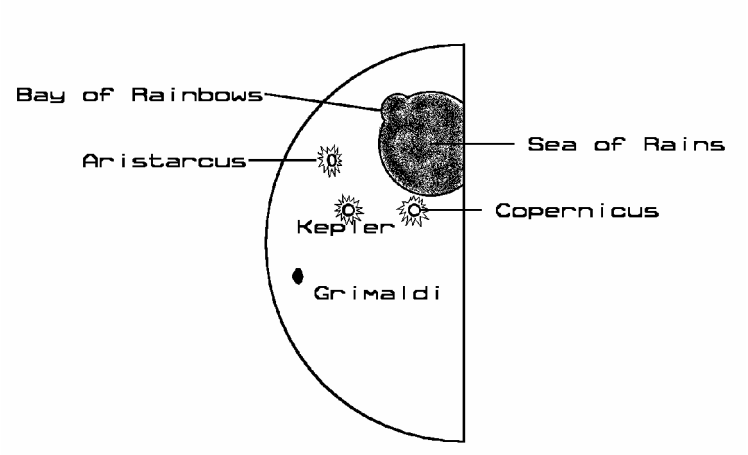
February 15 – 21

During the last half of the month, the Zodiacal Light will be its most visible. Look for a narrow triangle of light rising above the western horizon after it gets dark. The Zodiacal Light can appear as bright as the dusk, but you can tell the difference between them because the Zodiacal Light is taller and it appears after the last traces of the sun are gone. The Zodiacal light is sunlight reflecting from dust in orbit around the sun. Our solar system is a dusty place, what with all those comet tails and asteroid collisions.

Venus is the Morning Star in February and on the morning of the 17th, the planet is its brightest for the next couple of months. Venus is a thin crescent in telescopes. Over the next couple of months Venus will rise higher above the horizon and take on the shape closer to the full moon. Look for Venus low in the east-southeast beginning at 6:00 AM tonight. You can't miss it, since it's the brightest "star" in the sky.

The moon rises at midnight on the 18th. As it rises, you'll find Spica, the lucida of Virgo, just one degree away and to its upper right.

The moon is last quarter on the 21st at 1:17 AM (12:17 AM for the Oregon coast and 2:17 AM for the Midwest). You'll have to look after midnight if you wish to observe it. With your telescope or binoculars, look for these features.



On the morning of the 21st, the red giant star Antares will only be three degrees to the left of the Moon. Later today, but during daylight, the moon gets even closer.

February 22 – 31

Mercury is at its greatest eastern elongation on the 24th. The ecliptic (the path traveled by the sun, moon, and planets across the sky) rises pretty steeply in the west on February evenings. This is to our benefit, since it allows Mercury to rise rapidly above the horizon and away from the sun. Mercury's orbit is inclined with respect to the ecliptic and so this month Mercury is slightly above the ecliptic. As a result, for a few days around the 24th, Mercury is well away from the sun and high above the horizon. This makes it easier to see the elusive Mercury. Look for Mercury low in the west just after it gets dark. Our inner planet will be the only bright star low in the west (less than the width of your extended fist above the horizon) just after sunset. You may want to begin looking for Mercury at around 7:00 PM when the sun is well below the horizon, but before Mercury has a chance to get too close to the horizon. Currently the United States spacecraft Messenger is on its way to Mercury.

On the 27th at 4:00 AM (3:00 AM for the Oregon coast, 5:00 AM for the Midwest), the moon is at perigee, or it's closest to Earth for February. The moon will only be 221,760 miles away, or 30,739 miles closer than it was on the 13th.

The moon is new on the 27th at 6:30 PM (5:30 PM for the Oregon coast, 7:30 PM for the Midwest). When the new moon is near perigee (like it is on the 27th of this month), the coast experiences larger than usual tides.

This Month's Topic

The Atom
(An Abbreviated History)

Thousands of years ago, ancient Greek philosophers argued about the ultimate nature of matter. They debated whether matter could be continuously divided into smaller and smaller pieces, or if there was an ultimately smallest piece of matter that couldn't be further divided. Those who believed that there was a smallest unit of matter called this tiny chunk an atom (Greek, for not divisible). Philosophers who believed in the atom included Democritus of Abdera (Abdera was the Cleveland of the Greek world) and his teacher, Leucippus.

In the history of science, the Greek atomists did not prevail. Instead the physics of Aristotle ruled the western world for close to 2,000 years. Aristotle argued that nature abhorred a vacuum; therefore there could be no ultimate piece of matter. Because if a smallest building block did exist, then a vacuum would exist between them.

Chemistry became a science in the 17th century after alchemists made important discoveries about the compounds they were using. Chemists in the 18th century formalized these observations into a couple rules, like the Law of Constant Proportions

and the Law of Multiple Proportions. These laws stated that simple elements combined into compounds in fixed proportions every time they were mixed. For example, one part oxygen always combined with two parts hydrogen to create one part of water. Rules like these only made sense if matter consisted of a uniform units of matter. Since chemists couldn't see these building blocks of matter, they had to be pretty small. The 18th century chemist Dalton formalized the definition of the atom and explained that elements were made up of atoms. He also stated that chemical compounds were made up of molecules and that molecules consisted of atoms bound together in constant proportions.

Dalton's theory was called Scientific Atomism. In his theory, every atom of hydrogen was identical to every other atom of hydrogen. But there was obviously something different between an atom of hydrogen and an atom of oxygen. Scientific Atomism had such explanatory power and usefulness that it was accepted as true, even though atoms where far too small for chemists to detect. After the acceptance of Scientific Atomism, one of the major goals of chemistry for the next 200 years was to break down compounds and discover new elements.

Until the 20th century, atoms were believed to be indestructible. That is, every atom today existed in the same form since its creation. This meant atoms of one element could not be converted into atoms of a different element. This put to an end one dream of the alchemists, to convert base metals like lead into gold.

By the end of the 19th century, physicists were discovering a strange new property of some elements called radioactivity. It appeared that indestructible atoms were giving off some kind of energy or energetic matter. If correct, this meant atoms could be broken down into smaller parts.

The discovery of the electron proved that atoms consisted of smaller fragments. The physicist J.J. Thompson was one of the physicists experimenting with the strange rays that where emitted by atoms inside of a glass vacuum tube. The rays carried a charge (negative) and they were definitely lighter than any known atom. Thompson hypothesized that atoms contained electrons and that they could emit some of them when subjected to high electric current. If so, a positively charged piece of the atom must remain. This had to be true since atoms are on the whole, neutral, or without charge. Also, the left over piece of atom contained the majority of the mass of the atom since electrons were so light.

If atoms consisted of a positive and negative fragments, then what was the arrangement of these parts? Physicists proposed several models, including one called the plum pudding model. In the plum pudding model, atoms consist of a positive fluff (the pudding) with tiny electrons embedded inside (the plums).

Meanwhile, in England, Ernest Rutherford was shooting alpha particles, the decay products of some radioactive atoms, at a thin sheet of gold. Most of the alphas went straight through the foil like bullets through tissue paper. However, some were scattered at various angles, and in some rare cases, even backwards. From this observation,

Rutherford concluded that the atoms in the gold foil consisted mostly of empty space, and disproving the plum pudding model. This implied that there must be a tiny nucleus inside of each atom containing most of its mass.

If the electrons of an atom are separate from the nucleus, then their opposite charges will bring them together and the atom will collapse. The solar system avoids this disaster because the planets, which are also attracted to the sun, orbit the sun fast enough to avoid collapsing. So it was thought that electrons probably orbited around the nucleus too. But this introduced a new problem. When charged bodies like electrons accelerate, they emits radiation and lose energy. One form of acceleration is turning, or changing direction of travel. An electron orbiting around an atom's nucleus is in a state of constant acceleration. Therefore it's inescapable that electrons must continuously emit radiation and lose energy. As the electron spirals into the nucleus, it accelerates faster and faster and therefore the frequency of the radiation it emits also increases. In the tiniest fraction of a second, every atom should collapse and emit a burst of ultraviolet light. Physicists called this the Ultraviolet Catastrophe. Since atoms weren't doing this, something inside the atom was preventing it.

Quantum Mechanics (QM) was the hero of the day. In QM, energy only comes in specific amounts and not in intermediate amounts. This is like saying that money only comes in one dollars bills and that there can be no smaller denominations like quarters. So in QM, there can only be very specific changes in energy. If an electron doesn't have the exact amount energy needed to jump to the next higher energy level, it won't (in other words, electrons can't jump half way up). It also says that there must be discrete energy levels within an atom and that electrons cannot inhabit just any orbit within the atom. This is contrary to our experience with planets that can have any level of energy and orbit at any distance from the sun.

In QM it also turns out that two or more electrons don't like having the same set of properties within the same atom. This is called the Pauli Exclusion Principle. You can think of it like having people who don't want to be in the same room of a house at the same time. They don't mind living in the same house, but they only want to have one person in any room at a time. Specifically, in the case of an atom, electrons don't want to share the same quantum number. Some of these numbers refer to energy locations inside the atom. So in an atom, if an electron occupies a lower energy level, then no other electron can lose energy and jump into that level. The electrons stack up, one in each level, like a stack of dishes, and can't collapse into the nucleus (lucky for us). Bohr developed this model of the atom in 1913 and it looks a lot like our solar system, but with electrons orbiting the atom's nucleus in very specific orbits.

Today we don't envision the electrons as tiny bb's orbiting in well defined orbits around a tiny nucleus. Due to the Uncertainty Principle, the location and momentum, or energy and time, of the electrons and nucleus cannot be known exactly. So atoms appear, if we could see them, as fuzzy clouds. Somewhere inside that cloud is a tiny nucleus containing over 99.9% of the mass of nucleus. Around that nucleus is a poorly defined cloud of electrons buzzing the nucleus. We can calculate the probability of finding an

electron is a particular place, but we cannot calculate its exact location at a given time. That messy and uncertain ball of mass and charge makes chemistry operate in very predictable ways. And that makes life possible.

February's Website

This month check out the Stardust website. The Stardust website is designed in the standard JPL style. So at the top of the homepage is a small window where you can search topics at JPL. There's also links back to JPL websites on these topics, JPL Home, Earth, Solar System, Stars and Galaxies, and Technology. Below this top bar begins the Stardust website proper.

There are nine links at the top of the homepage with the following names, Overview, Mission, Science, Technology, Newsroom, Education, Gallery, Links, and Home Page. On the left side column are additional links, but some of these are duplicates of the links at the top. There's also a time line of events on the left side. The time line is a list of mission related events in chronological order. The central body of the webpage is filled with feature topics. Each feature topic has its own related image. On the right side is a column of quick facts. For this review, I'll focus on the links at the top of the webpage.

Overview
Here's your brief introduction to the Stardust mission. For example, you'll learn that the Stardust mission cost less than $150 million (that's around 50 cents per person in the United States)

Mission
This is a brief overview of the mission's goal and destination. There's also a list of the scientists involved with the mission. On the left side of the mission page is a drop down menu with links to the mission time line, the current location of Stardust, details on the mission, and details on the spacecraft. Some of this information is surprisingly detailed.

Science
Here's a brief introduction to comets and the Discovery missions. The Discovery missions are a program of inexpensive unmanned space flights and Stardust is the fourth in the series. In the detailed drop down menu is information on Stardust's destination, comet Wild 2, Q&A on comets, and where the comet samples will be stored. By the way, comet Wild 2 is named after its German discoverer and is pronounced like, Vildt two. In the Science in Depth link is a very detailed background on the mission, including the justifications and expectations of the mission. You'll learn a lot about interplanetary dust in this section. For example, in 1993 it was discovered that interstellar dust, that is, dust from outside our solar system, is passing through our solar system. To learn more about this material, the Stardust spacecraft spent part of its mission (before it reached comet Wild 2) collecting particles of this dust.

Technology

Under this link you'll learn about the technology on Earth and in space that makes the Stardust mission possible. You'll learn about that remarkable substance, Aerogel. Aerogel looks like solid smoke and is the least dense solid known. Did you know that there's a set of microchips onboard the spacecraft, etched with the names of people who submitted them to the Star Dust team? You're author is one of them. If you submitted your name back before the launch of Stardust in 1999, you'll find your name listed alphabetically under the Microchip link.

Newsroom
This is an archive of stories written by the Stardust team. There are press releases, status reports, and background information for the media.

Education
Here's where teachers and parents will find help teaching astronomical topics. There are teaching plans and educational materials for your use. I discovered in this link that the Stardust program has held workshops for teachers.

Gallery
The Gallery is an online art gallery. There are lots of photographs of things related to the mission. Gallery images are arranged by topic, like spacecraft and comets.

Links
The Links link is divided into six different categories. In this link you can access information on the small bodies of the solar system (like moons and asteroids), the Discovery missions, Comets, and Education.

Home
This link takes you back to the homepage, no matter where you are in the Stardust homepage.

You'll find the Stardust website at, http://stardust.jpl.nasa.gov/

This Month's Sources

Observer's Handbook 2006, The Royal Astronomical Society of Canada
Skywatch '06, Sky and Telescope Corporation
Space Calendar, http://www.jpl.nasa.gov/calendar/
Night Sky Explorer (software)
Stars, http://www.astro.uiuc.edu/~kaler/sow/
Orion, http://www.online-mythology.com/orion/
Discovery of the Atom, http://www2.kutl.kyushu-u.ac.jp/seminar/MicroWorld1_E/Part1_E/P12_E/DiscoverAtom_E.htm

Dark Skies and Bright Stars,
Your Interstellar Guide