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Word from the Editor

Kepler Mission

(NASA) The Kepler mission, scheduled to launch this month, will be a space mission to search for Earth-size and smaller planets around other stars in our neighborhood of the galaxy. Scientists also expect to detect larger planets during the mission. Kepler is a special-purpose spacecraft that precisely measures the light variations from distant stars, looking for planetary transits.

When a planet passes in front of its parent star, as seen from our solar system, it blocks the light from that star. This is known as a 'transit.' Searching for transits of distant 'Earths' is like looking for the drop in brightness when a moth flies across a searchlight. Measuring repeated transits, all with a regular period, duration and change in brightness, provides a rigorous method for discovering and confirming planets and their orbits, planets the size of Earth and smaller in habitable zones around other stars. Scientists define habitable zones as volumes in space where planets could be that may well have liquid water on their surfaces.

Kepler will survey four classes of stars, F stars (bigger and brighter than Earth's sun), G stars (similar to our sun in brightness and size) and K and M stars (smaller and less bright than our sun).

Kepler will operate for four years to view an area of the sky 500 times the area of Earth's moon. During this time, Kepler will continuously monitor the brightness of 100,000 stars in the Milky Way galaxy. The Kepler spacecraft consists of a spacecraft bus and a single instrument called a photometer, that is, a light meter, which can simultaneously measure the brightness variations of stars with a precision of about 20 parts per million.

Kepler must measure at least three transits of a planet to consider it a valid planetary candidate. Then, each star with a candidate planet must be observed by ground-based telescopes to eliminate any that have nearby stars that produce a signal that imitates a planetary transit. Consequently, the announcement of planetary discoveries can only be made after a minimum of several months. For Earth-size planets in orbit around stars similar to our sun, we must wait a minimum of three years to get three transits plus the ground-based observing time. Thus, the most valuable discoveries cannot be announced until near the end of the Kepler mission in 2012.

According to researchers, the results will tell scientists how often planets occur in the habitable zone of other stars. If these planets are common, then hundreds of Earth-size planets in the habitable zone and thousands outside the habitable zone will be detected, according to Kepler scientists. ☛
A Blast from the Past

(NASA/SSC/MPIA) Astronomers have used light echoes as a time machine to unearth secrets of one of the most influential events in the history of astronomy, a stellar explosion witnessed on Earth more than 400 years ago. By using a Galactic cloud as interstellar "mirror" an international team led by Oliver Krause of the MaxPlanck Institute for Astronomy in Germany has now re-analysed the same light seen on Earth in the 16th century and have, for the first time, determined the exact type of the explosion that happened. Calar Alto Observatory has contributed to this discovery and these results were published in the scientific journal Nature.

A brilliant new star appeared on the sky in early November 1572. The new star outshined all other stars in brightness and was even visible during daylight. It was widely observed by astronomers all around the world and it helped to change our understanding of the Universe forever. Precise measurements of the star position by the Danish astronomer Tycho Brahe, revealed that the star was located far beyond the Moon. This was inconsistent with the Aristotelian tradition that had dominated western thinking for nearly 2000 years. The supernova of 1572 was a cornerstone in the history of science and is today known as Tycho’s supernova.

An international research team has now used light echoes from the ancient supernova outburst to precisely classify the supernova witnessed by Tycho Brahe and others more than 430 years in the past. Although the direct photons from Tycho’s supernova went past Earth in 1572, they spread out through space in a constantly expanding sphere. When the light hits a cloud of dust and gas off to the side (in the sky) of the supernova, some photons are reflected towards Earth, and they reach us years later. Think of dropping a rock into a still pond, the waves go outwards uniformly until they hit (say) a pier; new waves are generated, which also travel outwards. An observer on the far shore of the pond would first see the direct waves from the rock, and some time later the reflected waves from the pier. By using such a galactic cloud as interstellar "mirror", Dr. Krause’s team could re-observe the same light witnessed on Earth in the 16th century, shortly before the invention of the telescope, with the powerful scientific tools of the 21st century available at modern observatories.
such as Calar Alto and Subaru. The spectroscopic analysis of the light echo showed the signatures of the atoms present when the supernova exploded. The resulting spectrum of light revealed silicon but no hydrogen, telltale signs that Tycho’s supernova resulted from a type Ia explosion of a white dwarf star. All supernovae of type Ia show practically the same intrinsic luminosity and, for this reason, they are used as cosmological probes to measure the large distances among the galaxies in the vastness of the Universe. The observation of type Ia supernovae in other galaxies has led to the discovery of the accelerated expansion of the Universe, what suggests the existence of the mysterious dark energy that puzzles astronomers and challenges fundamental physics since more than a decade.

Despite their importance, many details of type Ia supernovae remain to be fully understood. All recent type Ia supernovae have occurred in external galaxies. To describe the physics of these events in the greatest detail, it would be ideal if we could observe one of them in our own Galaxy: this is what has been done now in the study performed by Krause’s team. The results not only qualify Tycho’s supernova as a normal type Ia in the backyard of our own Galaxy, but also provide a wealth of new information which can be now compared in great detail to observations of both the explosion and the remnant at the same time.

The results of these studies have been published in the scientific journal Nature, 4th December 2008 issue. The article is authored by Oliver Krause (Max-Planck-Institut für Astronomie), with the following co-authors: Masaomi Tanaka (University of Tokyo, Japan), Tomonori Usuda (National Astronomical Observatory of Japan), Takashi Hattori (same institution), Miwa Goto (Max-Planck-Institut für Astronomie), Stephan Birkmann (same institution and European Space Agency), and Ken’ichi Nomoto (University of Tokyo, Japan).

**Dusty Shock Waves Generate Planet Ingredients**

(NASA/SSC) Shock waves around dusty, young stars might be creating the raw materials for planets, according to new observations from NASA’s Spitzer Space Telescope.

The evidence comes in the form of tiny crystals. Spitzer detected crystals similar in make-up to quartz around young stars just beginning to form planets. The crystals, called cristobalite and tridymite, are known to reside in comets, in volcanic lava flows on Earth, and in some meteorites that land on Earth.

Astronomers already knew that crystallized dust grains stick together to form larger particles, which later lump together to form planets. But they were surprised to find cristobalite and tridymite crystals. What’s so special about these particular crystals? They require flash heating events, such as shock waves, to form.

The findings suggest that the same kinds of shock waves that cause sonic booms from speeding jets are responsible for creating the stuff of planets throughout the universe.

"By studying these other star systems, we can learn about the very beginnings of our own planets 4.6 billion years ago," said William Forrest of the University of Rochester, N.Y. "Spitzer has given us a better idea of how the raw materials of planets are produced very early on." Forrest and University of Rochester graduate student Ben Sargent led the research, to appear in the Astrophysical Journal.
Planets are born out of swirling pancake-like disks of dust and gas that surround young stars. They start out as mere grains of dust swimming around in a disk of gas and dust, before lumping together to form full-fledged planets. During the early stages of planet development, the dust grains crystallize and adhere together, while the disk itself starts to settle and flatten. This occurs in the first millions of years of a star’s life.

When Forrest and his colleagues used Spitzer to examine five young planet-forming disks about 400 light-years away, they detected the signature of silica crystals. Silica is made of only silicon and oxygen and is the main ingredient in glass. When melted and crystallized, it can make the large hexagonal quartz crystals often sold as mystical tokens. When heated to even higher temperatures, it can also form small crystals like those commonly found around volcanoes.

It is this high-temperature form of silica crystals, specifically cristobalite and tridymite, that Forrest’s team found in planet-forming disks around other stars for the first time. "Cristobalite and tridymite are essentially high-temperature forms of quartz," said Sargent. "If you heat quartz crystals, you’ll get these compounds."

In fact, the crystals require temperatures as high as 1,220 Kelvin (about 1,740° F) to form. But young planet-forming disks are only about 100 to 1,000 Kelvin (about minus 280° F to 1,340° F), too cold to make the crystals. Because the crystals require heating followed by rapid cooling to form, astronomers theorized that shock waves could be the cause.

Shock waves, or supersonic waves of pressure, are thought to be created in planet-forming disks when clouds of gas swirling around at high speeds collide. Some theorists think that shock waves might also accompany the formation of giant planets.

The findings are in agreement with local evidence from our own solar system. Spherical pebbles, called chondrules, found in ancient meteorites that fell to Earth are also thought to have been crystallized by shock waves in our solar system’s young planet-forming disk. In addition, NASA’s Stardust mission found tridymite minerals in comet Wild 2.

Other authors of the paper include C. Tayrien, M.K. McClure, A.R. Basu, P. Manoj, Dan Watson, C.J. Bohac, K.H. Kim and J.D. Green of the University of Rochester; A Li of the University of Missouri, Columbia; E. Furlan of NASA’s Jet Propulsion Laboratory, Pasadena, Calif., and G.C. Sloan of Cornell University, Ithaca, N.Y.

JPL manages the Spitzer Space Telescope mission for NASA’s Science Mission Directorate, Washington. Science operations are conducted at the Spitzer Science Center at the California Institute of Technology, also in Pasadena. Caltech manages JPL for NASA. Spitzer’s infrared spectrograph, which made the observations, was built by Cornell University, Ithaca, N.Y. Its development was led by Jim Houck of Cornell.
Searching for Primordial Antimatter

(NASA/CXC) This view of the Bullet Cluster, located about 3.8 billion light years from Earth, combines an image from NASA's Chandra X-ray Observatory with optical data from the Hubble Space Telescope and the Magellan telescope in Chile. This cluster, officially known as 1E 0657-56, was formed after the violent collision of two large clusters of galaxies. It has become an extremely popular object for astrophysical research, including studies of the properties of dark matter and the dynamics of million-degree gas.

In the latest research, the Bullet Cluster has been used to search for the presence of antimatter leftover from the very early Universe. Antimatter is made up of elementary particles that have the same masses as their corresponding matter counterparts, protons, neutrons and electrons, but the opposite charges and magnetic properties.

The optical image shows the galaxies in the Bullet Cluster and the X-ray image (red) reveals how much hot gas has collided. If some of the gas from either cluster has particles of antimatter, then there will be annihilation between the matter and antimatter and the X-rays will be accompanied by gamma rays.

The observed amount of X-rays from Chandra and the non-detection of gamma rays from NASA's Compton Gamma Ray Observatory show that the antimatter fraction in the Bullet Cluster is less than three parts per million. Moreover, simulations of the Bullet Cluster merger show that these results rule out any significant amounts of antimatter over scales of about 65 million light years, an estimate of the original separation of the two colliding clusters.

Antimatter is made up of elementary particles that have the same masses as their corresponding matter counterparts but the opposite charges and magnetic properties. This illustration shows what happens when a particle of antimatter collides with one of matter. The particles annihilate each other and produce energy according to Einstein's famous equation, \( E=mc^2 \), mostly in the form of gamma rays, which scientists are looking for using the Compton observatory. Secondary particles are also produced. This annihilation has not been seen in the Bullet Cluster.
Hubble Finds Carbon Dioxide on an Extrasolar Planet

NASA’s Hubble Space Telescope has discovered carbon dioxide in the atmosphere of a planet orbiting another star. This is an important step along the trail of finding the chemical biotracers of extraterrestrial life as we know it.

The Jupiter-sized planet, called HD 189733b, is too hot for life. But the Hubble observations are a proof-of-concept demonstration that the basic chemistry for life can be measured on planets orbiting other stars. Organic compounds can also be a by-product of life processes, and their detection on an Earth-like planet may someday provide the first evidence of life beyond Earth.

Previous observations of HD 189733b by Hubble and the Spitzer Space Telescope found water vapor. Earlier this year, Hubble astronomers reported that they found methane in the planet’s atmosphere.

"This is exciting because Hubble is allowing us to see molecules that probe the conditions, chemistry, and composition of atmospheres on other planets," says Mark Swain of NASA’s Jet Propulsion Laboratory in Pasadena, Calif. "Thanks to Hubble we’re entering an era where we are rapidly going to expand the number of molecules we know about on other planets."

Swain used Hubble’s Near Infrared Camera and Multi-Object Spectrometer (NICMOS) to study infrared light emitted from the planet, which lies 63 light-years away. Gases in the planet’s atmosphere absorb certain wavelengths of light from the planet's hot glowing interior. Swain identified not only carbon dioxide, but also carbon monoxide. The molecules leave their own unique spectral fingerprint on the radiation from the planet that reaches Earth. This is the first time a near-infrared emission spectrum has been obtained for an exoplanet.

"The carbon dioxide is kind of the main focus of the excitement, because that is a molecule that under the right circumstances could have a connection to biological activity as it does on Earth," Swain says. "The very fact that we’re able to detect it, and estimate its abundance, is significant for the long-term effort of characterizing planets both to find out what they're made of and to find out if they could be a possible host for life."

This successful demonstration of looking at near-infrared light emitted from a planet is
very encouraging for astronomers planning to use NASA's *James Webb Space Telescope* when it is launched in 2013. These biomarkers are best seen at near-infrared wavelengths.

Astronomers look forward to using *Webb* to spectroscopically look for biomarkers on a terrestrial planet the size of Earth, or a "super-Earth" several times our planet's mass. "The *Webb* telescope should be able to make much more sensitive measurements of these primary and secondary eclipse events," Swain says.

Swain next plans to search for molecules in the atmospheres of other exoplanets, as well as trying to increase the number of molecules detected in exoplanet atmospheres. He also plans to use molecules to study changes that may be present in exoplanet atmospheres to learn something about the weather on these distant worlds. «

The Astronomy Store

The CSN Planetarium

open 5 pm to 9 pm Friday & 3 pm to 9 pm Saturday

The Astronomy Store features items for sale that are of interest to the patrons of The Planetarium. We carry a wide variety of novelties, toys and observing aids with a space or astronomical theme. When patrons obtain their tickets to planetarium shows, they can also purchase a variety of astronomically oriented items. *Friends of The Planetarium* receive a 10% discount.

The Astronomical Society of Nevada

The ASN normally meets on the 2nd Tuesday of each month at 6:30 pm at the Fleischmann Planetarium. Call 775-324-4814 for information. http://www.astronomynv.org/
The ASN has a Las Vegas Chapter. For information see: http://vegas.astronomynv.org/

Take a Field Trip to a Planetarium

Shows available for all grade levels are offered Monday thru Friday at both the Fleischmann Planetarium and the CSN Planetarium. For information, call 702-651-4505 in Las Vegas or 775-784-4812 in Reno.
The Incredible Journey of the James Webb Space Telescope

(NASA) The James Webb Space Telescope, targeted for launch in 2013, is already taking an incredible journey right here on Earth. It’s zigzagging up, down, and across the US to be "spit and polished" to perfection for its lofty space mission.

The making of the JWST mirrors begins here in a Utah Beryllium mine. [Brush Wellman, Inc., Beryllium Products division]

seriously, we do have three spare segments, so no problem there."

Let’s trace a mirror segment’s Earthly journey from rough start to "wickedly smooth," and finally to union with its 17 siblings to form a 6.5 meter (21½ foot) wide whole with a total area of 25 square-meters (almost 30 square yards).

The story begins in a Utah beryllium mine. Beryllium is one of the lightest of all metals, and the "stuff" of the telescope's mirrors.

Technicians in Ohio sift and purify the gritty beryllium powder from Utah into an extremely uniform optical grade especially for the Webb mirror. Then they pour the powder in a big, flat can, apply heat and pressure, and pump out the residual gas to create a large slab called a mirror billet. They bathe the billet in acid to burn off any stainless steel stuck to the billet when the can is removed. Next they split the billet in half Oreo-cookie-style to form two mirror blanks (no cream!). These mirror blanks are the largest ever produced in beryllium.

Workers in Alabama machine the back of each blank into a honeycomb structure to make the blanks lighter without reducing stiffness. The machined ribs are less than 1 millimeter thick, almost paper cut thin!

"This precision machining/etching removes 92% of a blank’s mass," says Lee Feinberg of
Friends of The CSN Planetarium
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College of Southern Nevada
3200 E. Cheyenne Avenue
North Las Vegas, NV 89030

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  Supernova ($100) - year credit, free admission for Friend & discount admission for family.
  Star Cluster ($200) - year large credit, free admission for Friend & family.
  Galaxy ($500) - year unshared credit, free admission for Friend & all guests.

the Goddard Space Flight Center. "Mass is critical in launching space missions."

Next, a California company grinds and polishes the segments to a very smooth and exact shape and optically tests them at room temperature.

But the Webb telescope will not operate in room temperature. Not only will this telescope mirror be "wickedly smooth," it will also be wickedly cold in space. Because it is an infrared telescope, the JWST is designed to pick up the heat of faint, awesomely distant stars and galaxies. To do that it has to be kept extremely cold. It will operate in space at about -238° C (-396° F or 35 Kelvin).

"The extreme cold may cause the telescope's structures and mirrors to change shape, so testing has to be done here on Earth under similar, hyper-cold conditions," says Cole.

This super-cold testing is done in Alabama. The Marshall Space Flight Center's X-ray & Cryogenic Facility has a vacuum chamber that can simulate the incredibly cold conditions of space. Testing in this chamber reveals even
the tiniest distortions that happen to the mirror segments in the cold. The tests provide precise data that specifies the exact repolishing to be done to compensate ahead of time for distortions likely to occur in space.

Once the mirror segments are polished to precision, gold is evaporated over them, forming a very thin coating on the smooth mirror surface.

"This gold coating is highly reflective over all the wavelengths of the Webb telescope, from visible to mid-infrared," says Feinberg.

All 18 segments finally meet at Goddard Space Flight Center. Here, they’re mounted on structures that will ultimately hold them in place and let them perform as if they were part of a single giant hexagonal mirror. (The mirror structure will be folded with its shield origami style when it’s time to fit in a rocket.) Next the telescope is fully assembled and attached to the instrument module, and the whole kit and caboodle is acoustic and vibration tested.

Final cryogenic testing takes place at Johnson Space Center, in the same vacuum chamber that tested the Apollo lunar lander.

The telescope is integrated with the spacecraft and sunshield at Northrop Grumman in California. It will lift-off from Kourou, French Guiana, on an Ariane 5 rocket.

Are we there yet? Almost. Only 930,000 more miles to go....

Artist’s concept of Altair on the moon with three crew members visible. [NASA]
Month in History

February

1: The Space Shuttle Columbia broke up during re-entry due to wing damage in 2003. The vehicle and its crew were lost.

2: Christopher Clavius, responsible for the calendar reform implemented by Pope Gregory XIII, died on this date in 1612. The Gregorian calendar is still in use today.

3: Luna 9, launched by the Soviet Union, made the first soft landing on the moon and returned pictures from another world for the first time on this date in 1966.

4: Clyde Tombaugh, the discoverer of Pluto, was born on this date in 1916. See Feb. 18.

5: The US spacecraft, Mariner 10, returned the first close images of our sister planet as it passed Venus on this date in 1974 headed towards Mercury.

5: Apollo 12, the 2nd mission to the moon’s surface landed near Fra Mauro close to the lunar equator on this date in 1971. Alan Sheppard and Ed Mitchell visited the surface and Stuart Roosa remained in orbit aboard the command module.

7: American astronauts Bruce McCandless and Robert Steward accomplished the first untethered space walks with Manned Maneuvering Units (MMU) during the STS-41B shuttle mission in 1984.

11: Japan became the fourth nation to launch an artificial satellite in 1970 with the launch of the 50 pound Ohsumi satellite. They used a newly developed solid fuel, multi-staged rocket similar to the US Scout rocket. The satellite’s battery failed the next day.

14: The US launched Syncom 1, the first geosynchronous satellite, in 1963.

15: Galileo Galilei was born in 1564 in Pisa, Italy. In December, 1609, he was the first person to use a telescope to look at the heavens and report what he saw.

18: Clyde Tombaugh, an observing assistant at the Lowell Observatory, announced the discovery of the planet Pluto in 1930 from photos taken over the previous two months.

19: Nicolaus Copernicus was born in 1473. He was the first modern proponent for a model of the solar system with the sun at the center.

19: The Soviet Union launched the Mir space station into orbit in 1986. This space station was deorbited and burned up in the atmosphere in March 2001.

20: John Glenn became the first American astronaut to orbit the earth in 1962 aboard the Friendship 7 Mercury craft. His mission lasted for three orbits which ended in less than five hours.

24: The discovery of the first pulsar was announced by Jocelyn Bell in 1968 at Cambridge in the United Kingdom.

28: The US launched the first spacecraft into a polar orbit on this date in 1959.

Give a Star

A popular service of The CSN Planetarium lets you dedicate a star to a loved one. For a donation of $35, we will provide an attractive certificate that proclaims your dedication of the star of your choice to any other person. The certificate will have a chart of the constellation containing the star and complete information about the star. A donation of $100 will give you an exclusive dedication. Call 651-4138 or 651-4505 for further information.
Sky Calendar

All times are Pacific Standard Time. Rise and set times are for the astronomical horizon at Las Vegas or Reno as noted.

The Planets

Mercury. Mercury is visible low in the eastern sky before sunrise in the middle of the month. Greatest western elongation (26°) occurs on February 13.

Venus. Venus is in the west after sunset. It will be prominent in the evening sky until late March. It reached greatest eastern elongation (47°) on January 14.

Mars. Mars, in Capricornus, is now rising in the east shortly before the sun. It will become more prominent in the morning sky as the months progress.

Jupiter. Jupiter, in Capricornus, is too close in direction to the sun to be visible. Conjunction on the far side of the sun occurred on January 23. It will become prominent in the morning sky next month.

Saturn. Saturn, in the constellation of Leo, is rising in the early evening. Look for the waning gibbous moon to rise just to the south of Saturn on the evening of February 11. Saturn will reach opposition on March 8.

Uranus. Uranus is in the constellation of Aquarius where it is low in the southwestern sky in the early evening. Conjunction with the sun will occur on March 12.

Neptune. Neptune, in Capricornus, is too close in direction to the sun to be observed at this time. Conjunction with the sun occurs on February 12.

Dwarf Planets. (At mid-month - 15th)

<table>
<thead>
<tr>
<th>Planet</th>
<th>Constellation</th>
<th>Transit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pluto</td>
<td>Sagittarius</td>
<td>8:09 am (36°)</td>
</tr>
<tr>
<td>Ceres</td>
<td>Leo</td>
<td>1:09 am (77°)</td>
</tr>
<tr>
<td>Eris</td>
<td>Cetus</td>
<td>3:34 pm (49°)</td>
</tr>
<tr>
<td>MakeMake</td>
<td>Coma Berenices</td>
<td>2:32 am (82°)</td>
</tr>
<tr>
<td>Haumea</td>
<td>Bootes</td>
<td>3:41 am (73°)</td>
</tr>
</tbody>
</table>

All Dwarf Planets require a telescope. Ceres is visible through most amateur telescopes. Pluto usually requires a telescope of at least 12" diameter. Dwarf planets beyond the orbit of Neptune can also be referred to as Plutoids. Eris ("EE-ris"), MakeMake (mah-keh-mah-keh) and Haumea, like most Plutoids, require a professional sized telescope. Transit times and altitudes (from Las Vegas) are when the object is at its highest in the southern sky. Each will appear slightly lower in the sky from Reno.

The Moon

Each day the moon rises about one hour later than the day before. The New Moon (not visible) is in the direction of the sun and rises and sets with the sun. The first quarter moon rises at about noon and sets near midnight. The full moon is opposite the sun in the sky and rises at sunset and sets at sunrise. The last quarter moon rises near midnight and sets near noon. Perigee is when the moon is closest to the earth and apogee is when it is farthest. The distance varies by ±6% from the average.

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
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</thead>
<tbody>
<tr>
<td>New Moon</td>
<td>Jan. 25</td>
</tr>
<tr>
<td>First quarter</td>
<td>Feb. 2</td>
</tr>
<tr>
<td>Full Moon</td>
<td>Feb. 9</td>
</tr>
<tr>
<td>Last quarter</td>
<td>Feb. 16</td>
</tr>
<tr>
<td>New Moon</td>
<td>Feb. 24</td>
</tr>
<tr>
<td>Apogee</td>
<td>Jan. 22</td>
</tr>
<tr>
<td>Perigee</td>
<td>Feb. 07</td>
</tr>
<tr>
<td>Apogee</td>
<td>Feb. 19</td>
</tr>
</tbody>
</table>
The Mid-Winter Sky

High in the south at about 8:00 pm during February is the bright constellation of Orion. Orion has more bright stars in it than most other constellations. Orion is the hourglass figure in the middle of the diagram.

The left shoulder of Orion is marked by the bright red star Betelgeuse. The right foot of Orion is the bright blue star Rigel. These are the two brightest stars of Orion.

The three stars at the waist of the hourglass form the “belt” of Orion. They are called Mintaka, Alnilam and Alnitak. Extending the line formed by the belt stars upward, takes you to the bright red star Aldebaran, the brightest star in Taurus, the Bull. Continuing the line takes you through the “V”-shaped pattern of the Hyades star cluster and eventually to the small “dipper-shaped” pattern of the Pleiades star cluster. The Pleiades are seven sisters kidnapped by Zeus in the form of Taurus.

Extending that same line downward takes you to Sirius, the brightest star in Canis Major, the Big Dog. Sirius is also the brightest appearing star in the sky.

Below the Belt of Orion, in the lower part of the hourglass, are three faint stars in a row. The middle star does not look quite sharp to the eye. This fuzziness is caused by the fact that the middle star is not actually a star, but a nebula. It is the famous Great Nebula of Orion, also known as M42. This cloud of glowing gas can be easily seen with a pair of binoculars. It is a star forming region that is 400 light years across and nearly 1500 light years away. Telescopes have shown evidence of hundreds of new stars being born here.

Above and to the left of Orion is the constellation of Gemini, the Twins. The two brightest stars, along the left side of the diagram, are Castor and Pollux. These stars are very similar in appearance which led to them being called “The Twins”.

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<table>
<thead>
<tr>
<th>Date</th>
<th>Sunrise</th>
<th>Sunset</th>
<th>Day</th>
<th>Date</th>
<th>Sunrise</th>
<th>Sunset</th>
<th>Day</th>
</tr>
</thead>
<tbody>
<tr>
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<td>6:36</td>
<td>5:14</td>
<td>Sat.</td>
<td>Feb. 7</td>
<td>7:00</td>
<td>5:27</td>
<td>Sat.</td>
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<tr>
<td>Feb. 10</td>
<td>6:33</td>
<td>5:17</td>
<td>Tue.</td>
<td>Feb. 10</td>
<td>6:57</td>
<td>5:30</td>
<td>Tue.</td>
</tr>
</tbody>
</table>
In Las Vegas

**Molecularium**
and

**Stargazing**

In Reno

**Ice Worlds**
and

**Amazing Journeys**

*The CSN Planetarium* and *The Fleischmann Planetarium* are units of the Nevada System of Higher Education.

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