March and April, 2000

Jupiter has slowly been gaining on Saturn in the evening skies of January and February, closing the distance between these worlds from 15° on January 1 to 10° on March 1. At the same time, the bright pair travelling along with the tail circlet of Cetus have approached Mars as it has traveled eastward against the stars and appeared to hang above the western horizon at sunset. The conjunction of Jupiter and Saturn will occur in May, but the most spectacular evening sights occur in March and April.

The full moon will occur on March 20 at 11:44 p.m., just a few hours before the vernal equinox at 2:35 a.m. on the 21st. Though the occurrence of the equinox and full moon supposedly determine the date of Easter, commonly understood to be the first Sunday following the first full moon following the vernal equinox, the actual date of Easter is determined from the ecclesiastical vernal equinox on March 21 at 12:00 a.m. (midnight at the Greenwich Observatory in London) and the ecclesiastical full moon calculated for a circular lunar orbit.

At the equinox, the sun is moving rapidly northward as Earth moves from the part of its orbit where the southern hemisphere tilts toward the sun to that where the northern hemisphere tilts toward the sun. These are the motions that observatories such as Stonehenge, where the sun moves 78° along the horizon during the year, and Chaco Cañon, where the sun moves 59°, were built to observe. Each semester I have my astronomy students draw the horizon and mark the position of sunrise or sunset for eight weeks. Even if you've watched the sun march north and south along your horizons many times, the speed at which it moves in March (and September) may surprise you if you mark it on a horizon diagram every few days for a couple weeks.

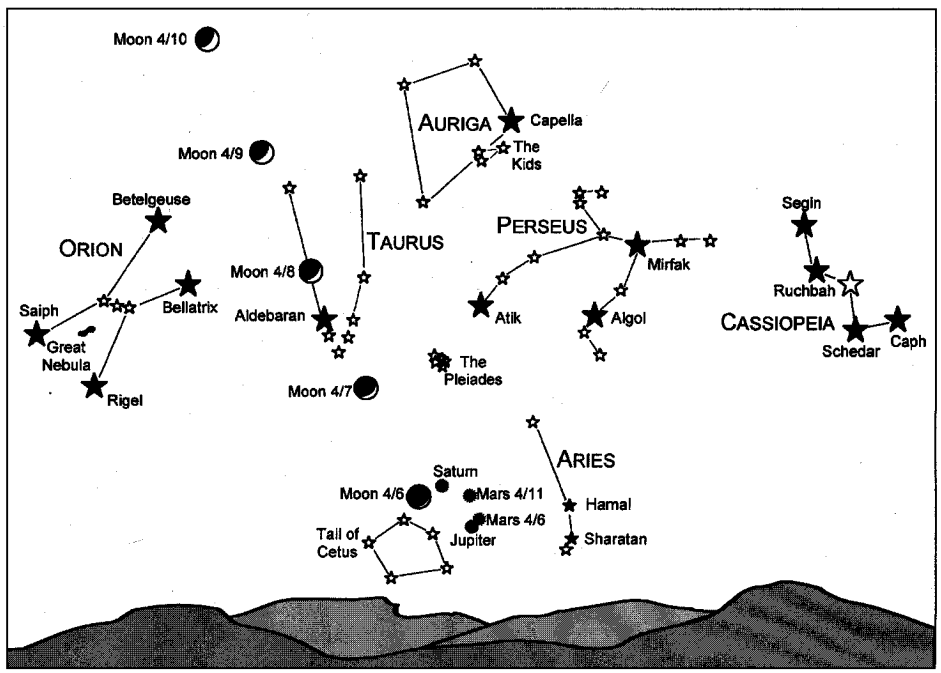

Diagram 1: Looking west on April 6–11 at 8:30 p.m.

Gathering of the planets

In the first half of April, the display of planets in the western sky at sunset will be spectacular and rare as Mars and the moon join with Jupiter and Saturn. The diagram shows the closest gathering of the planets as the moon waxes from a thin crescent (a day after the expected sighting of the new moon beginning the Muslim year 1421) to almost first quarter. This is the best gathering of these planets until 2080. After the gathering on April 11, the planets separate quickly in the brightening skies of spring. Jupiter and Saturn quickly pass Mars as they seem to move behind the sun in our sky. In truth, Earth's orbital motion puts the Sun between us and these worlds. When they're on the far side of the Sun, Jupiter and Saturn are 700 million and 1000 million miles away from Earth! By the end of April, both giant planets set within 40 minutes of the sun. Mars still sets 1.5 hours after sunset, but continues to fade as Earth's distance from it increases and the Sun slowly catches up to it, making it harder to see against the brightness of the twilight sky.

Venus remains in the morning sky, rising only an hour or so before the sun. As March begins, quick and illusive Mercury joins it. On March 13, the two "inferior" planets, named such for having orbits within Earth's, are within 3° of each other, rising at about 5:30 a.m. (standard time) in a sky already brightening with the dawn. The sun rises by about 6:15 a.m. If you have a low horizon to the east, look for the planetary pair between 5:45 and 6 a.m. Mercury continues moving away from the sun, and will be easiest to see around March 30th when it rises an hour before the sun. You may want to wait to look for Mercury until Daylight Savings begins on April 2 and suddenly makes all the celestial objects rise and set an hour later!

Mercury quickly zips back toward Venus, and passes within ⅓ of a degree of it on April 28. But they only rise 20 minutes before the sun by then, so this pairing will be impossible to see. But Jupiter and Saturn will give a show to the morning observers in May.

Orion and the Winter Hexagon dominate the starry skies of March and April. Pull out your *Adirondac* issues for January/February and March/April of 1999 to review the names of the brilliant array of stars that light our winter nights. Only a part of the winter hexagon including the stars of Rigel (RYE-jell) in Orion, Capella (as in *A Cappella* choirs) in Auriga (o-REE-ga) the charioteer (who carries two small goats . . . the kids), and Aldebaran (al-DEB-a-ron) in Taurus (the bull) is shown on this month's diagram. Sirius (as in "serious") in Canis Major (the Big Dog) is not shown, but it is the brightest star in the sky and is easily found by following

the line of Orion's belt toward the southeast, or left as it appears in the sky. Notice that Aldebaran is found by following the line of the belt the other way.

The other stars in the V that Aldebaran tops are in a cluster known as the Hyades (HIGH-a-dees) that is about 150 light years away (compared to Aldebaran's 65 ly distance) and contains about 200 stars (cluster membership is not always easy to determine, so the number of stars in a cluster is always an estimate). The best view of this cluster is obtained with binoculars.

Tales of the seven sisters

Continuing along the line from Orion's belt, a much tighter cluster of stars, the Pleiades (PLEE-a-dees), comes into view. This cluster is also known as the seven sisters whom Zeus turned into pigeons so that they could escape Orion, who was pursuing them through the forest. Orion still pursues them, though now Taurus the bull is ahead of him as the constellations march across the sky.

Only six stars usually appear to naked-eye observers, although nine stars in this cluster actually bear names (see Diagram 2 where the cluster is oriented with the line to Orion's belt horizontal as it is in Diagram 1) and two of them are the names of the parents (Atlas and Pleione), so the other seven named stars are the sisters (for an excellent discussion of the sisters' names, see <ras.ucalgary.ca/~gibson/pleiades/pleiades_myth.html>).

The association with seven may have less to do with the actual number of stars than the sacred or ritual significance of seven representing the directions of north, south, east, west, up, down, and inward. Since the Pleiades are very near the ecliptic, the path the sun and planets follow across the sky, this little cluster has been noticed and been used for the keeping of calendars and stories. The Aztecs observed the midnight transit of the Pleiades (when the cluster was almost directly overhead at midnight and thus directly opposite the sun) as part of the New Fire Ceremony that concluded one 52-year-long bundling of the years and began a new one[1]. The first rising of the Pleiades after sunset began the New Year's festival of Makahiki when winter rains returned to Hawaii to water the crops[2]. The Zuni people of New Mexico call the Pleiades the Seeds, and use their disappearance into the twilight of the setting sun to determine when to plant their crops. The Hindus of India picture the cluster in the shape of a flame

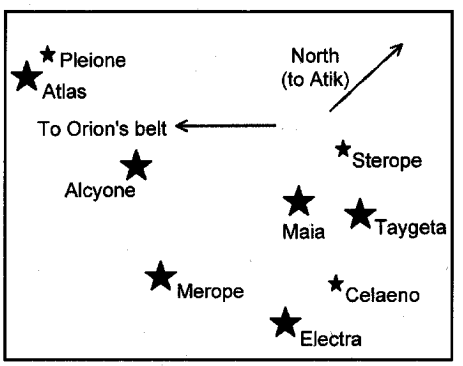

Diagram 2: The Pleiades

honoring Agni, the god of fire.

The Onondaga of our own Adirondack region tell of a band of children who danced together to avoid helping their parents in the daily chores. They would dance all day and become light-headed from dancing and from a lack of food. They asked permission to bring food with them while they danced, but their parents refused, telling them they had to eat at home. The children were undeterred, though, and continued to spend long days dancing. One late afternoon, as the children were light-headed from dancing and hunger, they began to rise in the air as they danced. Initially fun, dancing in the air soon became frightening because if they stopped, they would fall to the Earth below. When villagers noticed the children floating away, they called for them to come back. One boy became a falling star when he stopped dancing and fell to Earth at the sound of his father's voice. The other children continued floating up to the sky where they now dance among the stars[3].

Stars are born in clusters and a large cluster of stars is forming in the Great Nebula in Orion's sword. It is another interesting part of the sky to explore with binoculars or a small telescope. Since it's at the great distance of 1500 light years, this winter we're seeing it as it was in the year 500 CE! But 1500 years is a flash on astronomical time scales, so it will probably look much the same when the light leaving the nebula today arrives in 3500 CE. Interesting as it is in visible light as seen by the Hubble Space Telescope, with future planetary systems still forming (see <oposite.stsci.edu/pubinfo/pr/95/45.html>), it is even more interesting when viewed in the infrared (IR) portion of the spectrum as shown on Astronomy Picture of the Day (APOD) for February 2, 1999 (<antwrp.gsfc.nasa.gov/apod/ap990202.html>). The gas and dust that we see as the nebula is a small portion of a giant gas cloud complex that covers a much larger portion of the sky than the constellation (see APOD for 12/1/97 and NASA's IR astronomy page at <www.ipac.caltech.edu/Outreach/Edu/>). Much of the gas and dust hides the forming stars within this nebula from our view, but does not block the longer wavelength IR, so that we can see deeper into the nebula.

Our own solar system formed in such a nebula about 5 billion years ago. So huddle up in your warmest boots and parka, and with hot chocolate and binoculars spend some time contemplating the great questions while exploring the winter sky. —*Aileen O'Donoghue*

[1] Krupp, *Echoes of the Ancient Skies: The Astronomy of Lost Civilizations*, Oxford University Press: New York, 1983

[2] Krupp, *Skywatchers, Shamans, & Kings: Astronomy and the Archeology of Power*, Wiley: New York, 1997

[3] Monroe and Williamson, *They Dance in the Sky: Native American Star Myths*, Houghton Mifflin: Boston, 1987