

ASTRONOMICAL CALENDAR, HIGHLIGHTS & CHALLENGES

**2010 SKIES
FOR
TRI CITIES, WASHINGTON**

**W119.280°, N46.280°
W 119° 16' 48", N 46° 16' 48"
(Richland, WA)**

Tom Page

Tri Cities Astronomy Club
<http://www.tricityastronomyclub.org/>

January 2010

JANUARY

- ▶ Last Quarter Thu 7th 2:39 AM
- New Moon Thu 16th 11:11 PM
- ◐ First Quarter Sat 23rd 2:53 AM
- Full (Wolf) Moon Fri 15th 10:18 PM

Mercury is in eastern morning sky for first ½ of Jan. It is at greatest elongation west on the 27th.

Venus is not visible. At superior conjunction on the 11th.

Mars is visible most of the night, in retrograde portion of its orbit moving from Leo into Cancer. At opposition on the 29th it will be 5.5 light-minutes from Earth. The springtime northern hemisphere is tipped towards Earth.

Jupiter is low in SW in early evening sky, sets by mid-evening.

Saturn is in morning sky near Virgo <0.5°N of Celestial equator, rising near midnight. North side of rings are visible during 2010. Tilt varies from 4.9° in early January to a minimum of 1.7° in late May. Rings open to 10° by year's end.

Uranus is in the western sky and sets in late in the evening.

Neptune is low in the early western evening western sky. It disappears in the twilight by month's end.

- 1 Fri** Vesta, due to its light color is generally the brightest asteroid. This year's opposition on the evening of Feb 17th is relatively north, near and bright. Between now and April will be an easy binocular object shining at 7.3 to 6.2 magnitude. Vesta now at 7.2 magnitude.
- 2 Sat** Leslie Peltier, discover of 12 comets and 132,000 observations of variable stars, born 1900 in Delphos Ohio.
Earth at perihelion (149,597,900 km) 92,955,825 miles.
- 4 Mon Latest sunrise** 7:40 AM PST in the Tri-Cities.
- 7 Thu** Galileo discovered first 3 moons of Jupiter 400 years ago.
- 13 Wed** Galileo discovers Ganymede, moon of Jupiter 400 years ago.
- 30 Sat** Closest lunar perigee of 2010 and largest full Moon of 2010.

FEBRUARY

- ▶ Last Quarter Fri 5th 3:48 PM
- New Moon Fri 13th 6:51 PM
- ◀ First Quarter Mon 21st 5:42 PM
- Full (Snow) Moon 28th 8:38 AM

Mercury is in eastern morning sky, favoring southern hemisphere viewers.

Venus enters the western evening sky this month.

Mars is visible most of the night in cancer and is just past opposition with a brightness of -1.4 and a disk of about 13". The northern spring hemisphere is tilted towards Earth.

Jupiter leaves the evening twilight by mid-month. In conjunction with the Sun on the 28th.

Saturn is in morning sky in Virgo. Rises at mid-evening.

Uranus sinks into the evening twilight by month's end. Approaching conjunction.

Neptune is at conjunction on the 14th and not visible.

Vesta at opposition on the night of the 17th-18th, becomes a near naked eye object. At magnitude of 6.1 it is an easy binocular object.

1 Mon through Fri the 12th Venus, Saturn, and Mars put on a fine binocular display low in the southwest early evening sky. Venus is 3°S of Saturn on the 10th and 2°S of Mars on the 23rd. All three planets are in a binocular field of view for the first 12 days of the month.

Vesta at 6.2 magnitude

2 Tue Candlemas or Groundhog Day. One of four quarter-cross days, half way between the solstice and equinox. Mid-Winter in our calendar, the start of Spring in others.

12 Fri Farthest lunar apogee of 2010.

14 Sun **Challenge No. 1: See a very young new Moon 23 hrs after new.** Sunset 5:21 PM, azimuth 252°True. Moonset 6:23 PM, azimuth 262°True.

16 Tue Venus is near conjunction with Jupiter, very low in the west southwest bright twilight, a difficult spotting.

Challenge No. 2: Split Gamma Leonis. Vesta passes near Gamma Leonis (Algieba), a double star magnitude about 2 and the second star above Regulus in the sickle. Both stars are perhaps pale yellow and are now about as far apart (4.5") as they can be.

18 Thu **Challenge No. 3: See Vesta at opposition.** Vesta, in Leo is generally the brightest of the asteroids due to its light color. See January.

Two-fer: If you see Vesta while splitting Gamma Leonis between the 16th and the 18th, you get credit for seeing the opposition.

MARCH

- ▶ Last Quarter Fri 7th 7:42 AM
- New Moon 15th 2:01 PM
- ◐ First Quarter Wed 23rd 4:00 AM
- Full (Worm) Moon Mon 29th 7:25 PM

Mercury is at superior conjunction on the 14th. Reappears in the western evening sky in the last week of the month.

Venus is in western evening sky, well positioned for northern viewers. Crescent Moon passes 7° north of Venus on the 17th.

Mars is well position in evening sky, shrinking this month in apparent diameter from 12" to 9". At aphelion on the 30th.

Jupiter reappears in dawn twilight near mid-month; southern viewers favored.

Saturn is visible most of the night. At opposition on the 21st, 71 light-minutes from Earth. At opposition it shines at 0.5 magnitude and the north side of the ring plane is titled 3.2° toward Earth.

Uranus is not visible, at conjunction on the 17th.

Neptune reappears in the morning sky, not easily observed.

1 Mon Vesta at 6.2 magnitude.

3 Wed Zodiac light visible in the west after dark for the next two weeks.

12 Fri Simon Newcomb, first President of the American Astrological Society, was born in Nova Scotia 175 yrs ago (1835).

14 Sun Daylight Savings Time (Daylight Displacement Time - George Lovi) begins at 2:00 AM on 2nd Sunday of March. Spring your clocks a head 1 hr. Officially, no clock hour 2:00-3:00 AM. Daylight time now runs from 2nd Sunday in March to 1st Sunday in November. All summer it will be as though you were displaced one time zone east.

15 Mon Ides of March. Buzzards return to Hinckley, OH.

20 Sat Spring (Vernal) Equinox. Spring arrives in Tri-Cities at 10:32 AM PDT when the Sun crosses the equator into the northern hemisphere. Sun rises due E, sets due W. Marks mid-Spring in some alternative calendars.

Until 2007 the vernal equinox fell on the 20th or 21st Universal Time (7 hours earlier than PDT). It will now be on the 20th until the year 2044, after which it may occur on the 19th or 20th.

29 Mon Mercury and Venus this week in the evening twilight, best planet pair of the year.

APRIL

- ▶ Last Quarter Tue 6th 2:57 AM
- New Moon Wed 14th 5:29 AM
- ◐ First Quarter Thu 21st 11:20 AM
- Full (Pink) wed 28th 5:18 AM

Mercury at greatest elongation east on the 8th, puts on the best evening show in the first half of the month. It is at inferior conjunction on the 28th. The waxing crescent Moon is nearby on the 15th and 16th as are the Pleiades (use binoculars) on the 26th.

Venus is low in the western sunset sky all month. Mercury lies within 4° of Venus for the first 10 days of the month, northern observers favored. Crescent Moon passes 4° north of Venus on the 16th.

Mars is gibbous and shrinking in the evening twilight, dwindling to 9" to 7" but almost 70° high.

Jupiter is low in morning sky.

Saturn is just past opposition and visible all night.

Uranus reappears in the dawn sky, not easily observed.

Neptune In eastern morning not easily observed.

1 Thu Vesta at 7.3 magnitude.

3 - 8 Mercury, at greatest elongation on the 8th, just to lower right of Venus in quasi-conjunction for the first two weeks of the month. They are closest on the 3rd when they are 3° apart.

11 Mon Frank Drake started Search for Extraterrestrial Intelligence 50 years ago.

14 Wed **Challenge No. 4: See a very, very young Moon, 16 hrs after new.** In the west soon after sunset at 7:43 PM, azimuth 285°True. Moonset at 8:32 PM, azimuth 295°True.

16 Fri The Moon is close to the Pleiades in the evening twilight with Venus and Mercury below Mars 1°N of the Beehive cluster (M44).

22 Thu **Lyrid Meteor Shower** peaks. ZHR variable, up to 90. Av=18. The radiant, on the Lyra-Hercules border (18h04m +32°), is in useful view after 10:30 PM and improves all evening. A waning gibbous Moon sets about 2:30 AM just after the expected peak starts. The best time will be in the pre-dawn sky. Lyrids are swift meteors (49 km/s), occasionally bright with about 20-25% leaving persistent trains. April can bring more sporadic fireballs (-3 magnitude or greater).

Lunar Straight Wall visible.

24 Sat International Astronomy Day.

MAY

- ▶ Last Quarter Wed 5th 9:15 PM
- New Moon Thu 13th 6:04 PM
- ◐ First Quarter Thu 20th 4:43 PM
- Full (Flower) Moon Thu 27th 4:07 PM

Mercury is in the eastern morning sky for last three weeks, but not easily observed.

Venus is in the western evening sky and eclipsed by the crescent Moon on the 16th.

Mars is gibbous and dimming in the western evening sky. It's diameter is about ½ of what is was in February.

Jupiter is in the morning sky but not easily observed.

Saturn in Virgo is the planetary gem in the evening sky this month. It shines high (47°) in the sky at sunset and remains in the sky until early morning. The north side ring plane reaches the minimum tilt of 1.7° this month, dramatically thin. This is the last chance for many years to see the rings as a luminous spike or thread of light.

Uranus is in the eastern morning sky in Pisces.

Neptune In the eastern morning sky.

- 1 Sat** **May Day** or Beltane, the 2nd cross-quarter day of the year, half way between the equinox and the solstice. Start of Summer on some alternative calendars, mid-Spring in ours.
- 6 Thu** **Eta Aquarid Meteors.** Active Apr 19th-May 28th. ZHR 60 varying between ~40 to 85. Rates should be approaching the higher end in 2008-2010. Early reports from 2008 were 70 to 80/hr. Very fast (66 km/s), bright meteors, frequently leaving persistent trains (40-60). Associated with Comet 1P Halley. The radiant, the "Y"-shaped water jar asterism of Aquarius does not rise to a useful altitude in the E until about 3:30 AM, coincident with astronomical twilight. The last quarter Moon, rising about 1:15 AM will compromise viewing.
- 9 Sun** On the mornings of Sunday the 9th, Monday the 10th, and Tuesday the 11th, the waning crescent Moon slides down towards the horizon passing by Jupiter in the hour before dawn.
- 14 Fri** On the evenings of Friday the 14th, Saturday the 15th, and Sunday the 15th, the waxing crescent Moon climbs up into the sky in the hour after sunset passing by Venus.
- 16 Sun** Crescent Moon above Venus in evening twilight.

JUNE

- ▶ Last Quarter Fri 4th 3:13 PM
- New Moon Sat 12th 4:15 AM
- ◐ First Quarter Fri 18th 9:30 PM
- Full (Strawberry) Moon Sat 26th 4:30 AM

Mercury at superior conjunction on the 28th, is not easily observed.

Venus not easily observed.

Mars is in the western evening sky. On the 6th, it passes, 1°N of Regulus in Leo.

Jupiter In morning sky in Pisces. On the 6th is <1°S of Uranus.

Saturn is easily observed this month.

Uranus is in the eastern morning sky, see Jupiter.

Neptune is in the eastern morning sky, rising after midnight.

11 Fri **Challenge No. 5: See an old Moon.**

Old crescent Moon, 24 hrs before new, visible in morning twilight during the hour before sunrise at 5:05 AM, azimuth 54°True. Moonrise at 4:06 AM on azimuth 53°True. Phase ~1% lit.

14 Mon Earliest sunrise 5:05 AM PDT in the Tri-Cities. Crescent Moon appears below Venus in evening twilight.

18 Fri Lunar "X" near crater Werner visible at midnight.

20 Sun Summer Solstice. Longest day of the year, 15 hr 48 m of daylight, in Tri Cities. Summer begins in the Tri Cities at 6:00 PM PDT, when the Sun reaches its farthest point N of the equator. Mid-Summer in some alternative calendars. Until 1975 the solstice fell on June 21st or 22nd (Universal Time). Now it will only fall on June 21st (UT) until 2012 when it begins falling sometimes on the 20th.

26 Sat Partial Lunar eclipse. Eclipse begins with the Moon's contact with Sun's penumbral shadow at 1:57:21 AM Saturday morning. Umbral (partial) eclipse begins at 3:16:57 AM, greatest eclipse occurs at 04:38:27 when just over ½ (0.5368) of the Moon is in the Sun's umbra shadow. Partial eclipse ends at 5:59:50 AM, 50 minutes after the Sun rises. Penumbral eclipse ends at 7:19:50 AM.

Challenge No. 6: Partial Lunar eclipse, compare Danjon eclipse values with December 20th full eclipse. Estimate Danjon Values at greatest partial eclipse (4:38 AM PST). Danjon Values:

- L=0 Very dark eclipse, Moon almost invisible especially at mid-totality.
- L=1 Dark eclipse, grey or brownish color to Moon, details distinguishable only with difficulty.
- L=2 Deep-red or rust colored eclipse, very dark central shadow, outer umbra relatively bright.
- L=3 Brick red eclipse, umbra shadow usually has a bright or yellow rim.
- L=4 Very bright copper-red or orange eclipse, umbra shadow has bluish, very bright rim.

27 Sun Latest sunset at 8:53 PM PDT in the Tri-Cities.

JULY

- ▶ Last Quarter Sun 4th 7:36 AM
- New Moon Sun 11th 12:40 PM
- ◀ First Quarter Sun 28th 3:00 AM
- Full (Thunder) Moon Sun 25th 6:36 PM

Mercury is not easily observed.

Venus is not easily observed this month.

Mars is very low in the western evening sky setting after 10:00 PM.

Jupiter rises due east near midnight. For the first time in 6 yrs, Jupiter crosses the celestial equator, on the 8th from S to N, and on the 31st from N to S.

Saturn is low in the western evening sky and is not easily observed this month.

Uranus rises after midnight and is in the eastern sky at dawn.

Neptune rises in late evening and is in the morning sky at dawn.

- 1 Thu** Saturn, Mars, Regulus, and Venus are strung out in a straight line in the western sky spanning about 38° from upper left to lower right in the hour after sunset. Watch all month long.
- 2 Fri** Mid point of the year occurs at 1:00 PM PDT, if you consider the year starting at midnight PST on New Years Eve. If you count the year beginning when it did at Greenwich (Coordinated Universal Time) the mid-point of the year occurs at) 7:00 AM PDT.
- 3 Sat** **Challenge No. 7: See Jupiter after sunrise; i.e., in the daytime sky.** Jupiter at magnitude -2.5 will be 8° to the lower left of the Moon in the eastern dawn sky. Start tracking it in the early dawn twilight before sunrise at 5:10 AM PDT.
- 14 Wed** The line of Saturn, Mars, and Venus (with Regulus about 1° below) has contracted to about 24°.
- 15 Thu** **Challenge No. 8: Spot Arcturus unaided before sunset.** Polarizing sunglasses may help. Very Challenging but can be done (RASC). Sun sets at 8:46 PM. Arcturus transits at 7:34 PM. Alt-azimuth coordinates are, approximately 16° west of south (azimuth 196°) and +16°.
- 31 Sat** Mars is now passing south of Saturn and the line of July 1st has become a skinny triangle with Mars and Saturn both <8° from Venus.

AUGUST

- ▶ Last Quarter Mon 2nd 9:59 PM
- New Moon Mon 9th 8:08 PM
- ◀ First Quarter Mon 16th 12:14 PM
- Full (Sturgeon) Moon Tue 24th 10:05 AM

Mercury is low in the western evening sky for the first three weeks and is not easily observed.

Venus is in the western evening sky and at greatest elongation east on the 20th. Venus is 3°S of Saturn on the 10th and 2°S of Mars on the 23rd. All three planets lie within a binocular field of view for the first 12 days of the month, and Mercury is lower in the twilight. At greatest elongation, 46°, on the 20th.

Mars is in the western evening sky and passes, 2°S of Saturn on the 1st. It is 2°N of Venus on the 23rd. Binoculars may help in spotting it.

Jupiter rises in the east in late evening. Best observing is in the period before dawn.

Saturn is low in the western mid-evening sky and difficult to see. It is <2°N of Mars on the 1st and 3°N of Venus on the 10th. See Above.

Uranus is in the dawn sky.

Neptune at opposition on the 20th, is visible all night, 4.0 light-hours from Earth.

Mars, Venus, and Saturn put on a good show, low in the evening twilight from the 3rd through the 11th. See above.

1 Sun Lammas, the 3rd cross-quarter day of the year, half way between the summer Solstice and autumnal Equinox. Beginning of Fall in some alternative calendars, mid-Summer in ours.

3 Fri Double shadow transit on Jupiter 3:05 AM.

9 Mon **Challenge No. 9: See a very old Moon, 15 hrs before new.** Rises 5:15 AM, at azimuth 67°True, about 1% lit. Sun rises at 5:49 AM, azimuth 66°True.

12 Thu Perseid Meteors at maximum for the northwest on the night of 12th-13th. The radiant, a few degrees NE of double star cluster in Perseus, reaches useable elevation after 10:00 PM. New Moon on the 9th assures dark skies.

- Active from July 17 to August 24.
- Peak variable: ZHR 100.
- Swift atmospheric velocity 60 km/sec (~37 miles/sec) because head on to earth's orbit.
- Beginning height 110-160 km.
- Average magnitude 2.27. Brighter meteors often end in flares or bursts.
- Some fire balls; about 1/3 leave trains up to 2 degrees wide, lasting to 100 sec.
- Typically yellow, fewer white, brighter ones are green, orange, or red.
- Derived from comet Swift-Tuttle, period now receding.
- Historical record dates from 36 AD in China and 714 AD in Europe

16 Mon Lunar "X" near crater Werner visible 8:00 PM.

20 Wed Middle of the best time of the year to observe night skies.

24 Tue Today's full Moon is the smallest full Moon of 2010.

SEPTEMBER

- ▶ Last Quarter Wed 1st 10:22 AM
- New Moon Wed 8th 3:30 AM
- ◐ First Quarter Tue 14th 8:50 PM
- Full (Harvest) Moon Thu 23rd 2:17 AM
- ▶ Last Quarter Thu 30th 8:52 PM

Mercury is at inferior conjunction on the 3rd, and in the morning sky during the last half of the month. At greatest elongation W on the 19th, best morning view of the year for northern observers.

Venus is 3°S of Saturn on the 10th and 2°S of Mars on the 23rd. All three planets are in a binocular field of view for the first 12 days of the month in the western evening sky. It is at its maximum brightness on the 23rd at -4.6 magnitude.

Mars is low in the western evening sky and not easily observed.

Jupiter at its best this month rises in mid-evening and is visible all night. It is at opposition on the 21st at 33 light minutes from Earth, 2°S of the celestial equator and 1°S of Uranus. At opposition within 6 months of perihelion, obtains its 12-year maximum diameter at 49.7", and shines at -2.9 magnitude. On the 22nd, 24 hrs after opposition, Jupiter is <1°S of Uranus.

Saturn sinks onto the evening twilight early this month.

Uranus is visible all night. At opposition on the 21st, 2.6 light-hours from Earth, shines at 5.7 magnitude, and is 3.7" wide.

Neptune is just past opposition and is visible all night.

7 Tue **Challenge No. 10: See a very, very old Crescent Moon 21 hrs before new** in the hour before dawn. Moon rises at 5:31 AM, about 1% lit, azimuth 80°True. Sun rises at 6:25 AM at azimuth 80°True.

18 Sat Uranus 49' north of Jupiter. Conjunction.

23 Thu **Fall or Autumnal Equinox.** Fall starts in the Tri-Cities at 8:13 PM, when the Sun crosses the equator into the southern hemisphere. Mid-fall in some alternative calendars. Since 1968, this equinox has fallen on 23rd or 22nd. Until 1934 it also sometimes fell on the 24th.

The full Moon closest to the fall equinox is called the Harvest Moon. You can't get any closer to the that equinox than today's full Moon.

OCTOBER

- New Moon Thu 7th 12:44 PM
- ◐ First Quarter Thu 14th 2:27 PM
- Full (Hunter's) Moon Fri 22nd 6:36 PM
- ◑ Last Quarter Sat 30th 5:46 AM

Mercury is at superior conjunction on the 17th and is visible in the morning sky only early in the month.

Venus is 3°S of Saturn on the 10th and 2°S of Mars on the 23rd. All three planets are in a binocular field of view for the first 12 days of the month. Venus is at inferior conjunction on the 28th 6°S of Sun.

Mars is low in the early western evening sky.

Jupiter just past opposition is visible most of the night and remains near peak brightness and angular bigness.

Saturn is in conjunction with the Sun on the 1st, and reappears in the dawn twilight in the last half of the month. By month's end it rises 2½ hrs before sunrise.

Uranus is just past opposition and is visible most of the night.

Neptune is well placed in the evening sky.

10 Sun The Very Large Array radio telescope was dedicated 30 yr ago, Socorro, NM.



Image courtesy of NRAO/AUI and Kristal Armendariz, Photographer

14 Thu Lunar "X" visible, 8:00 PM.

NOVEMBER

- New Moon Fri 5th 9:02 PM
- ◐ First Quarter Sat 13th 8:38 AM
- Full (Beaver) Moon Sun 21st 9:27 AM
- ◑ Last Quarter Sun 28th 12:36 PM

Mercury is in the western evening sky and passes within 2° of Mars on the 21st.

Venus reappears in our eastern morning twilight early in the month. By mid-month it shines brightly in the east-southeast early dawn sky.

Mars is low in the southwestern early evening sky setting shortly after twilight.

Jupiter is well placed in the evening sky.

Saturn is low in the predawn sky.

Uranus Well placed in the evening sky.

Neptune is well placed in the evening sky and sets near midnight.

- 1 Mon** All Souls Day, the 4th the last cross-quarter day of the year, half way between the equinox and solstice. Mid-Fall in our calendar, the start of Winter in some alternative calendars.
- 7 Sun** Daylight Saving Time ends. Officially the hour 1:00 AM to 2:00 AM is repeated.
- 11 Thu** First photo of the of Earth's curvature made from balloon, Explorer 2, over South Dakota at an altitude of 72,000 ft., which was an altitude record 75 years ago (1935).
- 13 Sat** Jupiter with only one Moon visible 11:32 PM.
- 17/18 Wed** **Leonid meteors.** Active 10 to 23 Nov. ZHR variable; perhaps 100+ in 2009. Most years since the 2002 storm have produced rates of 20 to 60/hr. Extremely fast meteors, 71 km/s, often bright, 50-70% leave persistent trains. The radiant, in Leo's head near the sickle rises about 11:00 PM. The waxing late crescent Moon setting at 3:00 AM makes for poor conditions with only a few hours viewing before sunrise. Associated with comet 55P/Temple-Tuttle.

DECEMBER

- New Moon Sun 5th 9:36 AM
- ◐ First Quarter Mon 13th 5:59 AM
- Full (Long Nights) Moon Tue 21st 12:13 AM
- ◑ Last Quarter 27th 8:18 PM

Mercury is in the evening sky for the first half of the month then disappears into the Sun's glare; at conjunction on the 20th.

Venus is in the southeast of the morning sky shining at -4.7 magnitude.

Mars disappears into the evening twilight.

Jupiter is well placed in the early evening sky and sets near midnight.

Saturn appears well placed in the morning sky.

Uranus is well placed in the early evening sky, setting after midnight.

Neptune is in the early western evening sky.

8 Wed Earliest sunset 4:11 PM PST in the Tri-Cities.

14 Tue Geminid Meteors. ZHR 120, slightly variable. One of the best showers presently visible from Earth. Bright, medium speed meteors (35 km/sec), with few persistent trains. The radiant, above the head of Castor in Gemini (the twins) is available almost all night, rising in early evening. A reliable shower. A first quarter Moon sets at 12:49 AM on the morning of the 15th. Associated with an Apollo asteroid 3200 Phaeton. If the skies are clear, this shower is strong and worth bundling up for.

20 Mon Challenge No. 11: Compare Danjon Values of a total lunar eclipse with June's partial eclipse. Penumbral eclipse begins at 9:21 PM. Partial (umbral) eclipse begins at 10:32 PM Dec 20th. Total eclipse begins at 11:40 PM. Greatest eclipse occurs at 12:16:57 AM Dec 21st. Total eclipse ends at 12:53 AM. Partial eclipse ends at 2:01 AM. Penumbral eclipse ends at 3:04 AM.

Estimate Danjon Values at greatest total eclipse 12:16 AM PDT Dec 21st.

Danjon Values:

- L=0 Very dark eclipse, Moon almost invisible especially at mid-totality.
- L=1 Dark eclipse, grey or brownish color to Moon, details distinguishable only with difficulty.
- L=2 Deep-red or rust colored eclipse, very dark central shadow, outer umbra relatively bright.
- L=3 Brick red eclipse, umbra shadow usually has a bright or yellow rim.
- L=4 Very bright copper-red or orange eclipse, umbra shadow has bluish, very bright rim.

21 Tue Winter solstice. Shortest day of the year. Winter arrives in the Tri Cities at 3:42 PM PST. Mid-Winter in some alternative calendars. The Sun, appearing to travel along the ecliptic, reaches its farthest point south of the celestial equator. Tri-Cities get 8 hrs and 37 minutes of daylight. Sun rises at 7:37 AM and sets at 4:13 PM PST. The solstice was on the 20th or 21st until 1697. Since 1702, it has been on the 21st or 22nd. It will slip to the 20th in 2080.

2010 Challenges

Challenge No. 1: See a very young new Moon

February 14: 23 hrs after new. Sunset 5:53 AM, azimuth 252°T. Moonset 6:23 PM, azimuth 262°T.

- *Less than 24 hr, breathtakingly thin, barely brighter than surrounding sky.*
- *At 18 hr, very difficult even with binoculars and near perfect conditions.*
- *Visual record is now 15 hr.*
- *Binocular record is down to 11 hr 40 min with giant binoculars.*
- *Assumed minimum detectible limits are an arc 3° above horizon and 7° from the Sun (about 30 minutes after sunset).*

Challenge No. 2: Split Gamma Leonis

February 16: Vesta passes near Gamma Leonis (Algieba) a double star magnitude ~2 and the second star above Regulus in the sickle.

Challenge No. 3: See Vesta at opposition in Leo

February 18: See Vesta and split Gamma Leonis on the same night and meet both Challenges 2 and 3, 16th to 18th of February.

Challenge No. 4: See a very, very young Moon

April 14: 16 hrs after new in the west soon after sunset at 7:43 PM, azimuth 285°T. Moonset at 8:32 PM, azimuth 295°T.

Challenge No. 5: See an old Moon

June 11: Old crescent Moon, 24 hrs before new, visible in morning twilight during the hour before sunrise at 5:05 AM, azimuth 54°T. Moonrise at 4:06 AM on azimuth 53°T. Phase ~1% lit.

Challenge No. 6: See partial Lunar eclipse

June 26 Observe and record Danjon eclipse values to compare with December 20th full eclipse. Eclipse begins with the Moon's contact with Sun's penumbral shadow at 1:57:21 AM Saturday morning. Umbral (partial) eclipse begins at 3:16:57 AM, greatest eclipse occurs at 4:38:27 AM when just over ½ (0.5368) of the Moon is in the Sun's umbra shadow. Partial eclipse ends at 5:59:50 AM, 50 minutes after the Sun rises. Penumbral eclipse ends at 7:19:50 AM.

Danjon Values:

- L=0 Very dark eclipse, Moon almost invisible especially at mid-totality.
- L=1 Dark eclipse, grey or brownish color to Moon, details distinguishable only with difficulty.
- L=2 Deep-red or rust colored eclipse, very dark central shadow, outer umbra relatively bright.
- L=3 Brick red eclipse, umbra shadow usually has a bright or yellow rim.
- L=4 Very bright copper-red or orange eclipse, umbra shadow has bluish, very bright rim.

2010 Challenges (continued)

Challenge No. 7: See Jupiter in the daytime sky

July 3: Jupiter at -2.5 magnitude will be 8° to the lower left of the Moon in the eastern dawn sky. Start tracking in early twilight before sunrise at 5:10 AM PDT.

Challenge No. 8: Spot Arcturus unaided before sunset

July 15: Polarizing sunglasses may help. Very Challenging but can be done (RASC). Sun sets at 8:46 PM. Arcturus transits at 7:34 PM. Alt-azimuth coordinates are, approximately 16° west of south (azimuth 196°) and $+16^\circ$.

Challenge No. 9: See a Very Old Moon

August 9: Moon, 15 hrs before new, rises at 5:15 AM, azimuth 67° True, phase ~1% lit. Sun rises at 5:49 AM, azimuth 66° True.

Challenge No 10: See a very old Crescent Moon

September 7: Old crescent Moon 21 hrs before new in the hour before dawn. Moon rises at 5:31 AM, about 1% lit, azimuth 80° True. Sun rises at 6:25 AM at azimuth 80° True.

Challenge No. 11: See the total Lunar eclipse

December 20 Observe and Compare Danjon Values of a total lunar eclipse with June's partial eclipse. Penumbral eclipse begins at 9:21 PM. Partial (umbral) eclipse begins at 10:32 PM Dec 20th. Total eclipse begins at 11:40 PM. Greatest eclipse occurs at 12:16:57 AM Dec 21st. Total eclipse ends at 12:53 AM. Partial umbral eclipse ends at 2:01 AM. Penumbral eclipse ends at 3:04 AM.

Danjon Values:

- L=0 Very dark eclipse, Moon almost invisible especially at mid-totality.
- L=1 Dark eclipse, grey or brownish color to Moon, details distinguishable only with difficulty.
- L=2 Deep-red or rust colored eclipse, very dark central shadow, outer umbra relatively bright.
- L=3 Brick red eclipse, umbra shadow usually has a bright or yellow rim.
- L=4 Very bright copper-red or orange eclipse, umbra shadow has bluish, very bright rim.