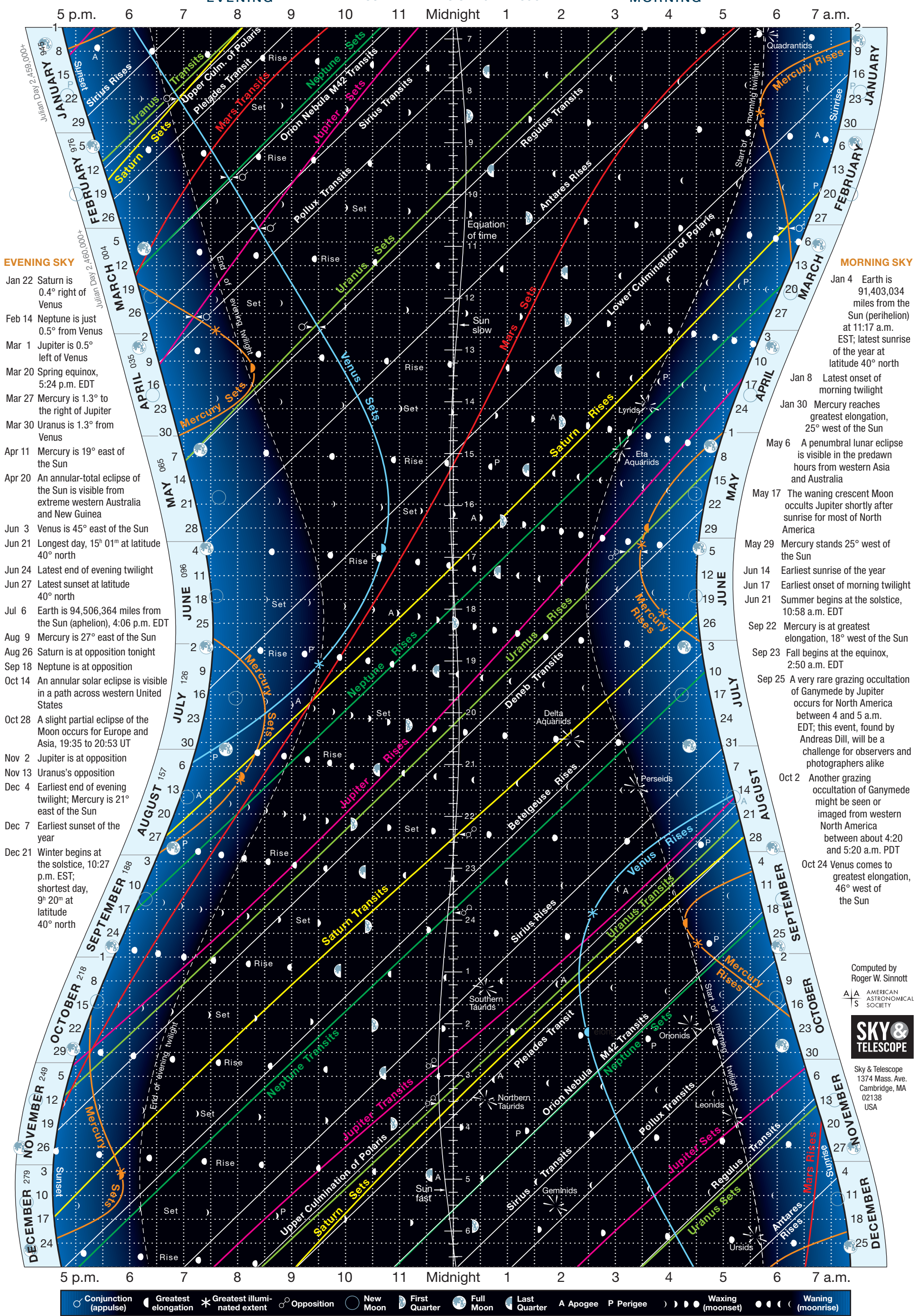


Skygazer's Almanac 40°N 2023

FOR LATITUDES NEAR 40° NORTH

A SUPPLEMENT TO SKY & TELESCOPE



EVENING SKY

- Jan 22 Saturn is 0.4° right of Venus
- Feb 14 Neptune is just 0.5° from Venus
- Mar 1 Jupiter is 0.5° left of Venus
- Mar 20 Spring equinox, 5:24 p.m. EDT
- Mar 27 Mercury is 1.3° to the right of Jupiter
- Mar 30 Uranus is 1.3° from Venus
- Apr 11 Mercury is 19° east of the Sun
- Apr 20 An annular-total eclipse of the Sun is visible from extreme western Australia and New Guinea
- Jun 3 Venus is 45° east of the Sun
- Jun 21 Longest day, 15^h 01^m at latitude 40° north
- Jun 24 Latest end of evening twilight
- Jun 27 Latest sunset at latitude 40° north
- Jul 6 Earth is 94,506,364 miles from the Sun (aphelion), 4:06 p.m. EDT
- Aug 9 Mercury is 27° east of the Sun
- Aug 26 Saturn is at opposition tonight
- Sep 18 Neptune is at opposition
- Oct 14 An annular solar eclipse is visible in a path across western United States
- Oct 28 A slight partial eclipse of the Moon occurs for Europe and Asia, 19:35 to 20:53 UT
- Nov 2 Jupiter is at opposition
- Nov 13 Uranus's opposition
- Dec 4 Earliest end of evening twilight; Mercury is 21° east of the Sun
- Dec 7 Earliest sunset of the year
- Dec 21 Winter begins at the solstice, 10:27 p.m. EST; shortest day, 9^h 20^m at latitude 40° north

MORNING SKY

- Jan 4 Earth is 91,403,034 miles from the Sun (perihelion) at 11:17 a.m. EST; latest sunrise of the year at latitude 40° north
- Jan 8 Latest onset of morning twilight
- Jan 30 Mercury reaches greatest elongation, 25° west of the Sun
- May 6 A penumbral lunar eclipse is visible in the predawn hours from western Asia and Australia
- May 17 The waning crescent Moon occults Jupiter shortly after sunrise for most of North America
- May 29 Mercury stands 25° west of the Sun
- Jun 14 Earliest sunrise of the year
- Jun 17 Earliest onset of morning twilight
- Jun 21 Summer begins at the solstice, 10:58 a.m. EDT
- Sep 22 Mercury is at greatest elongation, 18° west of the Sun
- Sep 23 Fall begins at the equinox, 2:50 a.m. EDT
- Sep 25 A very rare grazing occultation of Ganymede by Jupiter occurs for North America between 4 and 5 a.m. EDT; this event, found by Andreas Dill, will be a challenge for observers and photographers alike
- Oct 2 Another grazing occultation of Ganymede might be seen or imaged from western North America between about 4:20 and 5:20 a.m. PDT
- Oct 24 Venus comes to greatest elongation, 46° west of the Sun

Computed by Roger W. Sinnott
 AMERICAN ASTRONOMICAL SOCIETY



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☉ Conjunction (appulse)
 ☾ Greatest elongation
 ☼ Greatest illuminated extent
 ☽ Opposition
 ☾ New Moon
 ☽ First Quarter
 ☽ Full Moon
 ☽ Last Quarter
 A Apogee
 P Perigee
 ☾ Waxing (moonset)
 ☾ Waning (moonrise)

Skygazer's Almanac 40°N 2023

FOR LATITUDES NEAR 40° NORTH

What's in the sky tonight?

When does the Sun set, and when does twilight end? Which planets are visible? What time does the Moon rise?

Welcome to the *Skygazer's Almanac 2023*, a handy chart that answers these and many other questions for every night of the year. It is plotted for skywatchers near latitude 40° north — in the United States, the Mediterranean countries, Japan, and much of China.

For any date, the chart tells the times when astronomical events occur during the night. Dates on the chart run vertically from top to bottom. The time of night runs horizontally, from sunset at left to sunrise at right. Find the date you want on the left side of the chart, and read across toward the right to find the times of events. Times are labeled along the chart's top and bottom.

In exploring the chart you'll find that its night-to-night patterns offer many insights into the rhythms of the heavens.

The Events of a Single Night

To learn how to use the chart, consider some of the events of one night. We'll pick January 15, 2023.

First find "January" and "15" at the left edge. This is one of the dates for which a string of fine dots crosses the chart horizontally. Each horizontal dotted line represents the night from a Sunday evening to Monday morning. The individual dots are five minutes apart.

Every half hour (six dots), there is a vertical dotted line to aid in reading the hours of night at the chart's top or bottom. On the vertical lines, one dot is equal to one day.

A sweep of the eye shows that the line for the night of January 15–16 crosses

many slanting *event lines*. Each event line tells when something happens.

The dotted line for January 15–16 begins at the heavy black curve at left, which represents the time of sunset. Reading up to the top of the chart, we find that sunset on January 15th occurs at 4:59 p.m. *Local Mean Time*. (All times on the chart are Local Mean Time, which can differ from your clock time. More on this later.)

Following the dotted line for the 15th rightward, we see that the bright star Sirius rises at 6:01 p.m. Then at 6:35 evening twilight technically ends. This is when the Sun is 18° below the horizon and the sky is fully dark. At 6:38 Venus sets, so we know that until this time it has been shining brightly, low in the west.

The dim planet Uranus transits the meridian at 7:10, meaning it is due south and "riding high," an excellent time to look for it in binoculars. But the ringed planet Saturn sets at 7:18, so we can cross it off tonight's observing agenda.

At 7:21 Polaris, the North Star, has its upper culmination. It then stands directly above the north celestial pole (by 38' or 39' this year), a good time to check the alignment of an equatorial telescope.

The famous Pleiades star cluster transits at 8:07 p.m., followed by Mars (8:43) and the Great Nebula in Orion (9:55). Not only are they best placed for viewing in a telescope, but transit times of celestial landmarks help us keep track of the march of constellations across the night sky. At 10:36 Jupiter, well placed for viewing earlier, finally sets.

Running vertically down the midnight line is a scale of hours. This shows the sidereal time (the right ascension of objects on the meridian) at midnight. On January 15–16 this is 7^h 42^m. To find the sidereal time at any other time and date on the chart, locate that point and draw a line through it parallel to the white event

lines of stars. See where your line intersects the sidereal-time scale at midnight. (A star's event line enters the top of the chart at the same time of night it leaves the bottom. Sometimes one of these segments is left out to avoid crowding.)

Near the midnight line is a white curve labeled *Equation of time* weaving narrowly right and left down the chart. If you regard the midnight line as noon for a moment, this curve shows when the Sun crosses the meridian and is due south. On January 15th the Sun runs slow, transiting at 12:09 p.m. This deviation, important for reading a sundial, is caused by the tilt of the Earth's axis and the ellipticity of its orbit.

At 1:44 a.m. a small Moon symbol appears on the dotted line, and we can tell from the legend at the bottom of the chart that it is at waning crescent phase, rising. The wee hours continue, and not long after Mars sets at 4:15, Antares rises at 4:24. This is a star we usually associate with a much later season.

The first hint of dawn — start of morning twilight — comes at 5:44 a.m. Then the elusive planet Mercury rises at 6:01. The Sun finally peeks above the horizon at 7:20 a.m. on January 16th.

Other Charted Information

Many of the year's chief astronomical events are listed in the chart's evening and morning margins. Some are marked on the chart itself.

Conjunctions (close pairings) of two planets are indicated by a \oslash symbol on the planets' event lines. Here, conjunctions are considered to occur when the planets actually appear closest in the sky, not merely when they share the same ecliptic longitude or right ascension.

Opposition of a planet, the date when it is opposite the Sun in the sky and thus visible all night, occurs roughly when its transit line crosses the Equation-of-time

line (not the line for midnight). Opposition is marked there by a \circ° symbol, as for Saturn on the night of August 26–27.

Moonrise and *moonset* can be told apart by whether the round limb — the outside edge — of the Moon symbol faces right (waxing Moon sets) or left (waning Moon rises). Or follow the nearly horizontal row of daily Moon symbols across the chart to find the word *Rise* or *Set*. Quarter Moons are indicated by a larger symbol. Full Moon is always a large bright disk whether rising or setting; the circle for new Moon is open. *P* and *A* mark dates when the Moon is at perigee and apogee (nearest and farthest from Earth, respectively).

Mercury and *Venus* never stray far from the twilight bands. Their dates of greatest elongation from the Sun are shown by \blacktriangleright symbols on their rising or setting curves. Asterisks mark their dates of greatest illuminated extent in square arcseconds. For example, this occurs for Venus on the evening of July 7th this year.

Meteor showers are marked by a starburst symbol on the date of peak activity and at the time when the shower's radiant is highest in the night sky. This is often just as morning twilight begins.

Julian dates can be found from the numbers just after the month names on the chart's left. The Julian Day, a seven-digit number, is a running count of days beginning with January 1, 4713 BC. Its first four digits early this year are 2459, as indicated just off the chart's upper left margin. To find the last three digits for evenings in January, add 945 to the date. For instance, on the evening of January 15th we have $945 + 15 = 960$, so the Julian Day is 2,459,960. For North American observers this number applies all night, because the next Julian Day always begins at 12:00 Universal Time (6:00 a.m. Central Standard Time).

Time Corrections

All events on this *Skygazer's Almanac* are plotted for an observer at longitude 90° west and latitude 40° north, near the population center of North America. However, you need not live near Peoria, Illinois, to use the chart. Simple corrections will allow you to get times accurate to a couple of minutes anywhere in the world's north temperate latitudes.

Rising or Setting Corrections

	Declination (North or South)					
	0°	5°	10°	15°	20°	25°
50°	0	7	14	23	32	43
45°	0	3	7	10	14	19
40°	0	0	0	0	0	0
35°	0	3	6	9	12	16
30°	0	5	11	16	23	30
25°	0	8	16	24	32	42

To convert the charted time of an event to your civil (clock) time, the following corrections must be made. They are mentioned in order of decreasing importance:

- **Daylight-saving time.** When this is in effect, add one hour to any time obtained from the chart.

- **Your longitude.** The chart gives the *Local Mean Time* (LMT) of events, which differs from ordinary clock time by a number of minutes at most locations. Our civil time zones are standardized on particular longitudes. Examples in North America are Eastern Time, 75°W; Central, 90°; Mountain, 105°; and Pacific, 120°. If your longitude is very close to one of these (as is true for New Orleans and

Local Mean Time Corrections

Atlanta	+38	Los Angeles	-7
Boise	+45	Memphis	0
Boston	-16	Miami	+21
Buffalo	+15	Minneapolis	+13
Chicago	-10	New Orleans	0
Cleveland	+27	New York	-4
Dallas	+27	Philadelphia	+1
Denver	0	Phoenix	+28
Detroit	+32	Pittsburgh	+20
El Paso	+6	St. Louis	+1
Helena	+28	Salt Lake City	+28
Honolulu	+31	San Francisco	+10
Houston	+21	Santa Fe	+4
Indianapolis	+44	Seattle	+9
Jacksonville	+27	Tulsa	+24
Kansas City	+18	Washington	+8
Athens	+25	Lisbon	+36
Baghdad	+3	Madrid	+75
Beijing	+14	New Delhi	+21
Belgrade	-22	Rome	+10
Cairo	-8	Seoul	+32
Istanbul	+4	Tehran	+4
Jerusalem	-21	Tokyo	-19

Denver), luck is with you and this correction is zero. Otherwise, to get standard time *add 4 minutes* to times obtained from the chart for each degree of longitude that you are *west* of your time-zone meridian. Or *subtract 4 minutes* for each degree you are *east* of it.

For instance, Washington, DC (longitude 77°), is 2° west of the Eastern Time meridian. So at Washington, add 8 minutes to any time obtained from the chart. The result is Eastern Standard Time.

Find your time adjustment and memorize it. The table below left shows the corrections from local to standard time, in minutes, for some major cities.

- **Rising and setting.** These times need correction if your latitude differs from 40° north. This effect depends strongly on a star or planet's declination. (The declinations of the Sun and planets are listed monthly in *Sky & Telescope*.)

If your site is *north* of latitude 40°, then an object with a north declination stays above the horizon *longer* than the chart shows (it rises earlier and sets later), whereas one with a south declination spends less time above the horizon. At a site *south* of 40°, the effect is just the reverse. Keeping these rules in mind, you can gauge the approximate number of minutes by which to correct a rising or setting time from the table above.

Finally, the Moon's rapid orbital motion affects lunar rising and setting times if your longitude differs from 90° west. The Moon rises and sets about two minutes earlier than the chart shows for each time zone east of Central Time, and two minutes later for each time zone west of it. European observers can simply shift each rising or setting Moon symbol leftward a quarter of the way toward the one for the previous night.

For reprints (item SGA23W, \$4.95 each) or to order a similar chart for latitude 50° north or 30° south, go to: shopatsky.com/collections/calendars-almanacs

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