

# Skygazer's Almanac 40°N 2021

FOR LATITUDES NEAR 40° NORTH

EVENING

Courtesy of SKY & TELESCOPE

MORNING

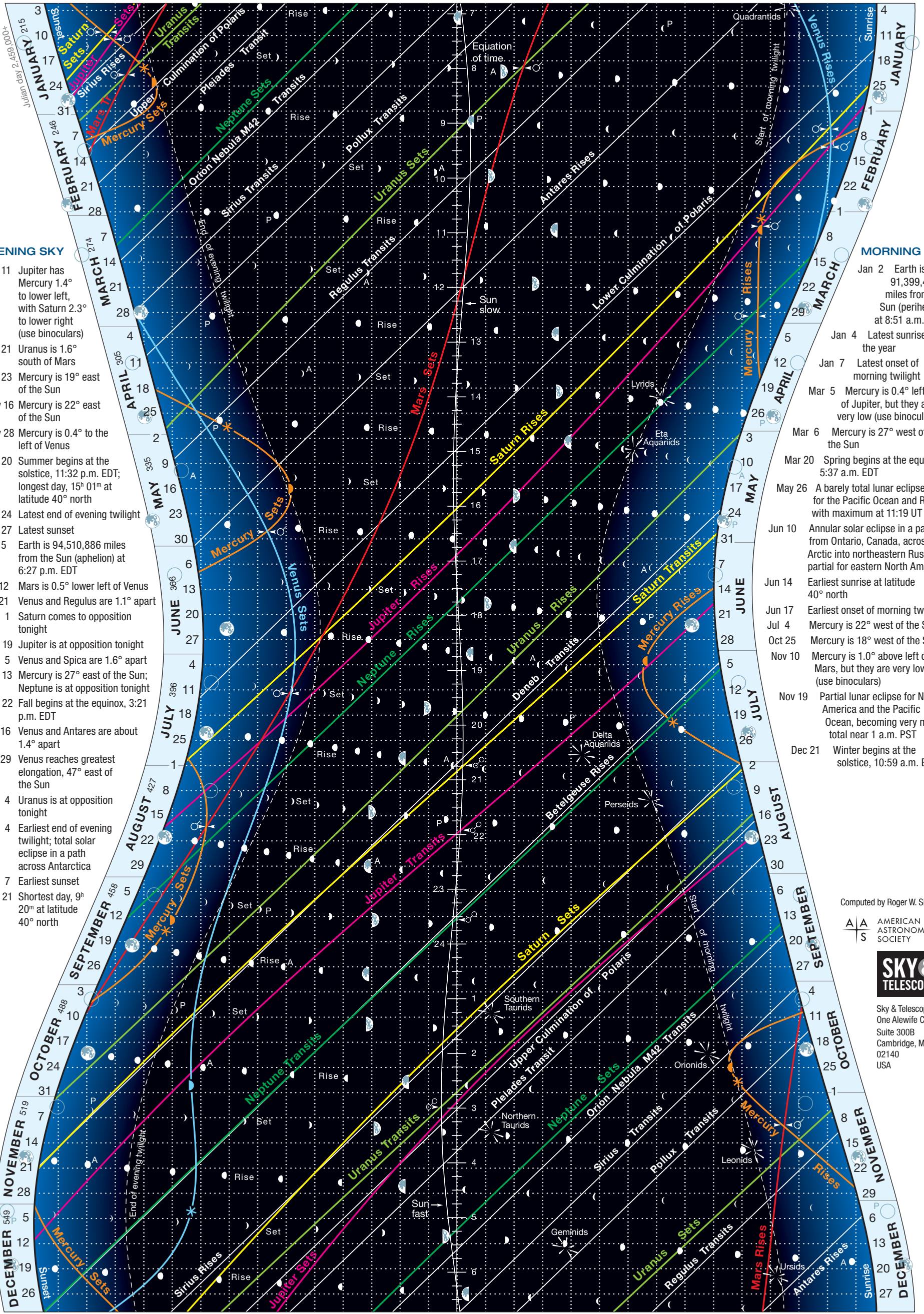
5 p.m. 6 7 8 9 10 11 Midnight 1 2 3 4 5 6 7 a.m.

## EVENING SKY

- Jan 11 Jupiter has Mercury 1.4° to lower left, with Saturn 2.3° to lower right (use binoculars)
- Jan 21 Uranus is 1.6° south of Mars
- Jan 23 Mercury is 19° east of the Sun
- May 16 Mercury is 22° east of the Sun
- May 28 Mercury is 0.4° to the left of Venus
- Jun 20 Summer begins at the solstice, 11:32 p.m. EDT; longest day, 15<sup>h</sup> 01<sup>m</sup> at latitude 40° north
- Jun 24 Latest end of evening twilight
- Jun 27 Latest sunset
- Jul 5 Earth is 94,510,886 miles from the Sun (aphelion) at 6:27 p.m. EDT
- Jul 12 Mars is 0.5° lower left of Venus
- Jul 21 Venus and Regulus are 1.1° apart
- Aug 1 Saturn comes to opposition tonight
- Aug 19 Jupiter is at opposition tonight
- Sep 5 Venus and Spica are 1.6° apart
- Sep 13 Mercury is 27° east of the Sun; Neptune is at opposition tonight
- Sep 22 Fall begins at the equinox, 3:21 p.m. EDT
- Oct 16 Venus and Antares are about 1.4° apart
- Oct 29 Venus reaches greatest elongation, 47° east of the Sun
- Nov 4 Uranus is at opposition tonight
- Dec 4 Earliest end of evening twilight; total solar eclipse in a path across Antarctica
- Dec 7 Earliest sunset
- Dec 21 Shortest day, 9<sup>h</sup> 20<sup>m</sup> at latitude 40° north

## MORNING SKY

- Jan 2 Earth is 91,399,454 miles from the Sun (perihelion) at 8:51 a.m. EST
- Jan 4 Latest sunrise of the year
- Jan 7 Latest onset of morning twilight
- Mar 5 Mercury is 0.4° left of Venus, but they are very low (use binoculars)
- Mar 6 Mercury is 27° west of the Sun
- Mar 20 Spring begins at the equinox, 5:37 a.m. EDT
- May 26 A barely total lunar eclipse for the Pacific Ocean and Rim, with maximum at 11:19 UT
- Jun 10 Annular solar eclipse in a path from Ontario, Canada, across the Arctic into northeastern Russia; partial for eastern North America
- Jun 14 Earliest sunrise at latitude 40° north
- Jun 17 Earliest onset of morning twilight
- Jul 4 Mercury is 22° west of the Sun
- Oct 25 Mercury is 18° west of the Sun
- Nov 10 Mercury is 1.0° above left of Mars, but they are very low (use binoculars)
- Nov 19 Partial lunar eclipse for North America and the Pacific Ocean, becoming very nearly total near 1 a.m. PST
- Dec 21 Winter begins at the solstice, 10:59 a.m. EST



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 2021

FOR LATITUDES NEAR 40° NORTH

Courtesy of SKY & TELESCOPE

## 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 2021*, 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 10, 2021.

First find "January" and "10" 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 10–11 crosses

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

The dotted line for January 10–11 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 10th occurs at 4:54 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.)

We see that Saturn, Mercury, and Jupiter all set in quick succession around 6 p.m. This means they are fairly close together in the sky, as described in the column of text left of the chart. But they may be hard to see so soon after sunset.

At 6:18 p.m. the bright star Sirius rises. Then at 6:31 a dashed line shows that twilight technically ends. This is when the Sun is 18° below the horizon and the sky is fully dark.

The red planet Mars transits the meridian at 6:34, meaning it is due south and "riding high," an excellent time to study it in a telescope.

At 7:36 Polaris, the North Star, has its upper culmination. It then stands directly above the north celestial pole (by 39' or 38' this year), a good time to check the alignment of an equatorial telescope.

The famous Pleiades star cluster transits at 8:25 p.m., followed by the Orion Nebula (10:13) and Sirius (11:22). Transit times of such celestial landmarks help us keep track of the march of constellations across the night sky.

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 10–11 this is 7<sup>h</sup> 24<sup>m</sup>. 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 10th the Sun runs slow, transiting at 12:08 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.

After being visible all evening, Mars finally sets at 1:22 a.m. The wee hours continue, and at 4:41 Antares rises. This is a star we usually associate with a much later season of the year.

The first hint of dawn — start of morning twilight — comes at 5:45 a.m. A beautiful crescent Moon rises around 6:01, as does Venus at 6:12. The Sun finally peeks above the horizon at 7:21 a.m. on January 11th.

### 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 (at appulse), 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  $\oslash$  symbol, as for Saturn on the night of August 1–2.



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 **D** 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 December 3rd 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. (Note that we've moved the peak of the Southern Taurids, a sparse, ill-defined shower, to a little earlier in the year.)

*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 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 215 to the date. For instance, on the evening of January 10th we have  $215 + 10 = 225$ , so the Julian day is 2,459,225. 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 90° west longitude and 40° north latitude, 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°	
North Latitude	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 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.

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

For reprints (item SGA21W, \$4.95 each) or to order a similar chart for latitude 50° north or 30° south, go to: [shopatsky.com/resource-materials/calendars-almanacs](http://shopatsky.com/resource-materials/calendars-almanacs)

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