MORRISON PLANETARIUM

2021

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POCKET ALMANAC

ALEXANDER F. MORRISON PLANETARIUM

Since 1952, the Academy's Morrison Planetarium has served the community as a valuable resource for astronomy education and skywatching information. It was the first major planetarium in the U.S. to build its own optomechanical star projector, which was considered at the time to be the world's finest simulator of the night sky. Now updated with state-of-the-art digital technology, the Planetarium immerses audiences in fulldome imagery based on actual scientific data, from the smallest living cells to the surfaces of distant planets and immense clusters of galaxies.

CALIFORNIA ACADEMY OF SCIENCES

Home to Morrison Planetarium, Steinhart Aquarium, Kimball Natural History Museum, Osher Rainforest, and world-class research and education programs, the California Academy of Sciences is the world's greenest museum and one of San Francisco's "must-see" destinations. Explore the depths of a Philippine coral reef, view a rainforest canopy amid swarms of butterflies, and blast off to the outer reaches of the Universe, all under one living roof. Daily interactions with animals, educators, and biologists within immersive, hands-on exhibits offer discovery and wonder for visitors of all ages.

SEASONS AND THE SUN

The terms below apply to the Northern Hemisphere.
South of the equator, the seasons are reversed.

			
SPRING EQUINOX	**SUMMER** SOLSTICE	**AUTUMN** EQUINOX	**WINTER** SOLSTICE
MAR 20	**JUN 20**	**SEP 22**	**DEC 21**
2:37 AM PDT	8:32 PM PDT	12:21 PM PDT	7:59 AM PST

PERIHELION
(Earth closest to the Sun):
JAN 2—0.98325 AU

APHELION
(Earth farthest from the Sun):
JUL 5—1.01673 AU

AU = Astronomical Unit, the average distance from Earth to the Sun (150,000,000 km or 93,000,000 mi)

DAYLIGHT SAVING TIME
(clocks set one hour ahead of Standard Time): MAR 14–NOV 7

Times and dates in this Pocket Almanac are given in Pacific Time. Calendars using anything other than Pacific Time may list certain events as occurring on the following day, because the conversion to other time zones occasionally crosses midnight, thus advancing the date.

PLANET-WATCHING

Five planets can be seen in the sky with the unaided eye. They are generally brighter than most stars and typically don't twinkle. Over time, they can be seen to change their positions against the constellations, which is why the ancients referred to them as "wandering stars."

PLANET	MORNING SKY	EVENING SKY	CONJUNCTION	OPPOSITION
Mercury	FEB 8–APR 18 JUN 10–AUG 1 OCT 9–NOV 28	JAN 1–FEB 8 APR 18–JUN 10 AUG 1–OCT 9 NOV 8–DEC 31	FEB 8 *(inf)* APR 18 *(sup)* JUN 10 *(inf)* AUG 1 *(sup)* OCT 9 *(inf)* NOV 28 *(sup)*	
Venus	JAN 1–MAR 25	MAR 25–DEC 31	MAR 25 *(sup)*	
Mars	OCT 7–DEC 31	JAN 1–OCT7	OCT 7	
Jupiter	JAN 28–AUG 19	JAN 1–28 AUG 19–DEC 31	JAN 28	AUG 19
Saturn	JAN 23–AUG 1	JAN 1–23 AUG 1–DEC 31	JAN 23	AUG 1

Visibility ranges above may vary slightly with latitude and are based on conjunction dates, and a planet may become increasingly washed from view in the Sun's glare as conjunction approaches.

CONJUNCTIONS—A conjunction occurs when a planet is in line with the Sun as observed from Earth and is crossing from the morning to the evening sky (or vice-versa). In the case of Mercury and Venus, *inferior* conjunction is when the planet is on the same side of the Sun as Earth and located between them, while *superior* conjunction is when the planet and Earth are on opposite sides of the Sun (planets farther from the Sun than Earth never come between the two and so are never seen at inferior conjunction).

OPPOSITIONS—Opposition is the best time to observe an outer planet, when it's *opposite* the Sun in the sky. This means it rises at sunset and is visible all night, appearing largest and brightest as seen from Earth. Being inside Earth's orbit, Mercury and Venus are never seen opposite the Sun in the sky.

PHASES OF THE MOON

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
New Moon	12	11	13	11	11	10	9	8	6	6	4	3
First Quarter	20	19	21	19	19	17	17	15	13	12	11	10
Full Moon	28	27	28	26	26	24	23	22	20	20	19	18
Last Quarter	6	4	5	4	3	2	1/31	30	28	28	27	26

Some dates may differ by one day from those in calendars which do not correct for Pacific Time.

ECLIPSES

This year, the Sun, Earth, and the Moon line up four times, producing two eclipses of the Moon and two of the Sun.

MAY 26—The year's first eclipse is a **total lunar eclipse**, during which the full Moon passes through Earth's shadow, turning a dark, coppery color. This is visible from along the Pacific Rim, with a very brief period of totality (when the Moon is completely immersed in the shadow) because the Moon passes just barely into the umbra (the darkest part of the shadow) and isn't in it for more than 15 minutes. As seen from San Francisco, the partial phase (when the Moon begins to enter the umbra) starts at 2:45 AM PDT, with totality lasting from 4:11–4:26 AM. Morning twilight begins as the Moon is exiting the umbra and the partial eclipse ends at 5:52 AM, just after sunrise and about 10 minutes before moonset.

JUNE 10—The year's second eclipse is an **annular solar eclipse**, which is similar to a total solar eclipse, when the new Moon passes between Earth and the Sun, casting its shadow onto Earth's surface. Unlike a total solar eclipse, the Moon doesn't completely block the disk of the Sun from view. At this time, it's a little farther away and appears slightly smaller, leaving a bright ring of the solar disk (or *annulus*) visible around it. The Moon's shadow falls across the far north on Earth's surface, passing from Ontario across Hudson Bay to Baffin Island and northwestern Greenland, over the North Pole, and across the Arctic Ocean into northern Siberia. Observers in the northeastern U.S. may see the Sun rise partly eclipsed, but will be too far from the centerline of the shadow's path to see annularity. A partial solar eclipse is observed from much of Europe and northwestern Asia.

NOVEMBER 18–19—The year's third eclipse is a **partial lunar eclipse**, in which the full Moon enters Earth's shadow, but not entirely—the shadow will cover about 97 percent of the Moon's diameter, with a sliver exposed to direct sunlight. Although totality never quite happens, observers will still see most of the lunar disk turn a deep, coppery red, with a bright, white edge. For observers in San Francisco, the partial phase of the eclipse starts at 11:17 PM on the night of the 18th, with maximum eclipse at 1:02 AM, and ends at 2:47 AM. The entire eclipse will be visible from Siberia and most of North America and Greenland, and portions will be seen from Central and South America, as well as parts of Asia and Europe.

DECEMBER 4—The final eclipse of the year is a **total solar eclipse**. Just like on June 10, the new Moon passes in front of the Sun and casts its shadow onto Earth. This time, it completely hides the solar disk from view, allowing our star's pale outer atmosphere, or *corona*, to become visible for less than two minutes. This will be seen along the path of the darkest part of the Moon's shadow, or *umbra*, which skims Earth far to the south, running from Marie Byrd Land to Birkner Island in Antarctica and certain locations in the South Atlantic and Southern Indian Ocean. Observers within the much broader penumbral shadow path (areas in Antarctica,

South Africa, and the very southernmost tip of South America) will see a partial solar eclipse in which only portion of the Sun's disk remains visible.

MAJOR METEOR SHOWERS

On any given night, about two to four sporadic meteors can be seen per hour and slightly more frequently toward dawn, as tiny particles of space dust burn up in Earth's atmosphere. When Earth passes through the dust trail left behind by a passing comet, more of these particles rain through the atmosphere, causing a meteor shower. Showers are named after the constellation from which meteors appear to radiate. Visibility can be affected by weather and by the Moon's brightness.

SHOWER	ACTIVE PERIOD	PEAK DATE*	RATE*	MOON PHASE
Quadrantids	JAN 1–5	JAN 2–3	40	Waning gibbous
Lyrids	APR 16–25	APR 22–23	20	Waxing gibbous
Eta Aquarids	APR 19–MAY 28	MAY 5–6	10–15	Waning crescent
Delta Aquarids	JUL 12–AUG 23	JUL 28–29	20	Waning gibbous
Perseids	JUL 17–AUG 24	AUG 12–13	60	Waxing crescent (!)
Orionids	OCT 2–NOV 7	OCT 21–22	20	Full/Waning gibbous
Leonids	NOV 6–30	NOV 17–18	15	Waxing gibbous
Geminids	DEC 6–19	DEC 13–14	50–80	Waxing gibbous
Ursids	DEC 17–25	DEC 21–22	5–10	Waning gibbous

**The peak date of a meteor shower is when the maximum rate of meteors is expected to be observed, but it is not the only date to watch for them. Moonlight-permitting, better-than-usual rates may also be seen during the midnight-to-dawn hours a day or two before and after the peak date. Exclamation marks (!) indicate favorable prospects. Approximate hourly rates given are for ideal, Moonless conditions (observing site away from bright lights, dark-adapted vision).*

DIGITAL POCKET ALMANAC is downloadable at: *www.calacademy.org*.

QUARTERLY SKYGUIDE, visit: *www.calacademy.org/exhibits/morrison-planetarium*

MORRISON PLANETARIUM DAILY SKYWATCHING INFORMATION is provided in many news publications nationwide.

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