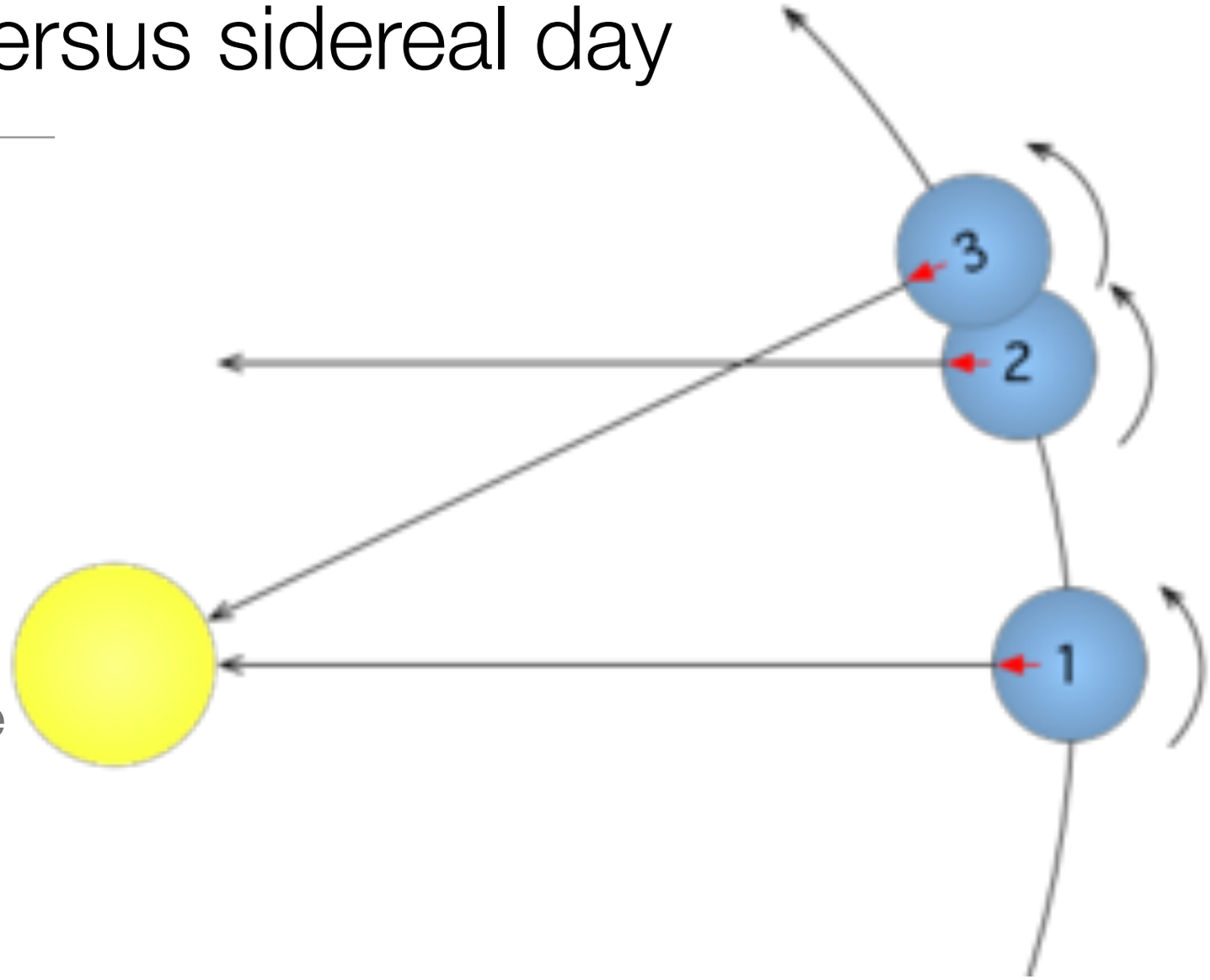
What is a day?

And when does it begin?

solar/synodic day versus sidereal day

- 1→3: Earth repoints to the sun (rotation >360°)
- A synodic or solar day is the time between successive astronomical noons. A mean solar day is 24 hours long. The earth has to rotate more than 360° for the sun to come back to “noon”.



- 1→2: Earth rotates 360°
- One sidereal day is the time it takes for a star in the sky to come back to the same place in the sky. For most purposes, the sky is “fixed”, so a sidereal day is when the earth rotates 360°. A sidereal day is 23 hours 56 minutes and 4.09 seconds long.

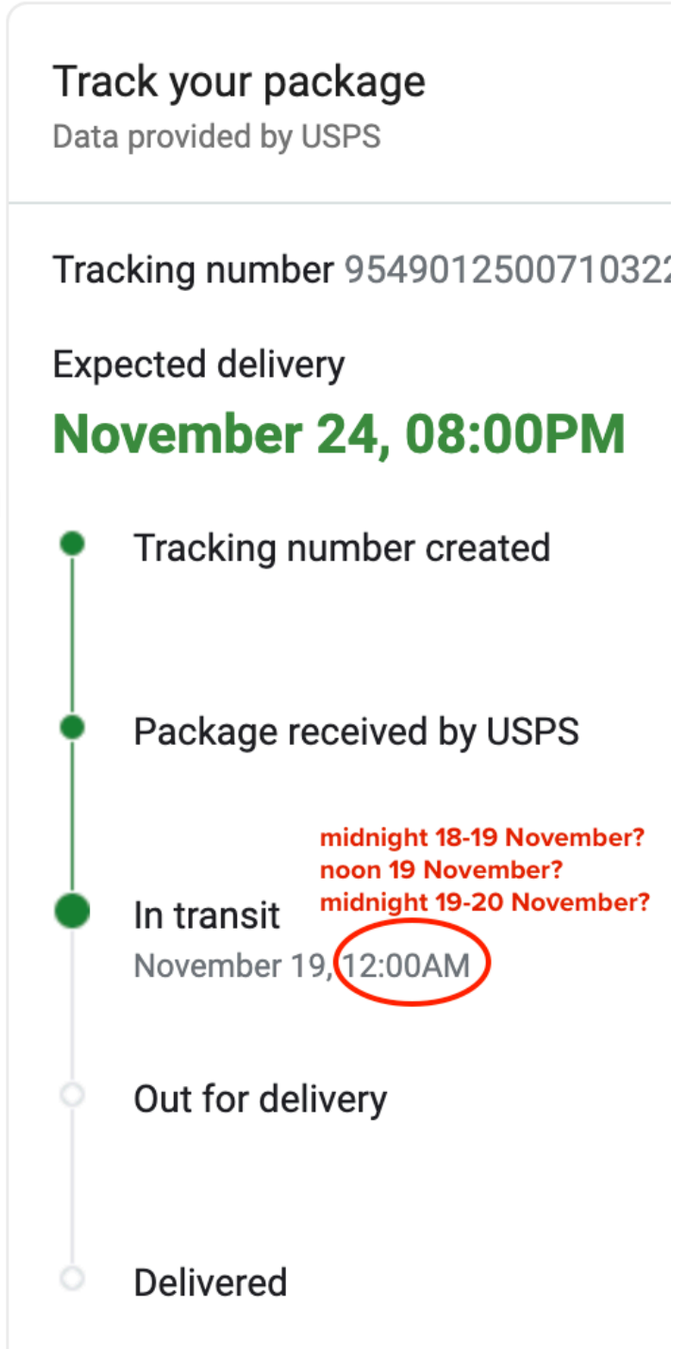
using a sundial: solar or astronomical noon

The shadow is shortest at “high noon”, i.e., when the sun is passing through the meridian and is at its highest point during the day. This is also called “astronomical noon” or “solar noon”.

meridian = noon = 正午 shōgo

- In local solar timekeeping, “12 noon” is the moment when the sun is at its highest point in the sky.
- PM = p.m. = post meridian “after noon” = 午後 gogo
- AM = a.m. = ante meridian “before noon” = 午前 gozen

- 11:59 a.m. < 12:00 noon < 12:01 p.m.
  11:59 p.m. < 12:00 midnight < 12:01 a.m.
- “12 a.m.” and “12 p.m.” are nonsense, because the precise moment of 12 o’clock is neither before noon nor after noon. When businesses incorrectly write “12 AM” or “12 PM”, it can be very confusing.



local time, mean time, GMT, and UTC

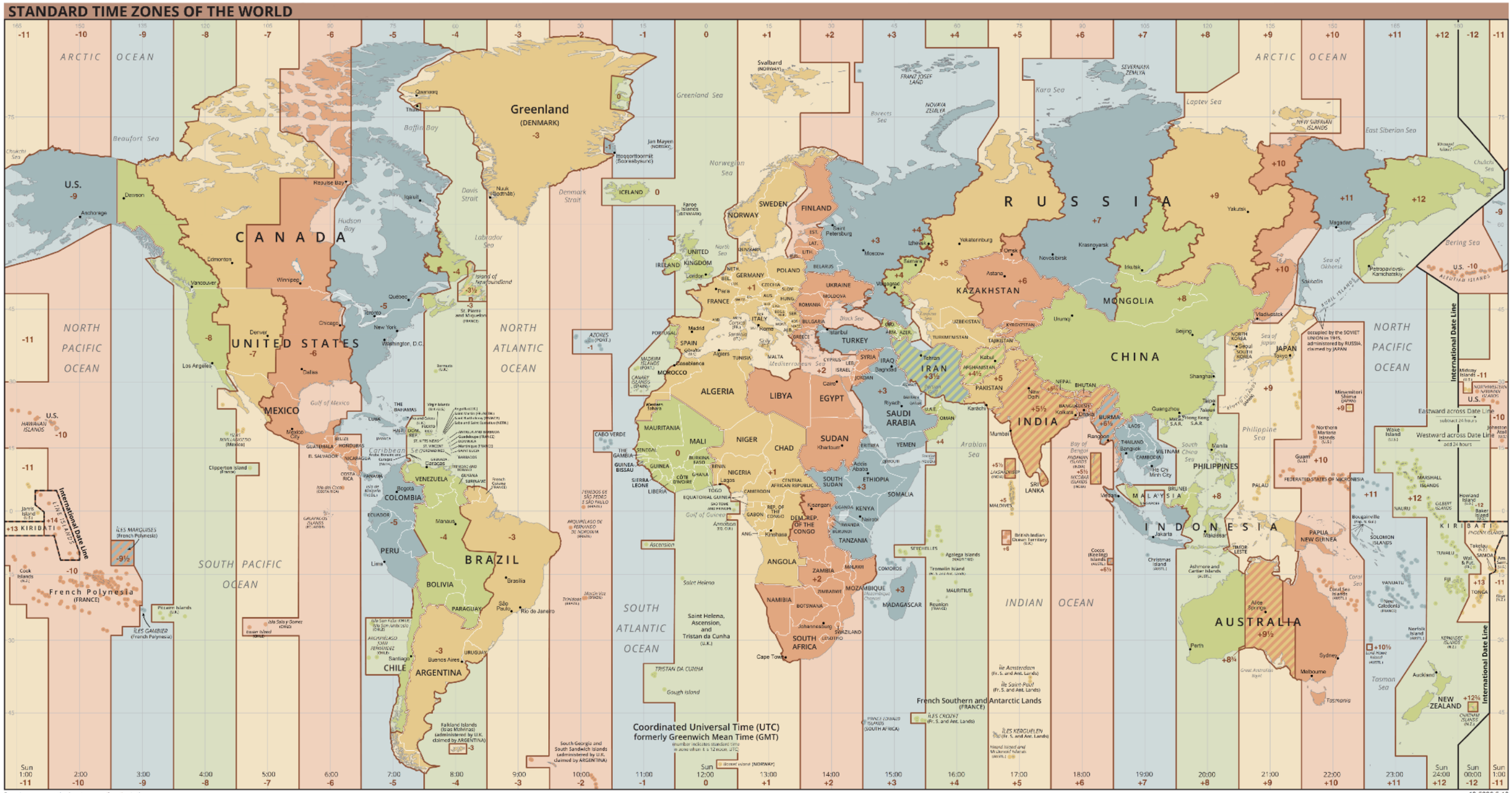
- Local solar clock time is based on setting a clock to 12 at the moment of local solar noon. This means that the local solar time in Tokyo is about 16 minutes earlier than the local solar time in Kyoto.

- Mean clock time is based on dividing the world into time zones, where the clocks in each time zone are all set to the same time. In the JST (Japan Standard Time) time zone, 12 noon in Tokyo and and 12 noon Kyoto are the same time.

- GMT (Greenwich Mean Time) is the mean time zone of London during the winter. The IERS Reference Meridian (0° 00′ 00″ longitude) is historically related to the meridian calculated at the Greenwich Royal Observatory in England by George Airy in 1851 (currently at 0° 00′ 05.3101″ W longitude).

- UTC (Coordinated Universal Time) is the international standard for regulating clock time. It is within about 1 second of mean solar time at the IERS Reference Meridian (0° 00′ 00″ longitude). GMT is the UTC 0 hour. In Japan, JST is UTC+9 hours.

Mean Time Zones



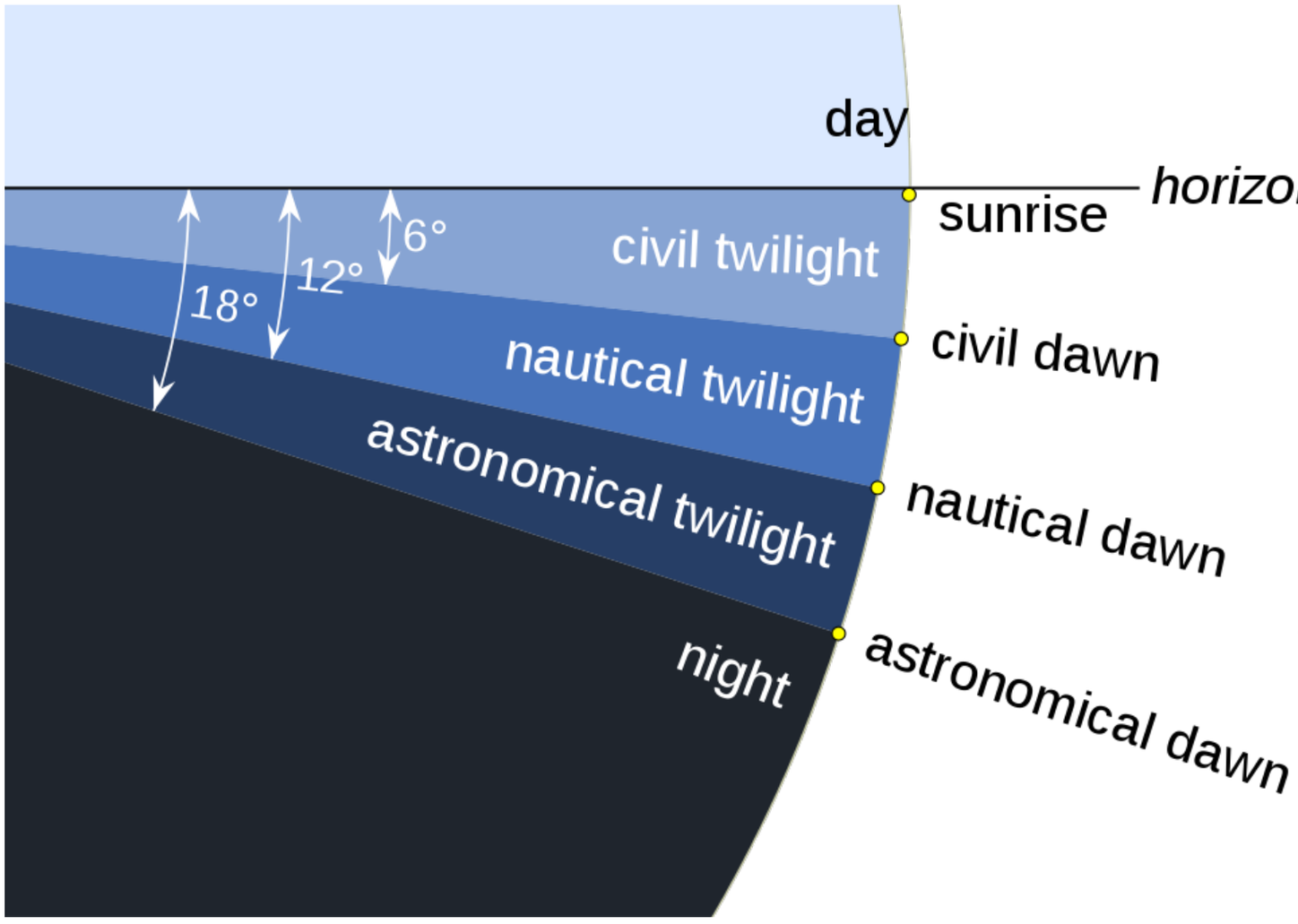
sunset in Cairo

When does the day begin?

When we awake?
When the sun comes up?
At noon?
When the sun sets?
At midnight?

sunrise in Tokyo

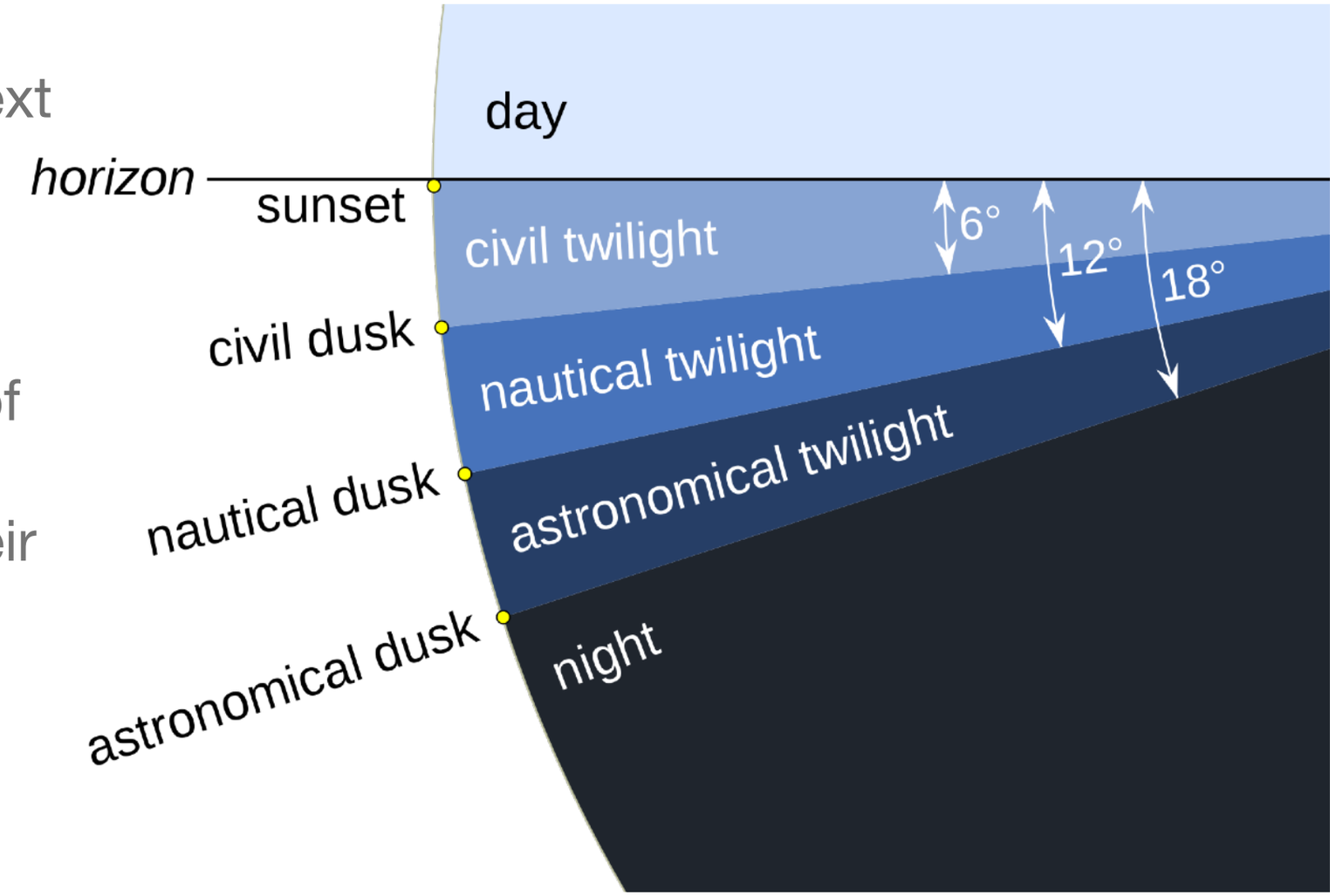
Does the day begin at sunrise? or perhaps dawn?



- Hindus consider the Brahma Muhūrta (04:24–05:12 AM on the day of the spring equinox) to be the best time to wake up.
- In US military tradition, BMNT (begin morning nautical twilight), i.e., nautical dawn, is the time after which an attack can begin.
- Some scholars have argued that the Biblical day began at sunrise (cf. J. Amanda McGuire, “Evening or morning: When does the Biblical day begin?”, *Andrews University Seminary Studies*, Vol. 46, No. 2, pp. 201-214).

Beginning the day at nightfall or sunset

- The Jewish day begins at nightfall and lasts until the next nightfall.
- Jews often treat twilight as neither day or night. Jews often begin their avoidance of Sabbath taboos just before sunset on Friday and end their avoidance after twilight on Saturday, about a 25-hour period.
- The Islamic day begins at sunset. The Maghrib prayer, which is prayed immediately after sunset, is the first of the five obligatory daily prayers.



The secular day starts at midnight.

- Astronomers start and end their days at noon.
- For all other scientific and secular purposes, the day begins and ends at midnight (i.e., 0:00 or 24:00).
- In accord with this international standard, the Japanese civil day begins and ends at midnight.

a Jewish/Hebrew birthday

- The Hebrew Calendar is important for Jews calculating birthdays, death dates, and the dates of a bar or bat mitzva.

- For a child born after nightfall but before midnight on the Gregorian date 31 December 2019, which was a Tuesday, the child's Hebrew birthday is actually Wednesday (which for Jews begins at sunset on Tuesday), the 4th day of Tevet, Anno Mundi 5780 (which ended at nightfall on 1 January 2020). The following year, Anno Mundi 5781, the 4th day of Tevet was on the Gregorian date 19 December 2020. It will be a long time before the child's Gregorian Calendar birthday (31 December) and the Hebrew Calendar birthday (the 4th day of Tevet) are on the same day, because the 4th day of Tevet will not be on 1 January again until 2066.