

A Brief Column for the Beginning Stargazer Introducing New Astronomical Terms

Astronomy is rich with terminology. This column, originally begun January 1999 to help beginning stargazers ease into the world of astronomy, briefly introduces a new but basic astronomical term (word, acronym or abbreviation) each month.

“Astronomy from Å to ZZ” started with the letter *a* and is alphabetical using successive letters for each month’s entry. The February 2001 column ended with *z* and is now in the second cycle of twenty-six terms.

[The thirty-seventh and last monthly, regular “Å to ZZ” column appeared January 2002. This column now only appears occasionally.]

Word of the Month for April 2002

libration¹ A slow oscillation or wobble, real or apparent, of one body as viewed from another celestial body around which it revolves (from Latin, to *oscillate*).

Lunar librations are most familiar and allow observers from Earth to see more than one-half of a lunar hemisphere as the Moon orbits Earth.

The Moon very nearly keeps the same face (hemisphere) turned toward Earth. This occurs because the Moon’s rotation period is *synchronous* with its revolution period around Earth. Synchronous rotation² (or *captured rotation*) means the time for the Moon to spin once on its axis (about 27.3 days) is the same as its time to orbit once around Earth (about 27.3 days).³

¹*libration* not *libation*!

²Synchronous rotation is a consequence of *tidal action*.

³Many people wrongly believe the Moon keeps the same face toward Earth because the Earth *does not rotate*. If the Moon did not rotate, all sides of the Moon would become visible during one orbit around the Earth. However, it is the Moon’s *synchronous rotation* that keeps the same lunar hemisphere facing Earth.

Note: A second common lunar myth holds the Moon has a *perpetual dark side*. **It does not!** The Moon has a day-night cycle as Earth except the Moon takes about 27.3 days to spin once while the Earth takes only about 23.9 hours.

However, about 59 percent rather than 50 percent of the lunar surface is visible from Earth due to libration.⁴ Causes of lunar librations are both physical and geometrical.

physical libration The Moon’s rotation is not perfectly uniform so rotation and revolution are slightly out of sync causing a small libration (less than two arc min).

geometrical (optical) librations Three librations occur due to geometry (*longitude, latitude* and *diurnal*):

libration in longitude The Moon appears to swing side to side (east-west) by up to about 7.9 degrees in each direction. The Moon does not run at a constant rate in its elliptical orbit about the Earth. Because the Moon’s orbital velocity is not constant, but its rotation is nearly so, the Moon’s rotation is sometimes slightly ahead or behind its orbit position.

libration in latitude The Moon appears to nod up and down (north-south) by up to about 6.8 degrees in each direction. The Moon’s axis of rotation is not perpendicular to its orbit plane.⁵ This allows observers from Earth to “peak” slightly beyond either lunar north or south *limbs* (edges) as the Moon orbits the Earth.

diurnal libration Observers on Earth can sometimes see slightly around the Moon’s east or western limbs (by less than one degree) at different times of the day. This libration is thus caused by an observer’s changing position relative to the Moon as the Earth spins (rotates). Thus, this libration is really a libration of the observer! The amount of diurnal libration depends on the observer’s position and reaches its maximum value of about one degree at Earth’s equator.

References. J. Mitton 1991, *Concise Dictionary of Astronomy* (Oxford Univ. Press); I. Ridpath 1997, *A Dictionary of Astronomy* (Oxford Univ. Press).

⁴The Soviet Union’s Luna 3 Spacecraft first observed the “backside” or “far side” of the Moon in October, 1959!

⁵The Moon’s axis tilt is about 6.7° from the perpendicular to its orbital plane. In contrast, the Earth’s axis tilt is about 23.4° to its orbital plane.