

Galactic coordinate system

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The **galactic coordinate system** is a celestial coordinate system in spherical coordinates, with the Sun as its center, the primary direction aligned with the approximate center of the Milky Way galaxy, and the fundamental plane approximately in the galactic plane. It uses the right-handed convention, meaning that coordinates are positive toward the north and toward the east in the fundamental plane.^[1]

Contents

-
- 1 Galactic longitude
-
- 2 Galactic latitude
-
- 3 Definition
-
- 4 Rectangular coordinates
-
- 5 In the constellations
-
- 6 See also
-
- 7 References
-
- 8 External links



Artist's depiction of the Milky Way galaxy, showing the galactic longitude relative to the galactic center

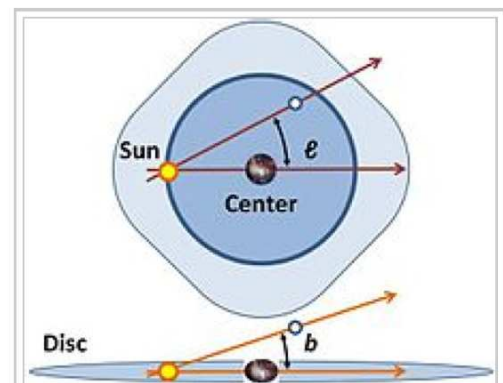
Galactic longitude

Longitude (symbol l) measures the angular distance of an object eastward along the galactic equator from the galactic center. Analogous to terrestrial longitude, galactic longitude is usually measured in degrees ($^{\circ}$).

Galactic latitude

Latitude (symbol b) measures the angular distance of an object perpendicular to the galactic equator, positive to the north, negative to the south. For example, the north galactic pole has a latitude of $+90^{\circ}$. Analogous to terrestrial latitude, galactic latitude is usually measured in degrees ($^{\circ}$).

Definition



The galactic coordinates use the Sun as the origin. Galactic longitude (l) is measured with primary direction from

The first Galactic coordinate system was used by William Herschel in 1785. A number of different coordinate systems, each differing by a few degrees, were used until 1932, when Lund Observatory assembled a set of conversion tables that defined a standard Galactic coordinate system based on a North pole at RA 12h40m, Dec +28° (in the 1900.0 epoch convention) and a 0° longitude at the point where the Galactic plane and the Celestial plane intersected.^[1]

the Sun to the center of the galaxy in the galactic plane, while the galactic latitude (*b*) measures the angle of the object above the galactic plane.

In 1958 the International Astronomical Union (IAU) defined the galactic coordinate system in reference to radio observations of galactic neutral hydrogen through the hydrogen line, changing the definition of the Galactic longitude by 32° and the latitude by 1.5°.^[1] In the equatorial coordinate system, for equinox and equator of 1950.0, the north galactic pole is defined at right ascension 12^h 49^m, declination +27.4°, in the constellation Coma Berenices, with a probable error of ±0.1°.^[2] Longitude 0° is the great semicircle that originates from this point along the line in position angle 123° with respect to the equatorial pole. The galactic longitude increases in the same direction as right ascension. Galactic latitude is positive towards the north galactic pole, the galactic equator being 0°, the poles ±90°.^[3] Based on this definition, the galactic poles and equator can be found from spherical trigonometry and can be precessed to other epochs; see the table.

Radio source Sagittarius A*, which is the best physical marker of the true

galactic center, is located at 17^h 45^m **Equatorial coordinates B1950.0 / (J2000.0) of galactic reference points**^[1]

40.0409^s, −29° 00' 28.118"

(J2000).^[2] Rounded to the same number of digits as the table, 17^h 45.7^m, −29.01° (J2000), there is an offset of about 0.07° from the defined coordinate center, well within the 1958 error estimate of ±0.1°.

Rectangular coordinates

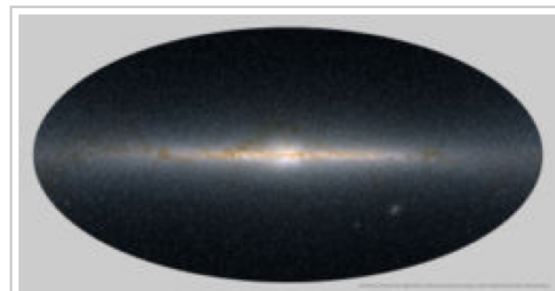
There are two major rectangular variations of galactic coordinates, commonly used for computing space velocities of galactic objects. In these systems the *xyz* axes are designated *UVW*, but the definitions vary by author. In one system, the *U* axis is directed toward the galactic center (*l* = 0°), and it is a right-handed system (positive towards the east and towards the north galactic pole); in the other, the *U* axis is directed toward the galactic anti-center (*l* = 180°), and it is a left-handed system (positive towards the west and towards the north galactic pole).^[4]

	right ascension	declination	constellation
north pole (+90° latitude)	12 ^h 49 ^m (12 ^h 51.4 ^m)	+27.4° (+27.13°)	Coma Berenices
south pole (−90° latitude)	0 ^h 49 ^m (0 ^h 51.4 ^m)	−27.4° (−27.13°)	Sculptor
galactic center (0° longitude)	17 ^h 42.4 ^m (17 ^h 45.6 ^m)	−28.92° (−28.94°)	Sagittarius
anti-center (180° longitude)	5 ^h 42.4 ^m (5 ^h 45.6 ^m)	+28.92° (+28.94°)	Auriga

In the constellations

The galactic equator runs through the following constellations:^[5]

- | | | |
|---------------|------------------|-------------|
| ▪ Sagittarius | ▪ Camelopardalis | ▪ Vela |
| ▪ Serpens | ▪ Perseus | ▪ Carina |
| ▪ Scutum | ▪ Auriga | ▪ Crux |
| ▪ Aquila | ▪ Taurus | ▪ Centaurus |
| ▪ Sagitta | ▪ Gemini | ▪ Circinus |
| ▪ Vulpecula | ▪ Orion | ▪ Norma |
| ▪ Cygnus | ▪ Monoceros | ▪ Ara |
| ▪ Cepheus | ▪ Canis Major | ▪ Scorpius |
| ▪ Cassiopeia | ▪ Puppis | ▪ Ophiuchus |



The anisotropy of the star density in the night sky makes the galactic coordinate system very useful for coordinating surveys, both those that require high densities of stars at low galactic latitudes, and those that require a low density of stars at high galactic latitudes. For this image the Mollweide projection has been applied, typical in maps using galactic coordinates.

See also

- Galactic quadrant
- Supergalactic coordinate system
- Celestial coordinate system
- Galaxy formation and evolution
- Milky Way



Wikimedia Commons has media related to ***Galactic coordinate system***.

References

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- "SEDS Milky Way Constellations".

External links

- Universal coordinate converter (<http://heasarc.gsfc.nasa.gov/cgi-bin/Tools/convcoord/convcoord.pl>).
- Galactic Coordinate System - Wolfram Demonstration (<http://demonstrations.wolfram.com/GalacticCoordinateSystem/>)
- Galactic coordinates (http://www.daviddarling.info/encyclopedia/G/galactic_coordinates.html), The Internet Encyclopedia of Science
- Fiona Vincent, Positional Astronomy: Galactic coordinates (<http://star-www.st-and.ac.uk/~fv/webnotes/chapter8.htm>), University of St Andrews
- An Atlas of the Universe (<http://www.atlasoftheuniverse.com/>)

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