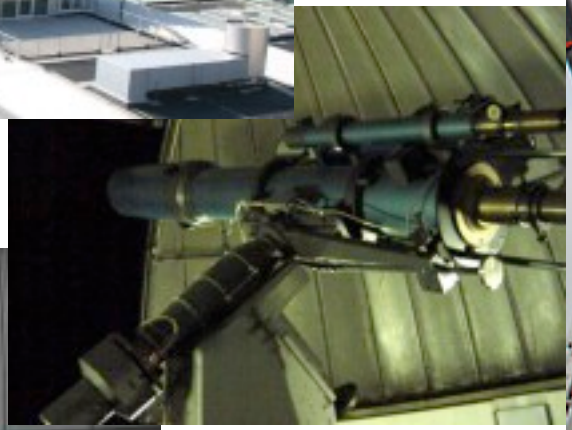
Astronomisch Practicum 1

(3 ec)
tweede semester

32 uur practicum

Maandag 13:30 – 17:30



Jörg R. Hörandel

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Radboud University Nijmegen

Astrophysics

Astronomisch Practicum 1

2009/2010

tweede semester, 3 ec

32 uur practicum, Maandag 13:30 - 17:30

Teaching assistant: Kars Verbeek (K.Verbeek#science.ru.nl)

Topics:

		room
01.02.2010	Coordinate systems and time, visual observations, constellations	HG00.075
22.02.2010	Introduction to Linux and IRAF (Image Reduction and Analysis Facility)	HG 03.761
15.03.2010	Introduction to 35 cm telescope and CCD camera	telescope
29.03.2010	Flat field observations, filters	telescope
19.04.2010	Clear night observations, magnitude system	telescope
10.05.2010	tbd	
31.05.2010	tbd	
14.06.2010	Introduction to examination project	

Jörg R. Hörandel

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Astronomisch Practicum 1

(3 ec)
tweede semester

32 uur practicum **Maandag 13:30 – 17:30**

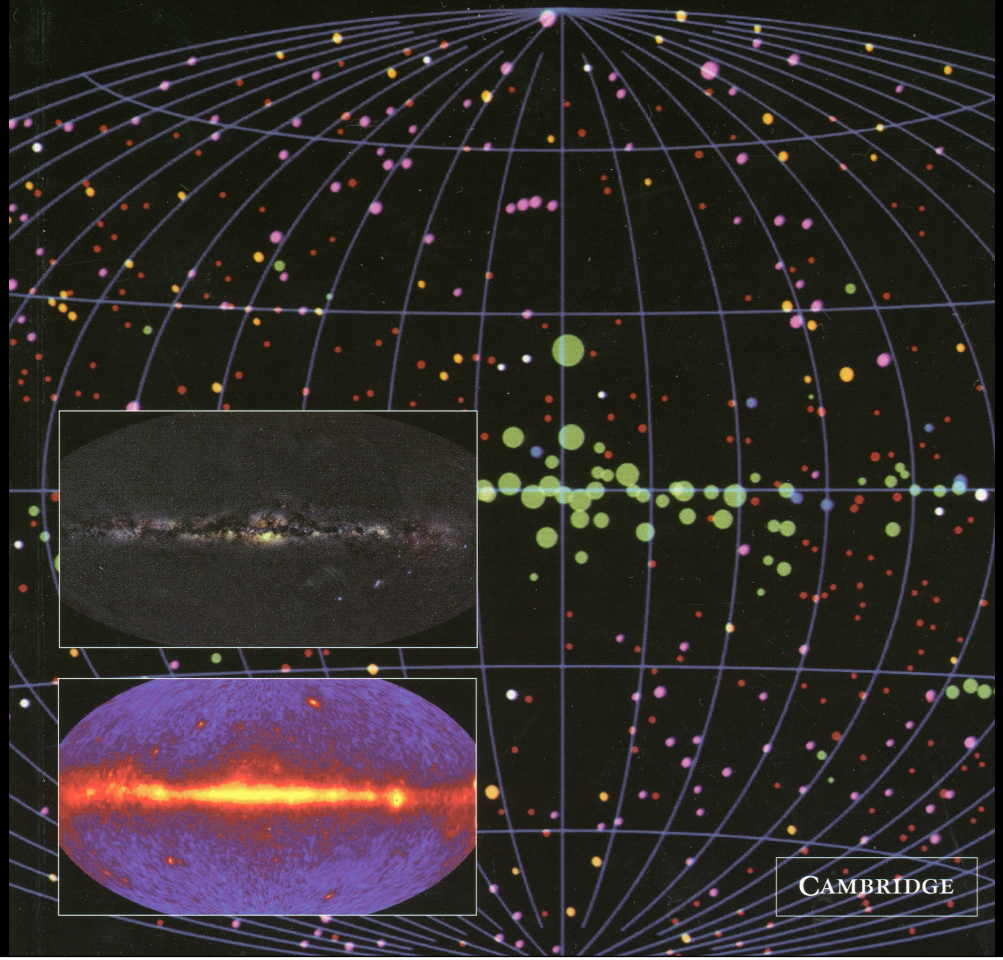
1. Coordinate systems and time
   visual observations, constellations
2. Propper motion, digital sky survey
3. Introduction to 35 cm telescope and CCDs
   data taking & data reduction
4. Observations with 35 cm telescope
   filters, ...
5. Clear night observations, magnitude system,
   limiting magnitude, faintest source
6. tbd
7. tbd
8. tentamen

Jörg R. Hörandel – Afdeling Sterrenkunde – IMAPP – J.Horandel@astro.ru.nl

Hale Bradt

Astronomy Methods

A Physical Approach to Astronomical Observations



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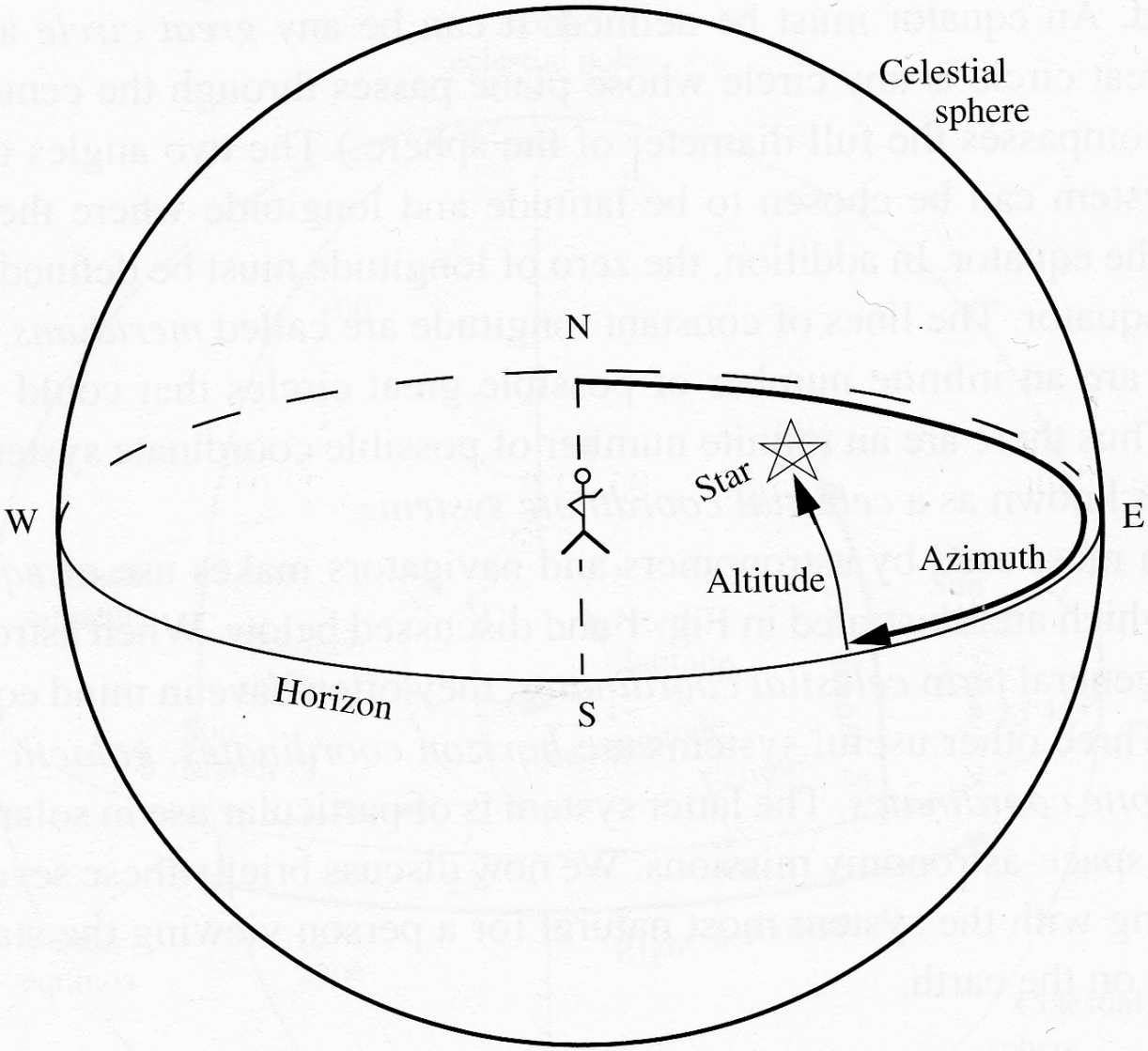


Figure 3.2. The horizon coordinate system on the celestial sphere. A celestial object is located by the two angles, altitude and azimuth, in a coordinate system with the equator defined by the plane of the earth's surface at the observer's position.

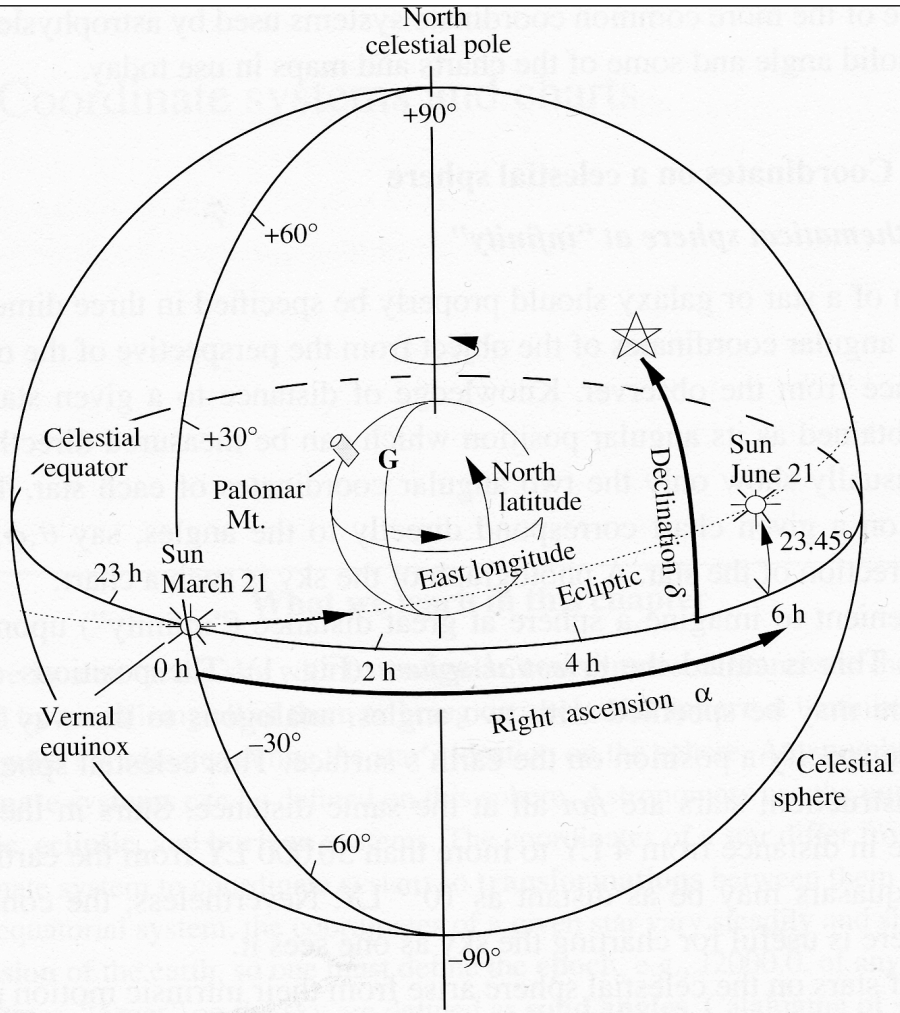


Figure 3.1. The celestial sphere (outer sphere) with equatorial coordinates and the spinning earth within it. The letter "G" indicates Greenwich England. The mathematical celestial sphere is "at infinity"; stars and galaxies are considered to be fixed upon it with equatorial coordinates right ascension α and declination δ as shown by the heavy arrows. The sun follows a great-circle path (ecliptic; dotted line) inclined 23.4 degrees to the celestial equator. The zero of right ascension is the intersection of these two planes where the sun is proceeding from south to north on about March 21. The motions of the stars relative to one another (*proper motion*) and the slow *precession* of the earth's spin axis both lead to changes in the equatorial coordinates of a given object as time progresses.

Table 3.1. *Examples of celestial equatorial coordinates*

Object	Epoch	Right asc. (α) h m	Declination (δ) ° ′
Sirius (α CMa)	B1950	06 42.9	−16 39
(bright star)	J2000	06 45.1	−16 43
Andromeda nebula[a]	B1950	00 40.0	+41 00
(M31; close galaxy)	J2000	00 42.7	+41 16
Crab nebula[a]	B1950	05 31.5	+21 59
(supernova remnant)	J2000	05 34.5	+22 01
Proxima Cen	B1950	14 26.3	−62 28
(closest star; 4.3 LY)	J2000	14 29.7	−62 41
Tarantula nebula[a]	B1950	05 39	−69 09
(in Large Magellanic Cloud)	J2000	05 39	−69 06
Vernal equinox	B1950	00 00	00 00 (by definition)
	J2000	00 00	00 00 (by definition)

[a] Diffuse objects ranging in size from ~5′ (Crab) to ~2° (Andromeda).

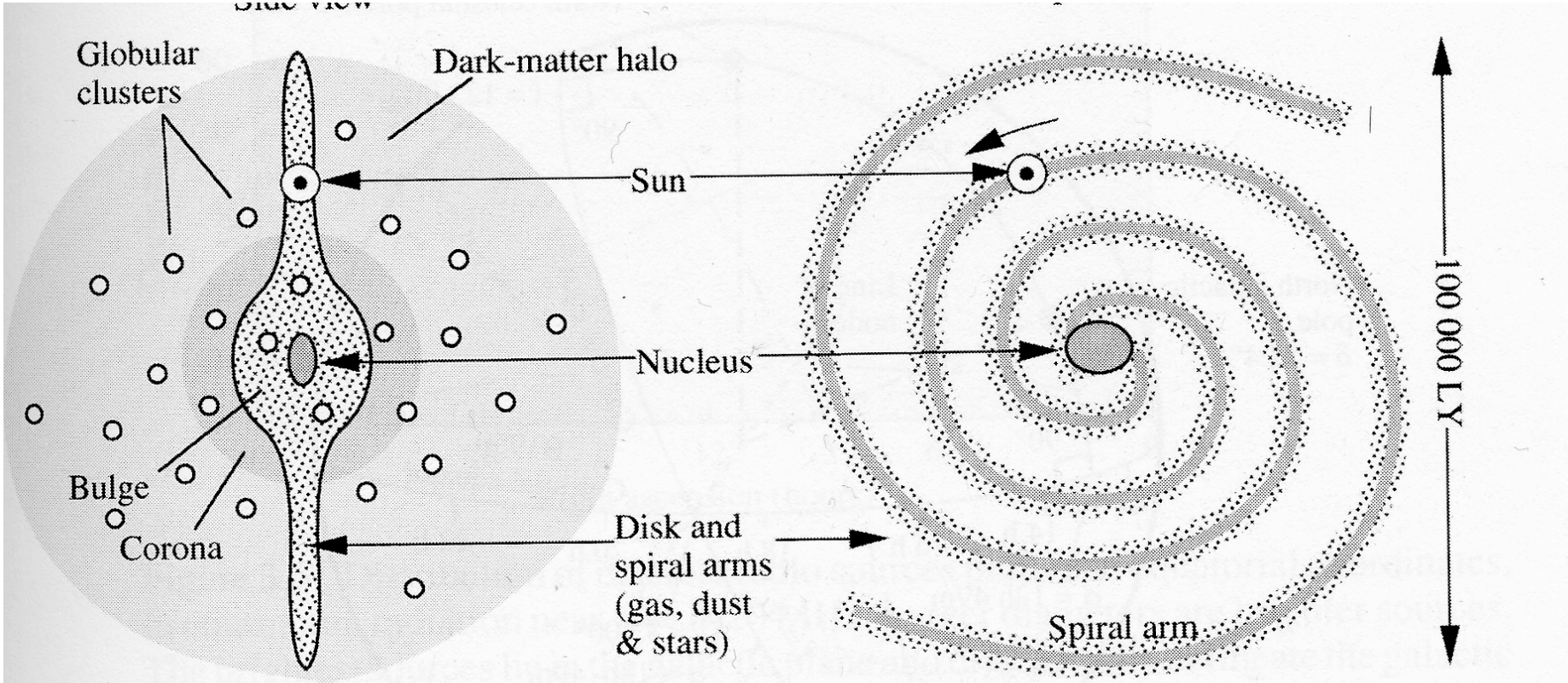


Figure 3.3. Simplified sketches of our Milky Way system of stars showing spiral arms of increased matter density, the bulge, the corona, a dark matter halo, globular clusters, and the position of the sun. The stars, gas, and dust rotate in the counter-clockwise direction about the center. As the dust and gas pass through the slowly rotating spiral arms, shocks cause new star formation to take place. [Adapted from Abell, *Exploration of the Universe,* 3rd Ed., Holt Rinehart Winston, 1975, p. 484]

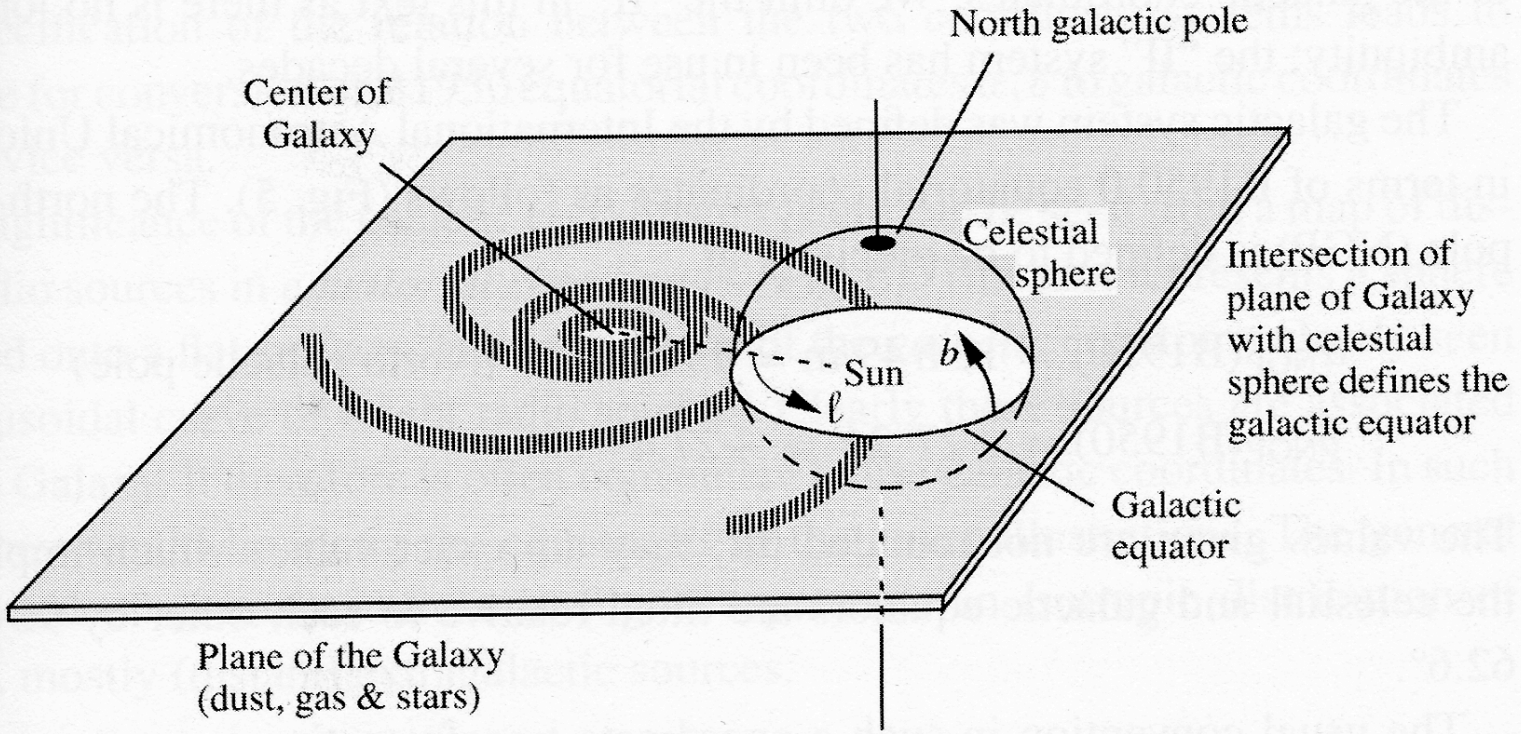


Figure 3.4. Galactic coordinates. The plane of the Galaxy defines the galactic equator on the celestial sphere. The angles that specify the location of a celestial body are measured from the sun. Galactic longitude, ℓ, is measured approximately eastward from the direction of the galactic center in units of degrees (0° to 359.9°) as shown. Galactic latitude, b, is measured in degrees (0° to ±90°) from the galactic equator, similar to latitude on the earth's surface. The north galactic pole (dark circle) is shown. The celestial sphere is quite small in this figure; in fact, its radius is infinite. The earth observer is located close to the sun.

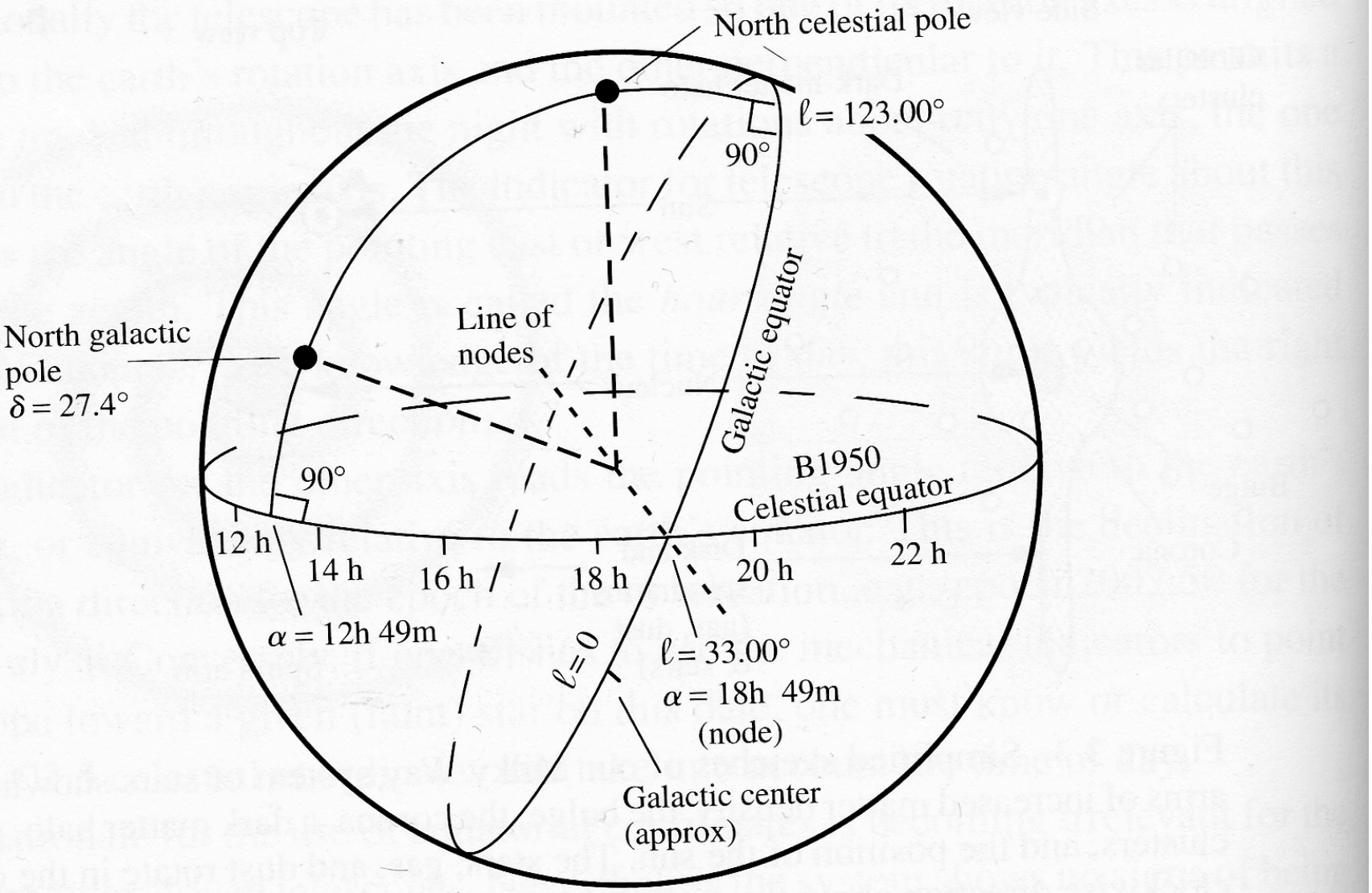


Figure 3.5. Celestial sphere showing the celestial (B1950) and galactic equators, their north poles, and the line of nodes.

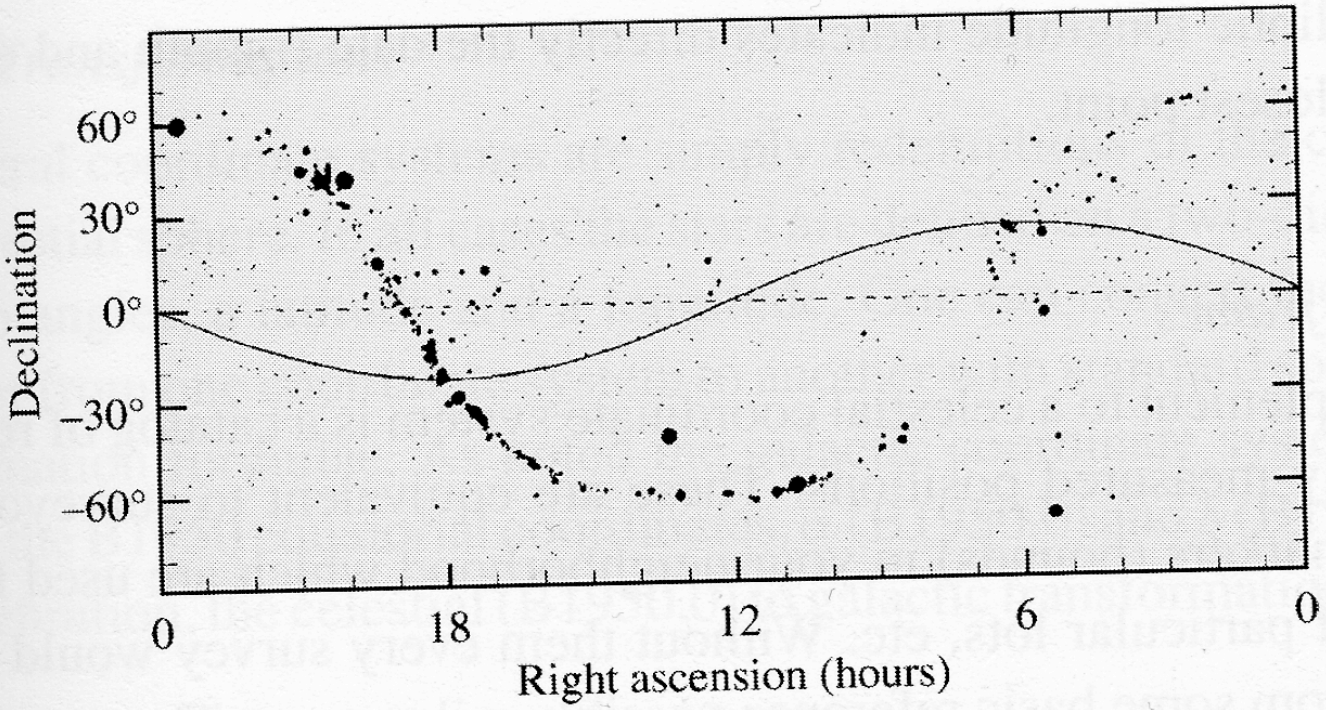


Figure 3.6. Distribution of discrete radio sources plotted in equatorial coordinates, in continuum radiation near $\nu = 1420$ MHz. Larger diameters are brighter sources. The brightest sources lie in the galactic plane and dramatically delineate the galactic equator. [Courtesy G. Verschuur]

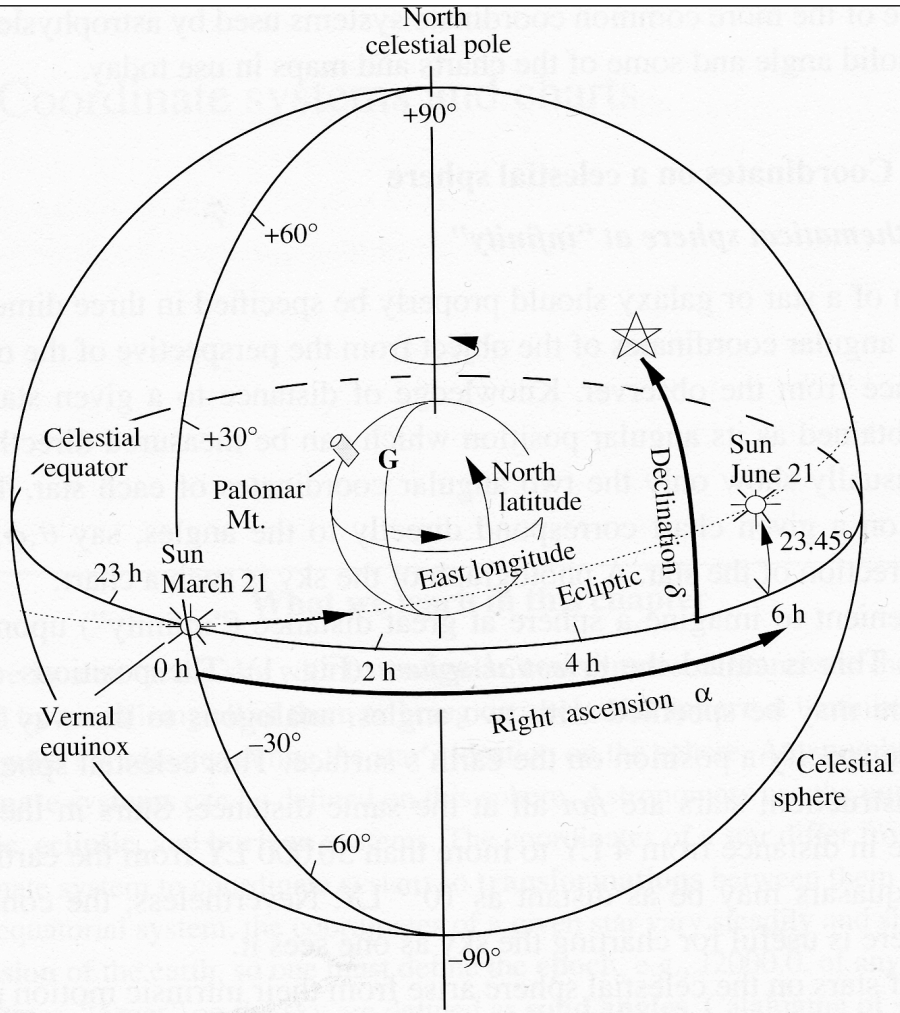


Figure 3.1. The celestial sphere (outer sphere) with equatorial coordinates and the spinning earth within it. The letter "G" indicates Greenwich England. The mathematical celestial sphere is "at infinity"; stars and galaxies are considered to be fixed upon it with equatorial coordinates right ascension α and declination δ as shown by the heavy arrows. The sun follows a great-circle path (ecliptic; dotted line) inclined 23.4 degrees to the celestial equator. The zero of right ascension is the intersection of these two planes where the sun is proceeding from south to north on about March 21. The motions of the stars relative to one another (*proper motion*) and the slow *precession* of the earth's spin axis both lead to changes in the equatorial coordinates of a given object as time progresses.

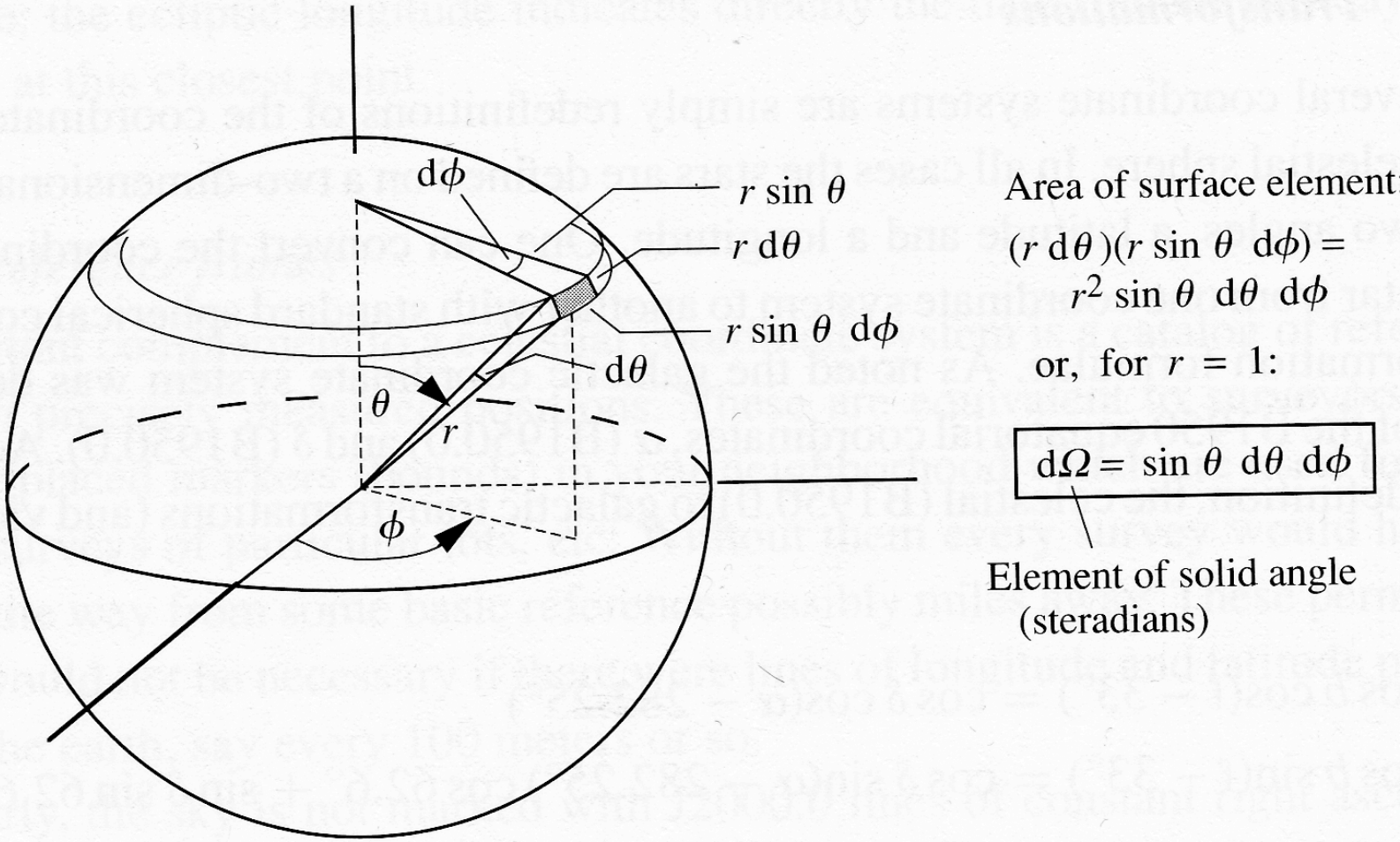
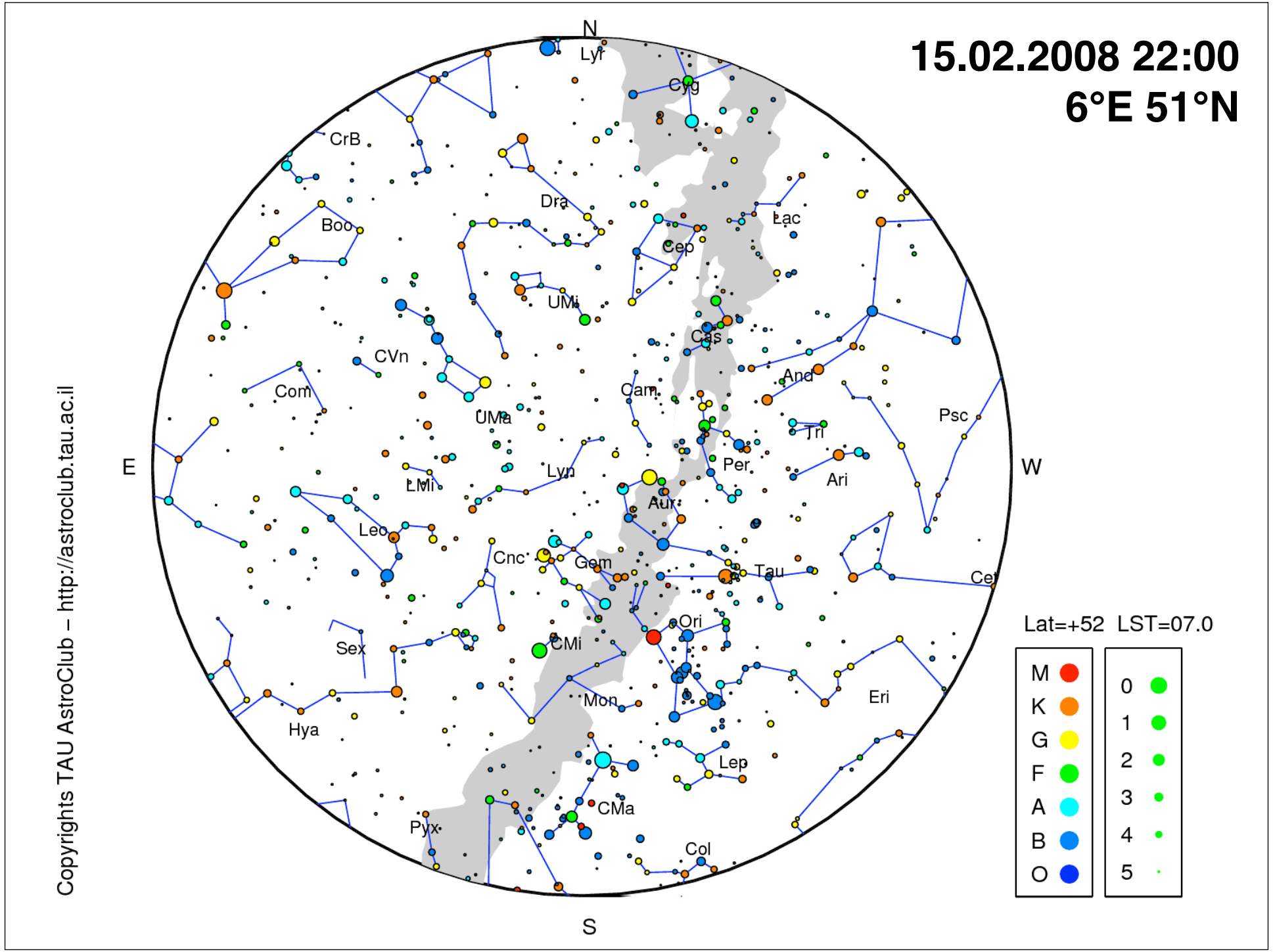


Figure 3.7. The concept of *solid angle*, Ω, which is the "angular" area on a sphere. The element of solid angle $d\Omega$ (hatched area) can be expressed in terms of steradians (or "square radians") which is numerically equal to an element of surface area on a sphere of unit radius. Integration over the entire sphere yields a total solid angle of 4π steradians.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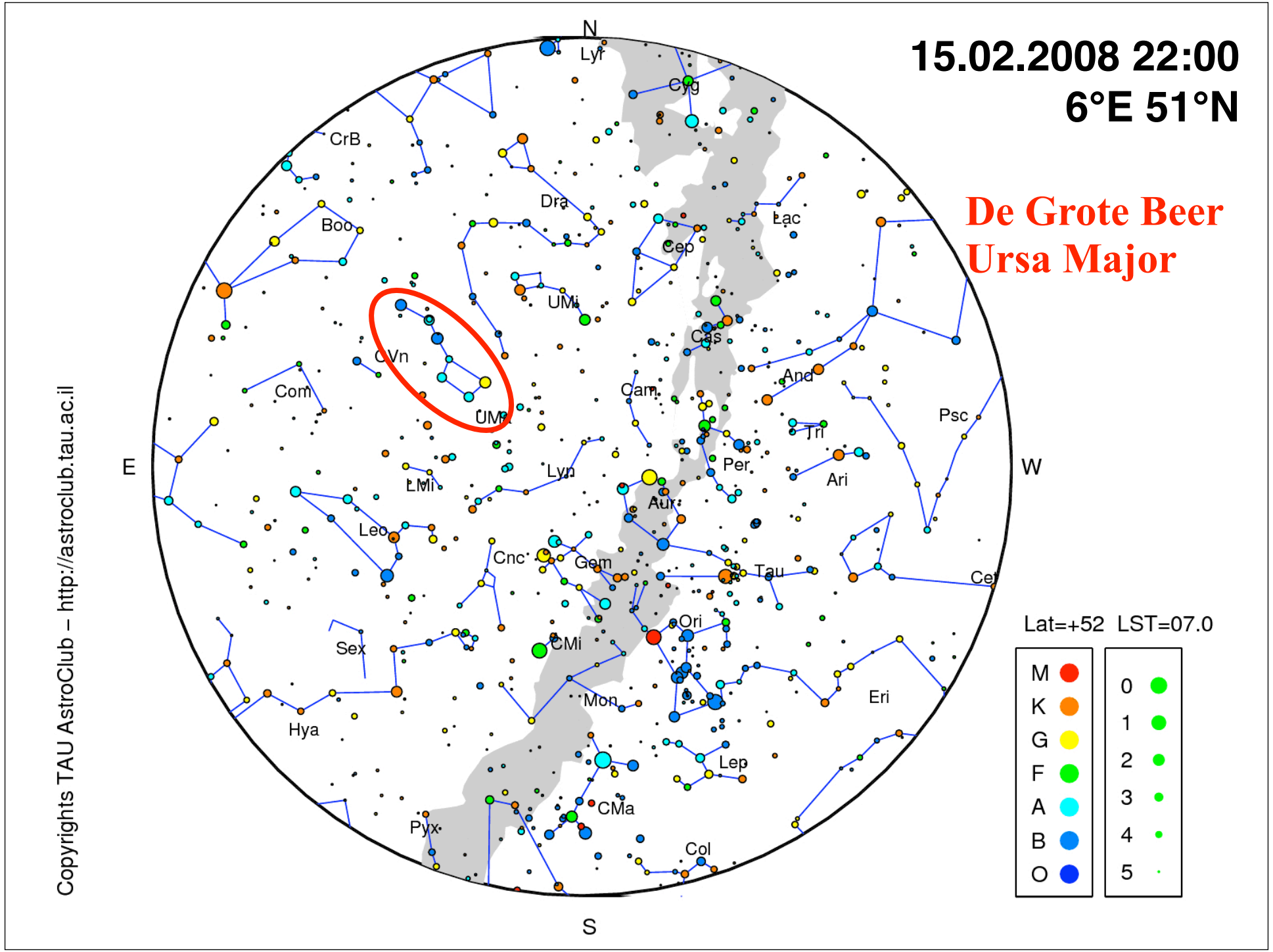
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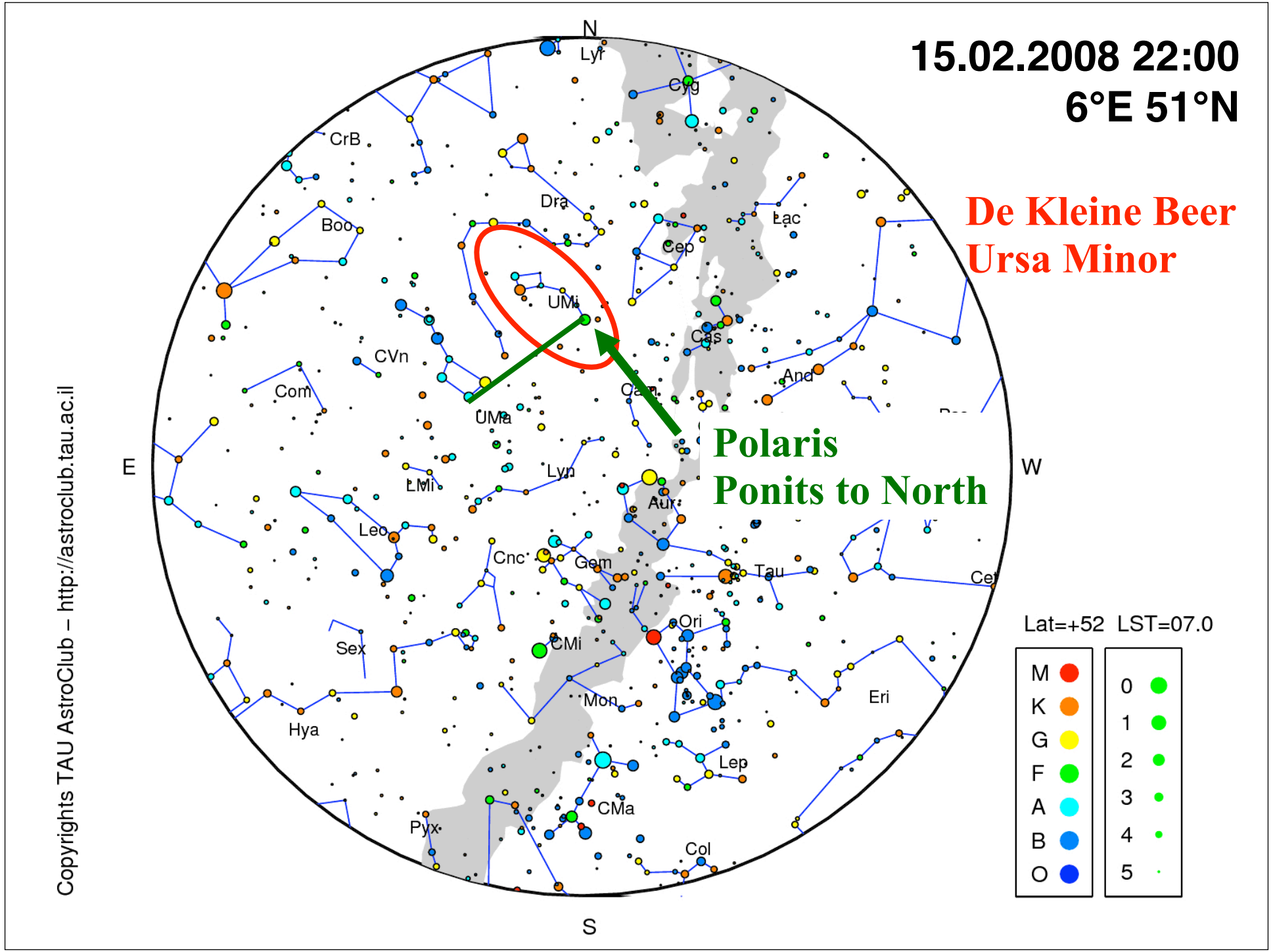
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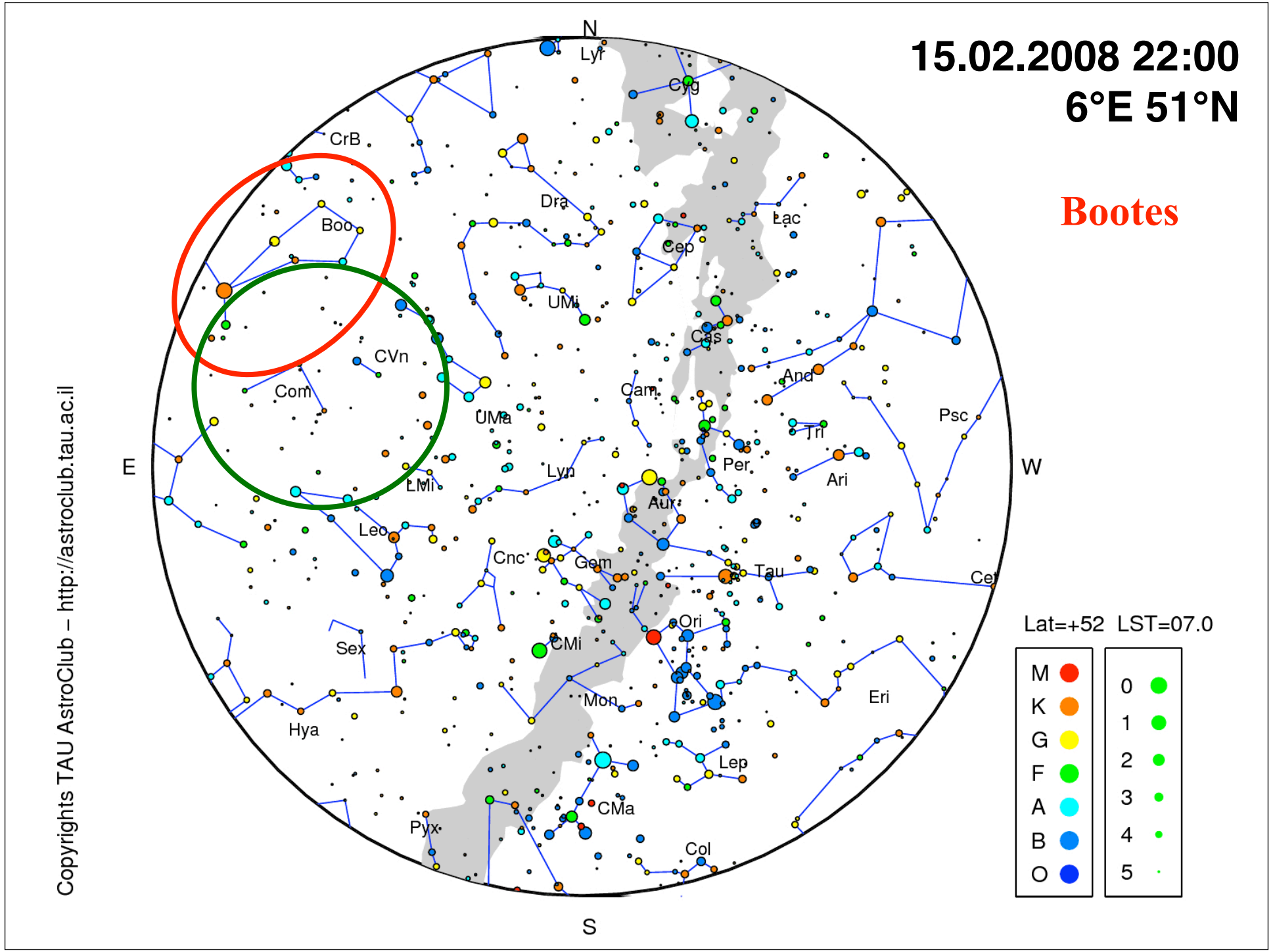
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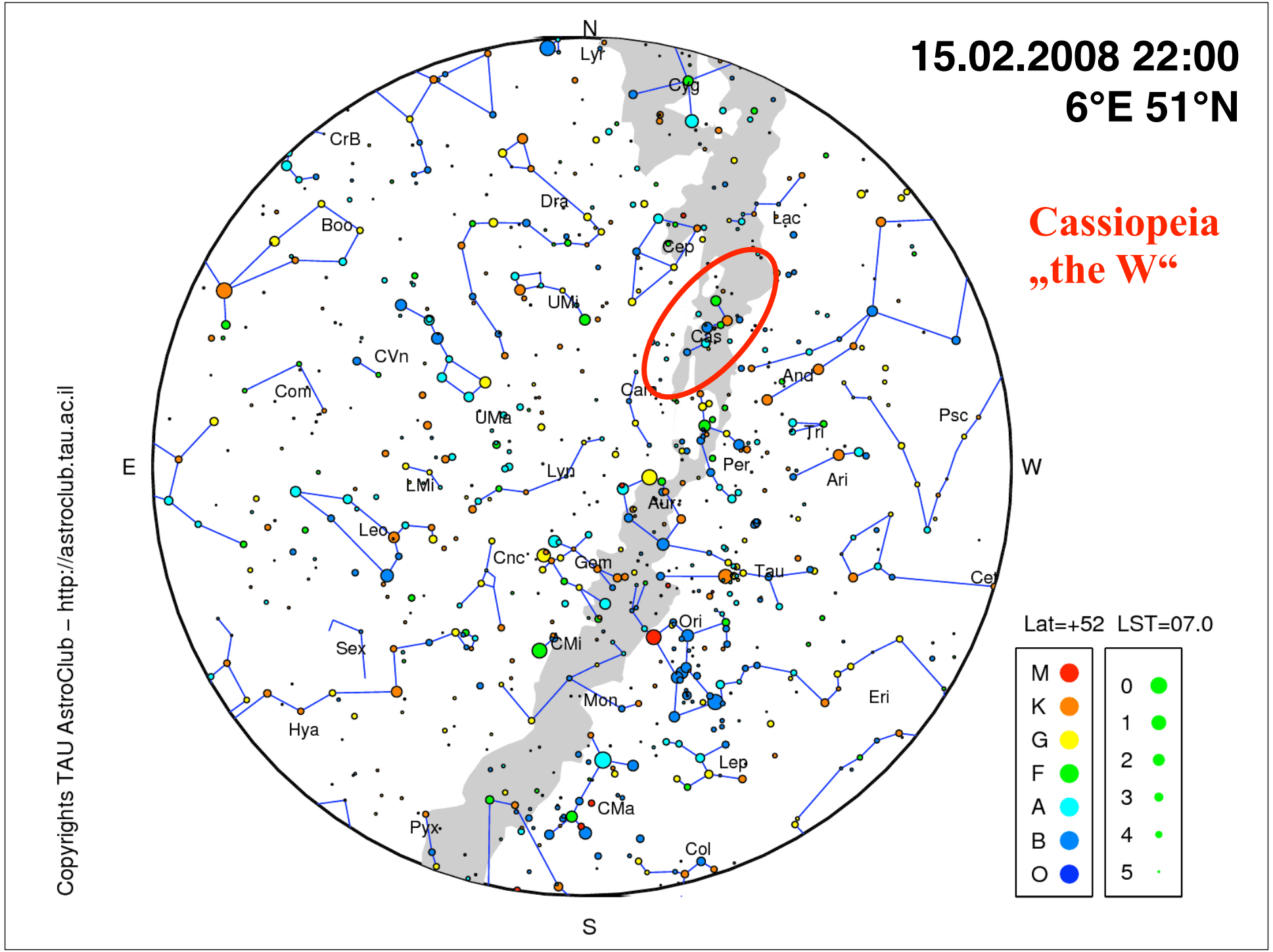
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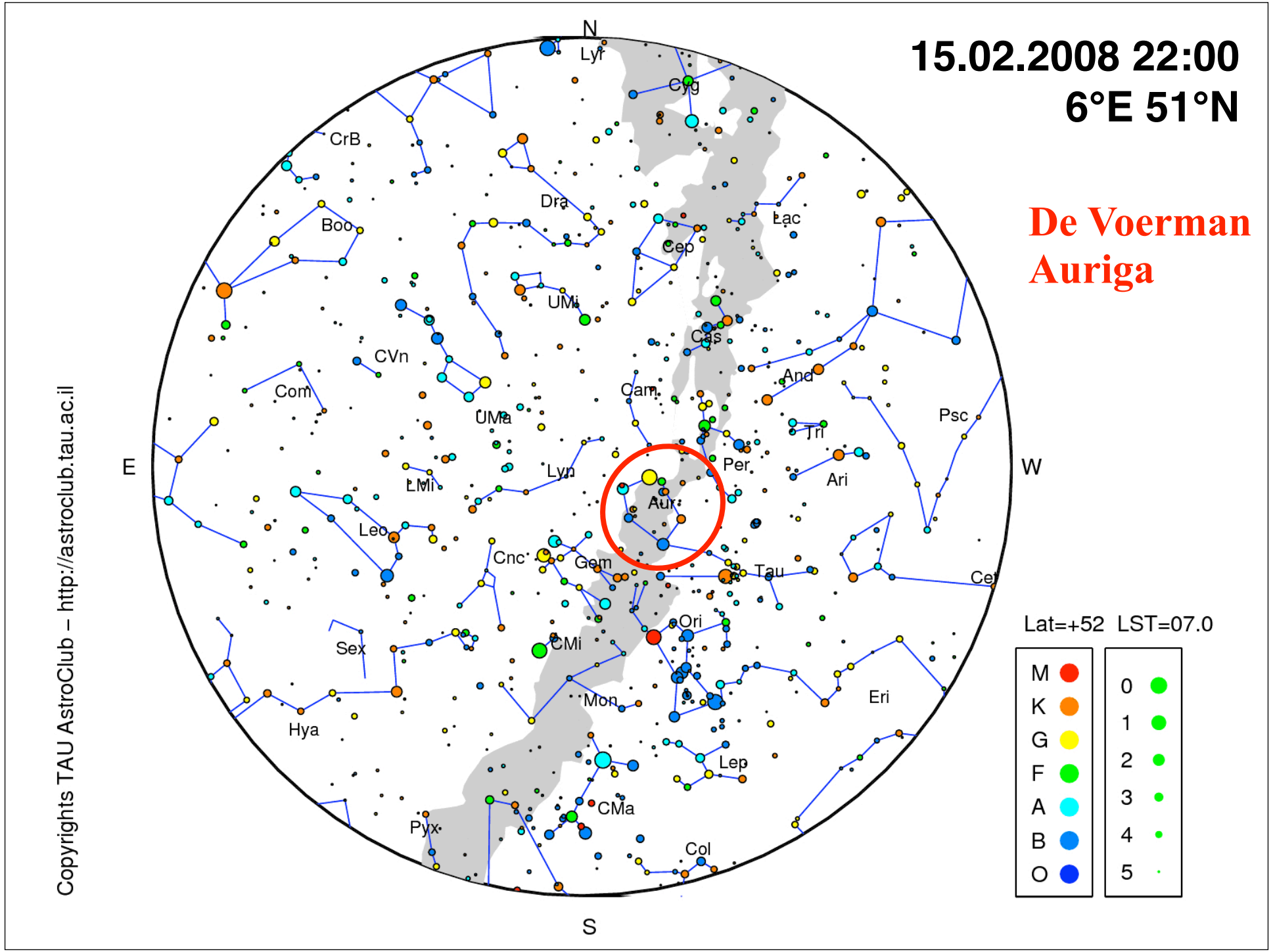
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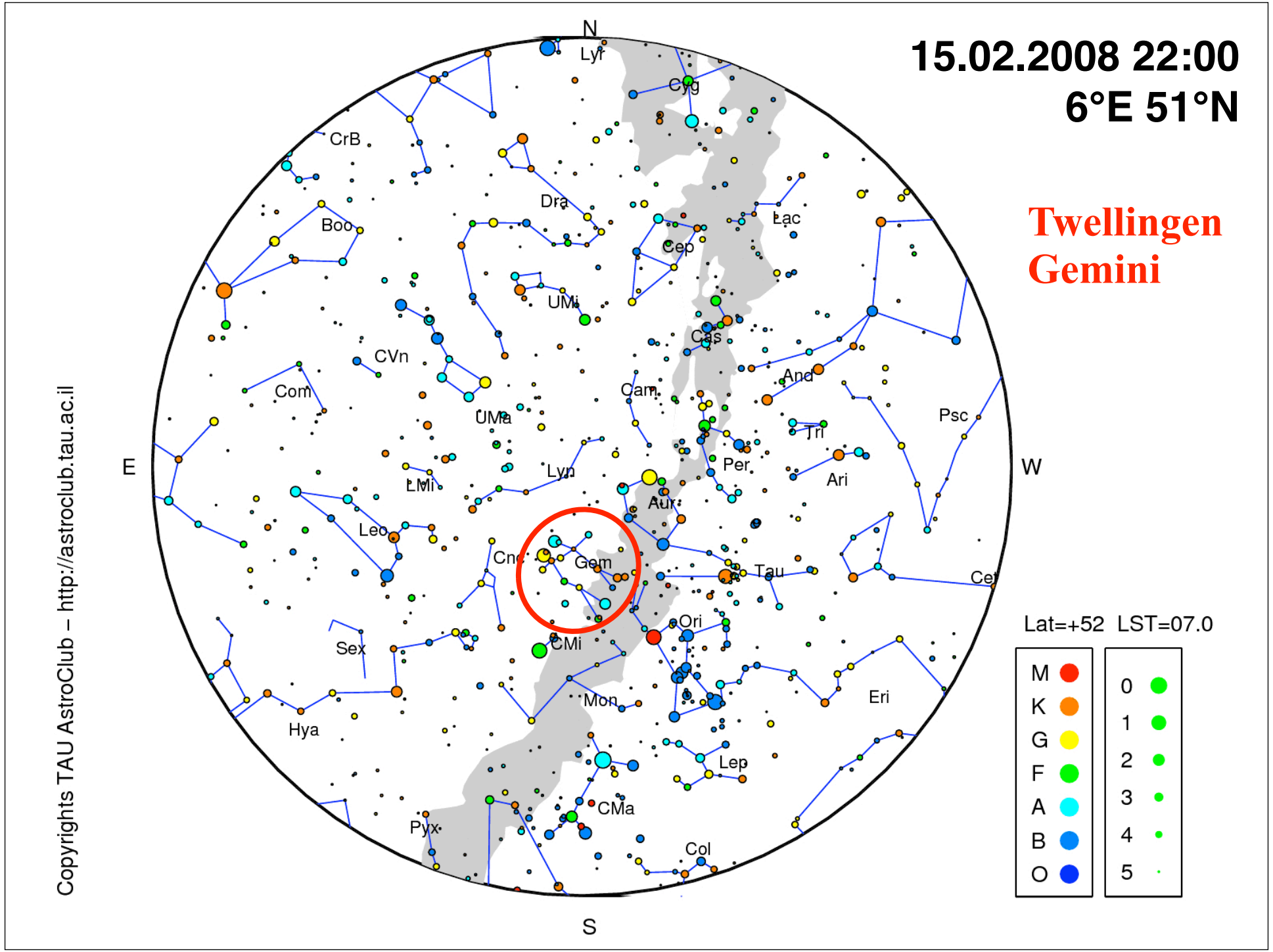
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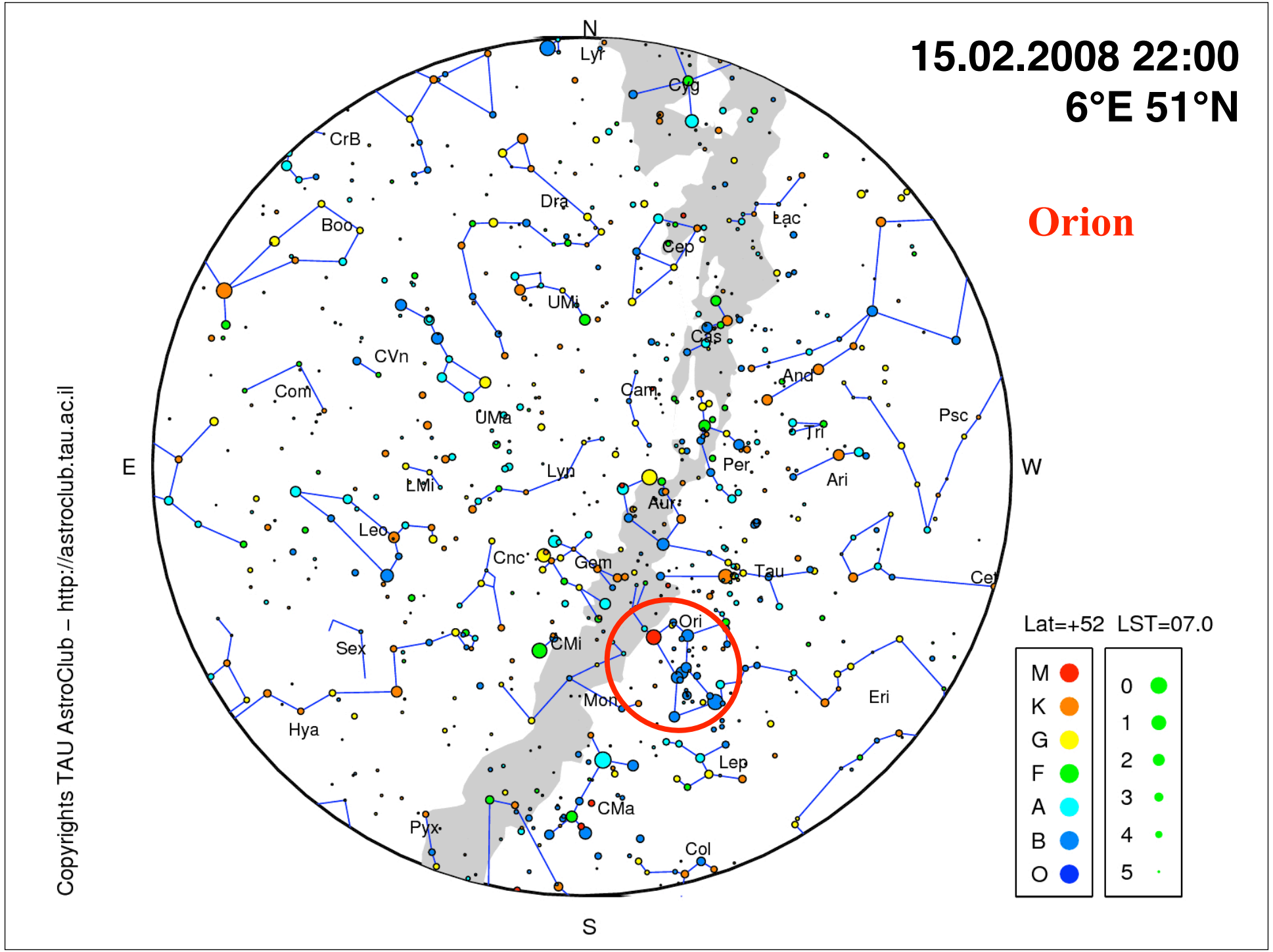
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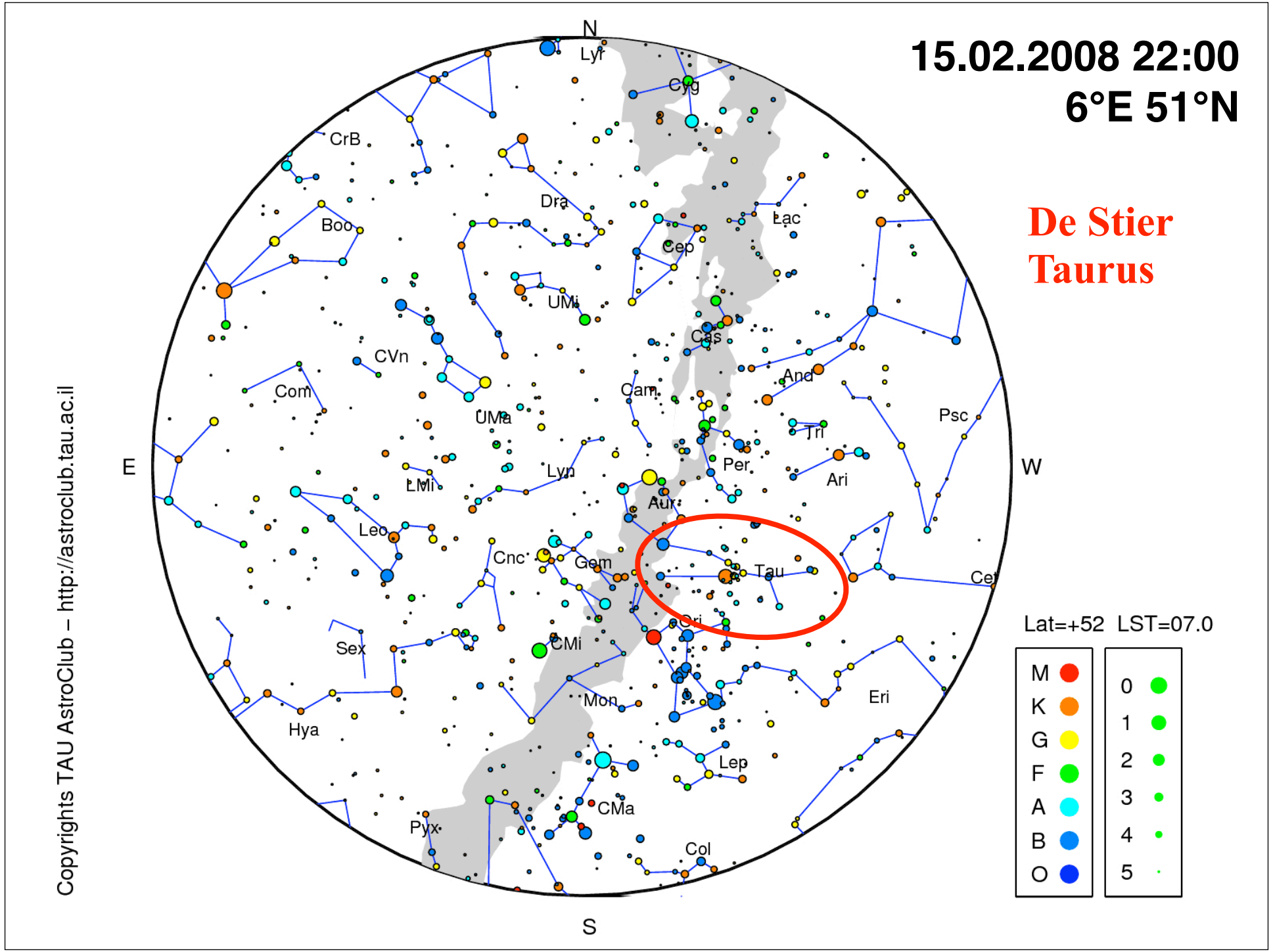
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