A brief introduction to the Lunar Distance Charts

The following charts are a graphical way of representing the data in the Lunar Distance Tables, which are created separately and should accompany these charts. The intention behind these charts is simply to put the available data into a picture so one can appreciate the relative positions of the Moon, Sun, the four navigational planets, and the 21 stars (magnitude ≤ 1.5) plus Polaris used as Lunar Distance targets, in addition to the remaining stars (with magnitude <5.0) and their constellations in the sky.

No attempt is made to depict which objects are visible from the Earth - as this is dependent on the observer's location (daytime?/nighttime? and between moonrise and moonset?). The celestial objects are found as positioned on the charts: SHA, or Sidereal Hour Angle, (together with Declination) fixes the position of the objects. SHA units effectively cancel out the Earth's rotation. Thus the stars "remain fixed" in the sky, and the Sun hardly moves at all in just one day. The navigationsl stars have standard numbering.[1]

The daily chart is automatically scaled (SHA and Declination) to give the best view of all (or most of) the celestial objects involved in the Lunar Distance Tables. The most appropriate objects change daily - the strategy to pick suitable objects is basically those with the largest change in hourly LD angle and within reach of a sextant (LD <120°).

The Moon is the fastest moving object. One chart page represents data for one day in Universal Time (UT) - the same time standard as used in Nautical Almanacs. Lunar Distance is the angle between the center of the Moon and the center of a chosen celestial object. This angle, up to around 120°, can be measured with a sextant, though normally the angle from the edge of the Moon (and Sun) is measured and a correction is required to add or subtract the semi-diameter of the Moon (and Sun).

The Lunar Distance Tables show the angle between two objects for every hour of the day. It is pointless to draw all of these on a chart, so only the position of the Moon at 0h, 12h and 24h is shown. Furthermore, only the Lunar Distance lines at 0h (start of day) are drawn - with one exception. Ocassionally an object has no valid Lunar Distance value at 0h, so 24h (end of day) is used instead. There are various possible reasons for this, such as: the object is too close to the Moon (the LD values change significantly non-linearly); the object comes into range during the day (as the LD angle drops below 120°).

The Sun and (navigational) planets also change their position slightly during the day. A blue circle indicates the position at 0h (start of day) and a blue "smudge" shows where the object (the blue circle) moves to by 24h (end of day). In addition, the planet's name is printed nearby with an arrow indicating the direction of movement. (Note: planets ocassionally "stop" and change direction in SHA units, i.e. against the stary sky.) A special event is a New Moon... if you can't see the Moon, no Lunar Distance measurements are possiblle. Fortunately this "blackout" doesn't last too long.

So, what's the motivation to master the technique of Lunar Distance measurement, essentially an 18th century technique to calibrate the time on a ship's clock? Indeed, this technique is considered to be the supreme discipline of sextant usage. "The methods are a good deal more laborious than the more commonplace procedures of celestial navigation. It is perhaps the most difficult possible operation within the discipline of celestial navigation. However, one argument for maintaining celestial skills is the utility of celestial navigation as an emergency substitute for electronic navigation."[2] "Nothing else comes close to the lunar for developing skill with a sextant - and the observation is demanding enough to hold one's interest for a lifetime."[3]

Well, what happens when the electronics on a yacht fail? "According to BoatUS Marine Insurance, the odds of a boat being struck by lightning are 1 in 1000, increasing to 3.3 in high risk areas."[4] There is also one infrequent event that can destroy electronics: a geomagnetic storm, such as the Carrington Event (`https://en.wikipedia.org/wiki/Carrington_Event`) when a solar CME hit the Earth's magnetosphere in 1859. It's a safe bet that this will occur again. And this time it could take out some GPS satellites. Mastering the Lunar Distance technique is thus a wise insurance policy (assuming the tables are already printed on paper).

Acknowledgements:
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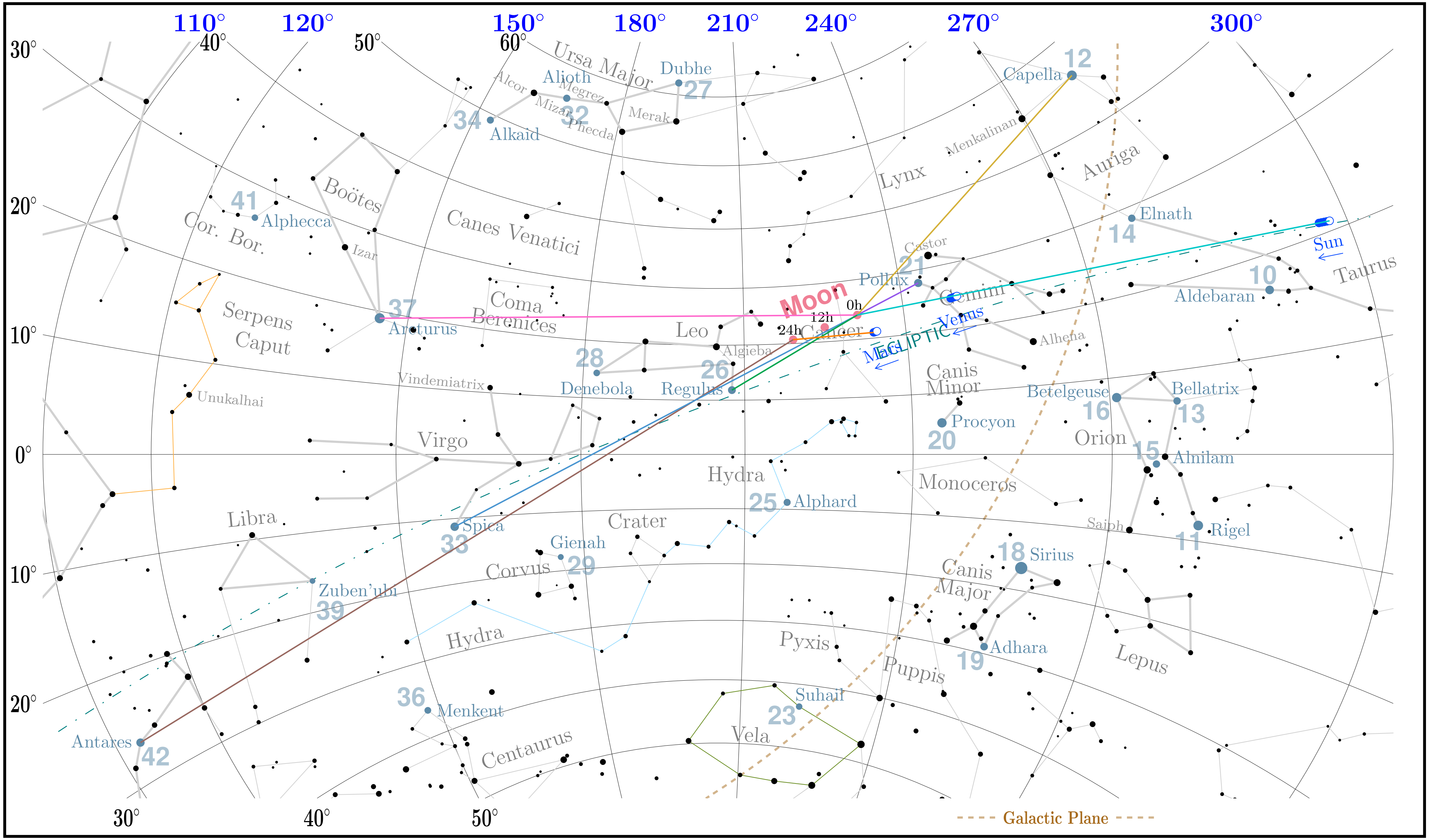
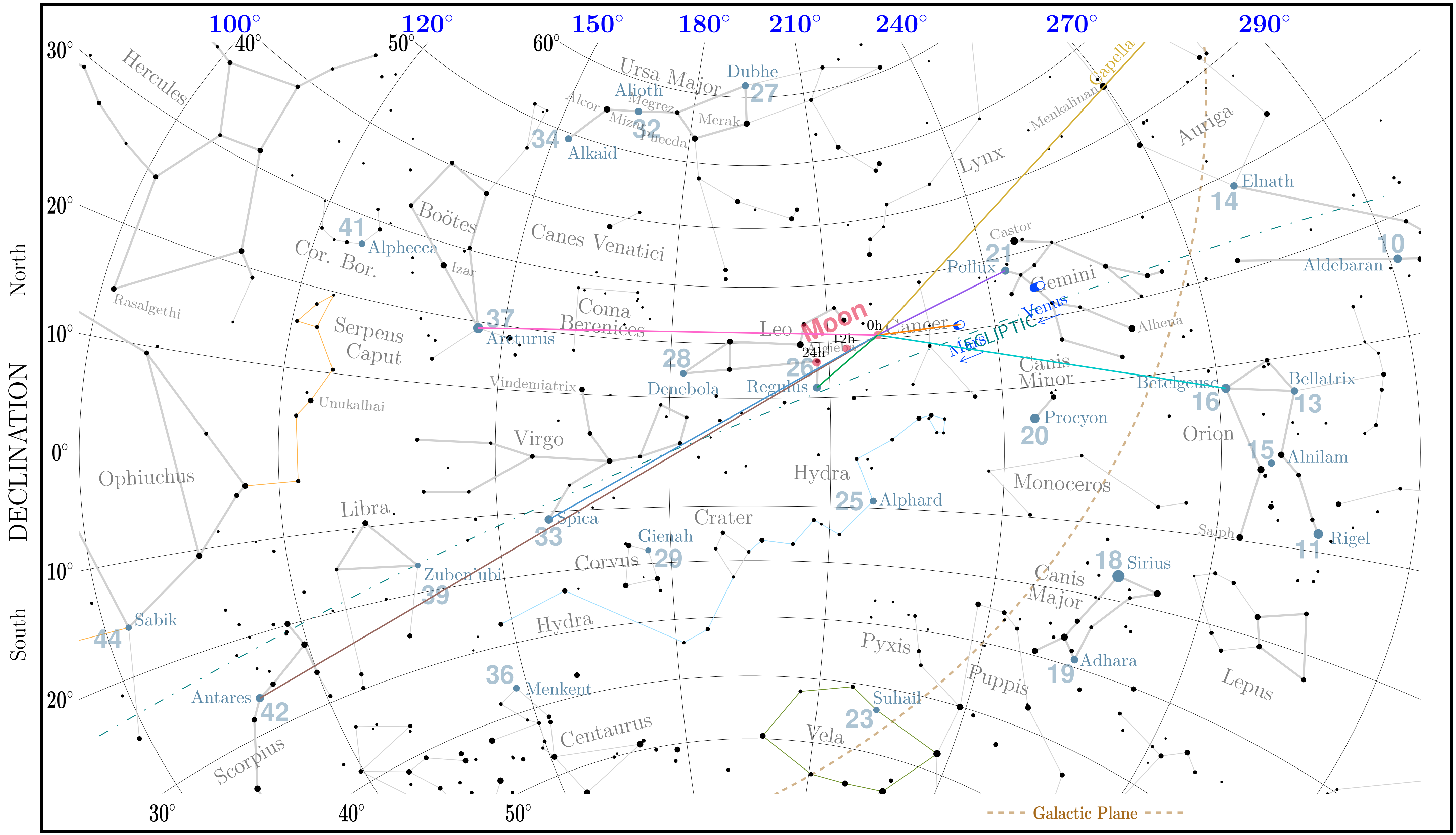
[1] Wikipedia "List of stars for navigation" (`https://en.wikipedia.org/wiki/List_of_stars_for_navigation`)
[2] Eric Romelczyk, The Journal of Navigation, Volume 72, Issue 6 "GMT and Longitude by Lunar Distance: Two Methods Compared From a Practitioner's Point of View"
[3] Bruce Stark, page vi, "Tables For Clearing the Lunar Distance and Finding Universal Time by Sextant Observation", ISBN 978-0-914025-21-4
[4] Mawgan Grace, Ocean Sailor, October 2021 (`https://oceansailormagazine.com/ocean-sailor-october-2021/`), Page 11 "Thunderbolts & Lightning"

LUNAR DISTANCE (SHA 110° to 300°) 25 May 2023



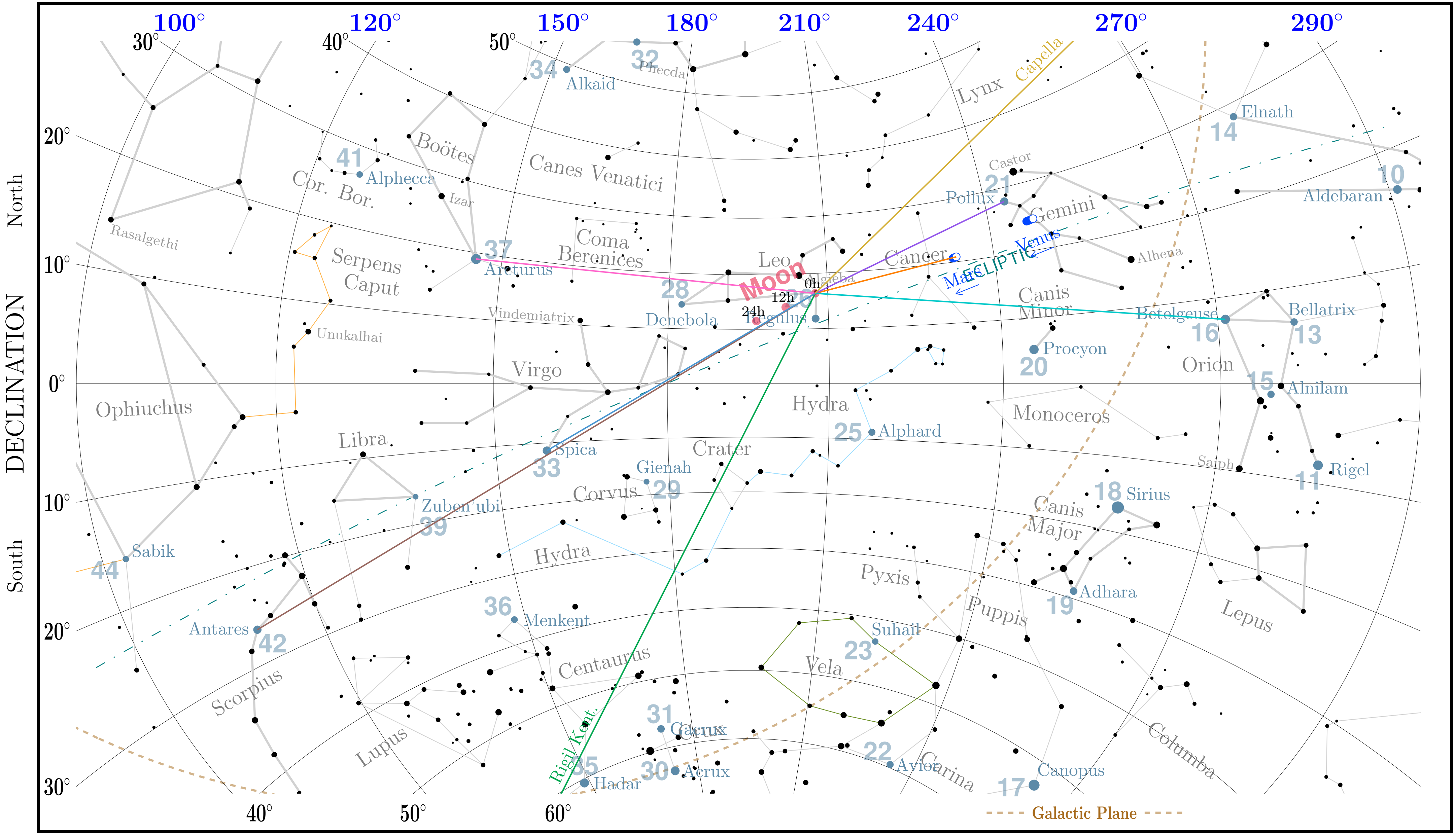
SIDEREAL HOUR ANGLE

LUNAR DISTANCE (SHA 100° to 290°)   26 May 2023



SIDEREAL HOUR ANGLE

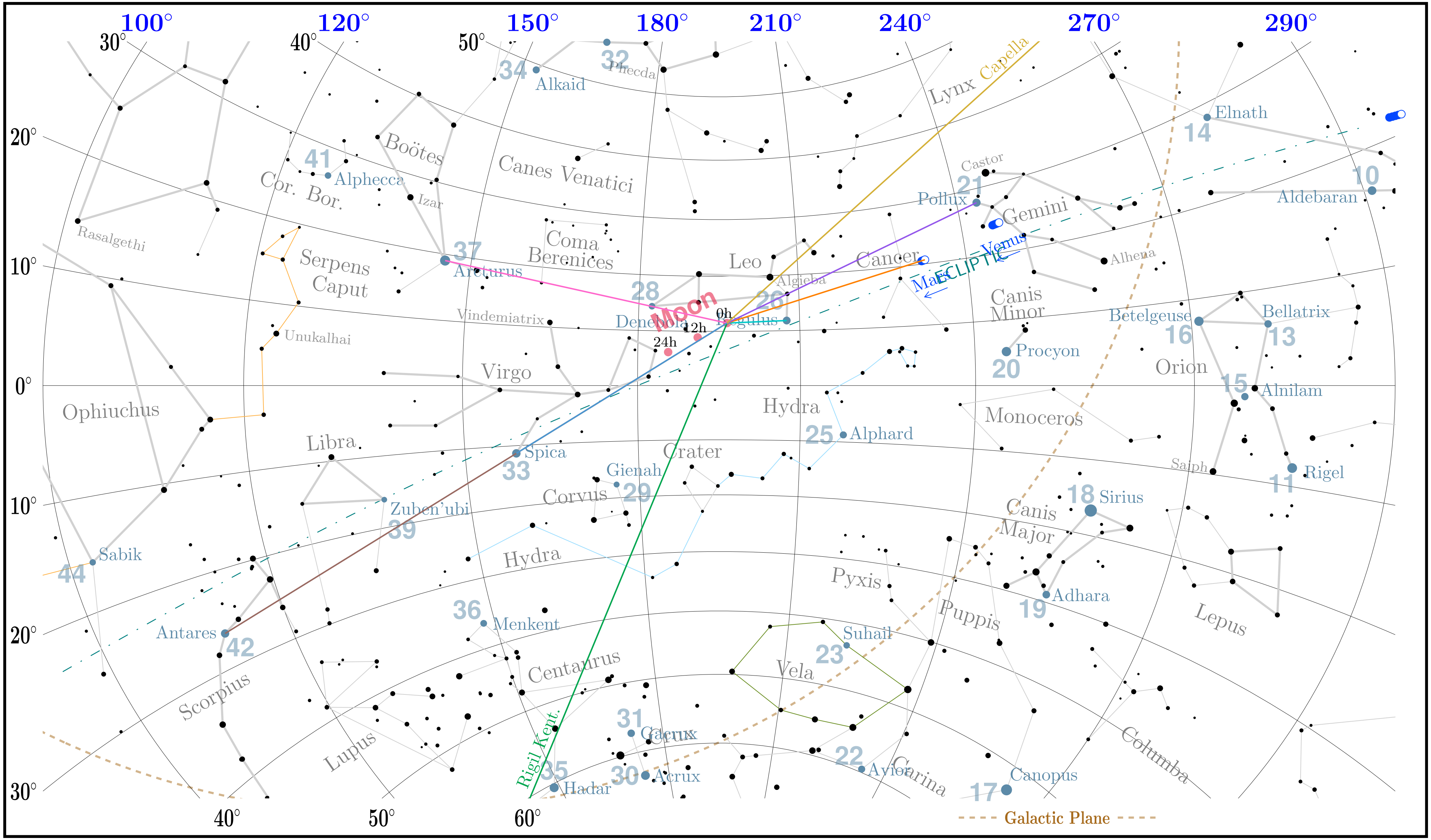
LUNAR DISTANCE (SHA 100° to 290°)   27 May 2023



32= Alioth

SIDEREAL HOUR ANGLE

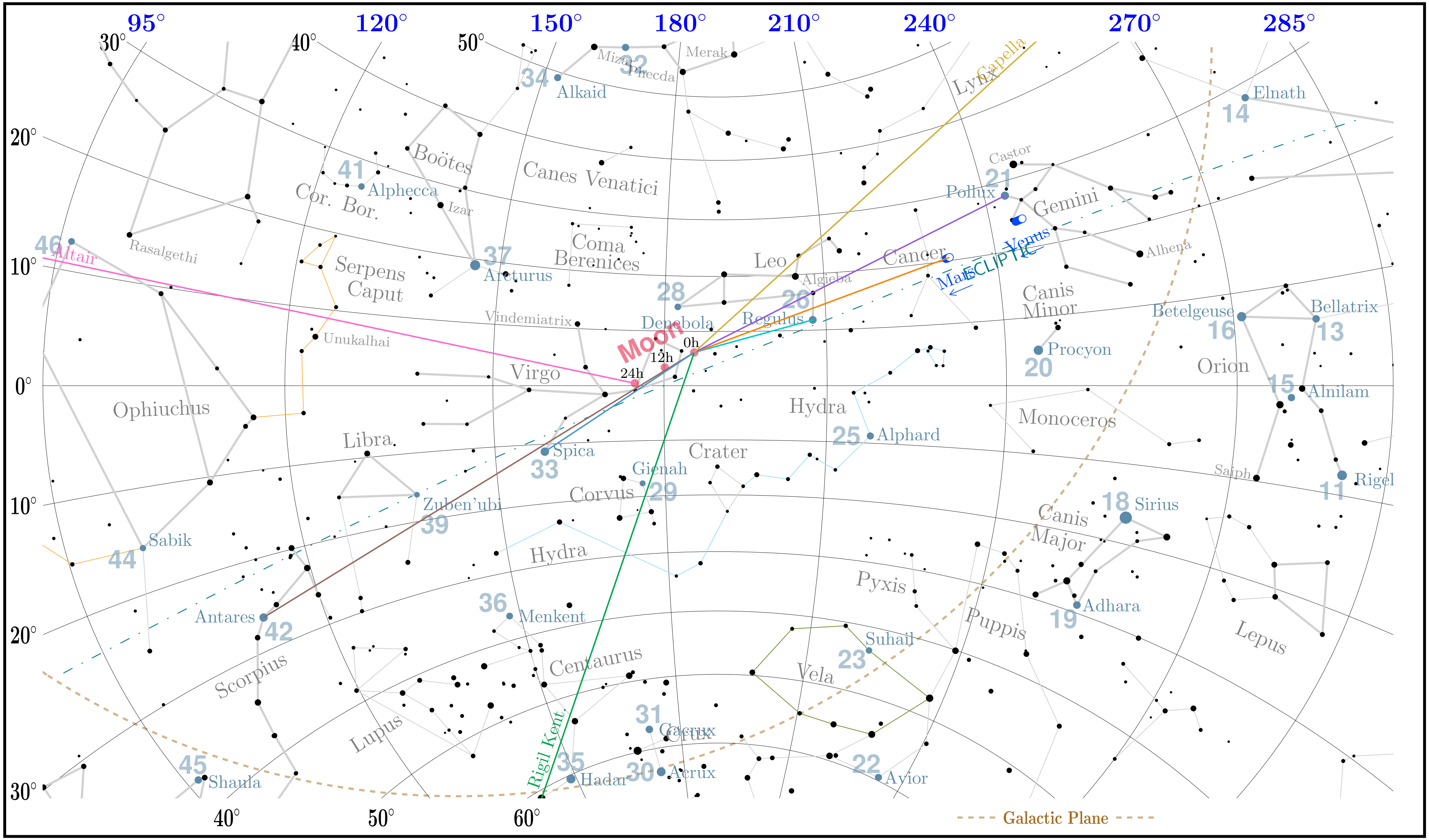
LUNAR DISTANCE (SHA 100° to 290°) 28 May 2023



32= Alioth

SIDEREAL HOUR ANGLE

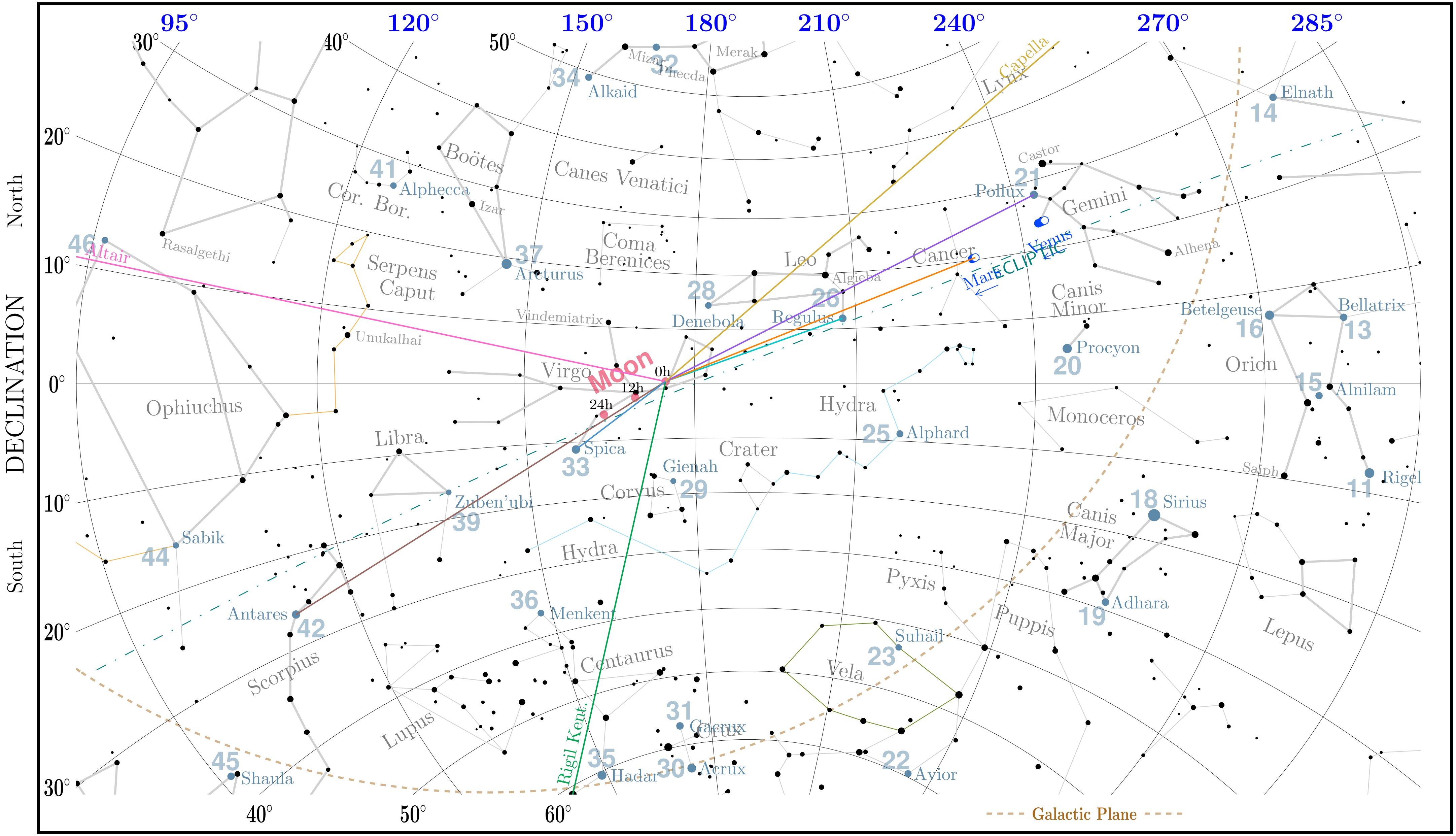
LUNAR DISTANCE (SHA 95° to 285°)   29 May 2023



46= Rasalhague   32= Alioth

SIDEREAL HOUR ANGLE

LUNAR DISTANCE (SHA 95° to 285°) 30 May 2023



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SIDEREAL HOUR ANGLE