TEACHING TRAINING COURSE ON ASTRONOMY

- **Lectures Topics**
  - 3 – History of Astronomy
  - 4 – Solar System
  -
- **Workshops Topics**
  - 1 – Local Horizon and Sundials.
  - 2 – Stellar, solar and lunar demonstrators
  - 3 – Earth-moon-sun system: phases and eclipses
  - 4 – Young astronomer briefcase

WS1: Local Horizon and Sundials

Summary
The study of the horizon is crucial to facilitate the students' first observations in an educational center. A simple model that has to be made in each center allows us to make the study and the comprehension of the first astronomical rudiments easier. The model is also presented as a simple model of an equatorial clock and from it; we can make other models (horizontal and vertical).

Goals
- Understand the diurnal and annual movement of the Sun.
- Understand the celestial vault movement.
- Understand the construction of an elemental Sundial.

List of Materials.

Activity 1:
- 4-sphere model
- 1 Bulb,
- 1 Support for the light bulb,
- 2 meters of electric cable and a plug
- 4 balls of porexpan or icopor of 8 cm
- 4 sticks with 4 supports (2 of equal height, 1 lower, 1 higher as explained in the WS1 text)
- 1 circular mat that is used as a base for cakes or pies
- 1 a card with a cut angle of 23º

Activity 2: Model of the parallel Earth
- 1 terrestrial sphere that can be removed from your support. About 30 cm in diameter
- 1 bowl that serves to put the terrestrial sphere on it
- 1 compass
- 1 rope of 2 meters in length
- 1 box of chopsticks
- 1 package of play dough for children

Activity 3: Horizon model.
- a photo strip of the local horizon (taken as explained in the workshop)
- 1 Photo of stellar traces of the cardinal point east or west
- 1 Photo of sunrise at 2 or 3 minutes intervals (approx) made on the day of the equinox
- 3 photos of the sunrise (or sunset) on the first day of the solstices and an equinox
- 1 photo of the Orion belt area with about 15 or 20 minutes of exposure time
- 1 Wood sheet (cardboard or cork does not work because it is soft) of 40x 40
- 2 meters galvanized wire, cut into three sections, (simulation of the apparent path of the sun at solstices and equinoxes and to simulate the rotation axis of the Earth)
- 1 Flashlight (with the light jet inside a cardboard tube so that it focuses well on

the jet)
- 1 compass

Activity 4: Equatorial Sundial
- 1 compass
- 1 wooden rod for the gnomon of the solar clock.
- Scissors and tail (for setting the sundial)

Activity 5: Reading Time
- Without equipment

WS2: Stellar, solar, and lunar demonstrators

Summary
This worksheet presents a simple method to explain how the apparent motions of stars, the Sun, and the Moon are observed from different places on Earth. The procedure consists of building a simple model that allows us to demonstrate how these movements are observed from different latitudes.

Goals
- Understand the apparent motions of stars as seen from different latitudes.
- Understand the apparent motions of the Sun as seen from different latitudes.
- Understand the Moon's movement and shapes as seen from different latitudes.

List of Materials

Activity 1: Stellar Simulator
- Extended photocopied material for the instructor, so it looks better.
- Scissors.
- Cutter, carving or scalpel
- Glue to paste.

Activity 2: Solar simulator
- Extended photocopied material for the instructor, so it looks better.
- Scissors.
- Cutter, carving or scalpel
- Glue to paste.
- 1 clip (to secure the Sun). You have to draw a sun and stick it on one end of the clip

Activity 3: Parallel Earth Simulator
- Extended photocopied material.
- Scissors.
- Cutter, carving or scalpel
- Glue to paste.
- 1 ping pong ball
- 1 piece of elastic band.
- 1 mobile flashlight.

Activity 4: Lunar Simulator

- Extended photocopied material for the instructor, so it looks better.
- Scissors.
- Cutter, carving or scalpel
- Rubber to paste.
- 1 clip (to secure the Moon). You have to draw a half moon and stick it on one end of the clip with the diameter of the half-moon perpendicular to the clip

WS3: Earth-moon-sun system: Phases and eclipses

Summary
The following work deals with moon phases, solar eclipses, and lunar eclipses. These eclipses are also used to find distances and diameters in the Earth-Moon-Sun system.

Goals
- To understand why the moon has phases.
- To understand the cause of lunar eclipses.
- To understand why solar eclipses occur.
- To determine distances and diameters of the Earth-Moon-Sun system.
- To understand the origin of the tides.

List of Materials

Activity 1: Model of the hidden face of the Moon

- 1 mask (cut out on white card) to simulate the visible face of the Moon

Activity 2: Model of the phases of the Moon

- 4 masks (cut out on white card) to simulate the 4 phases of the Moon
- 1 projector of the ones used to project the ppt (you have to leave it blank using a blank Word page for example)

Activity 3: Tierra Luna model to scale

- 1 4cm sphere and 1 wait of 1cm in diameter
- 1 rigid wood or plastic rod 1.3 m
- 2 nails for driving the two spheres into the rod at a distance of 1.2 m

Activity 4: Illustration Errors

- Without equipment

Activity 5: Lunar Eclipsis

- The same equipment of Activity 3

Activity 6: Solar Eclipsis

- The same equipment of Activity 3

Activity 7: Sol Luna model at scale
- 1 savannah where to paint a Sun of 220 cm in diameter
- 1 Moon 6 mm in diameter (can be a pellet of play dough for children) punctured on a toothpick

Activity 8: Finger Cinema
- 1 notebook with spiral
- a series of photos of a Moon or Sun eclipse
- 1 tube of glue or glue

Activity 9: Measure the diameter of the Sun
- 1 plastic tube at least 1 meter long and 8cm in diameter (camera obscured)
- 1 hour of translucent paper (vegetable, butter, tracing paper)
- 1 piece of aluminum foil
- 1 calculator
- 1 clip to undo and puncture with the aluminum foil

Activity 10: Aristarchus' Experiment
- Without equipment

Activity 11: Eratosthenes' Experiment
- Without equipment

WS4: Young Astronomer Briefcase

Summary
To further observation it is necessary that students have a set of simple tools. It is proposed that they construct some of them and then use them in observing the sky from the school itself.
Students should understand in a basic way how various instruments have been introduced over the centuries, how they have developed, and have become necessary. It is an important part of astronomy, noting the great ability to build them and the skill to use them to do readings of the observations. These requirements are not easy to develop with students and for that reason here we propose very simple instruments.

Goals
- Understand the importance of making careful observations.
- Understand the use of various instruments thanks to the fact that students do the construction by themselves.

List of Materials

Scissors, cutter and glue or tail are required for the different activities

Activity 1: rule to measure angles
- 1 piece of cardboard of 20x3 cm
- 1 piece of string of 65 cm

• Paste the photocopy of the rule

Activity 2: simplified quadrant

• 1 piece of cardboard of 20x12 cm
• 1 piece of string of 25 cm
• 1 lead (can be anything heavy that can be knotted with the string
• Paste to the photocopy of the quadrant
• 2 pieces of cardboard 4x4 cm where the hole is made to measure the height of the sun

Activity 3: Simplified horizontal goniometer

• 1 piece of porexspan, isopor or quite thick cardboard of 25x20 cm
• Paste the photocopy of the semicircle
• 3 pins or needles with colored heads

Activity 4: Planisphere

- Cut out photocopies
- Glue
- Scissors

Activity 5: Equatorial Coordinates

• No materials

Activity 6: Moon map

• Prepare various lunar maps

Activity 7: Spectroscope

• 1 matchbox
• 1 piece of CD (1/8 of CD is enough). The CD can be used
• 1 black marker

Activity 8: Equatorial Sundial

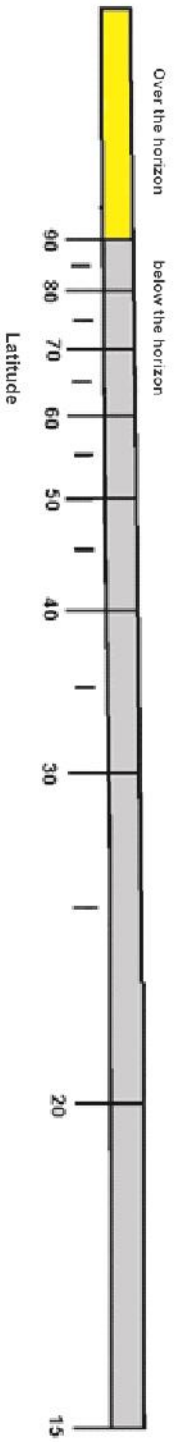
- 1 compass
- 1 wooden rod for the gnomon of the solar clock.
- Scissors and tail (for setting the sundial)

Activity 9: Red light torch and other materials

• 1 flashlight,
• 1 piece of red cellophane paper to stick on the lantern
• 1 compass
- 1 notebook
- 1 pencil or pen
- 1 camera
- glasses to see eclipses
- 1 mobile

Activity 10: Build the briefcase

- 1 bag type folder
- 1 piece of rope a little thick to make the handle


Over the horizon
below the horizon
Latitude
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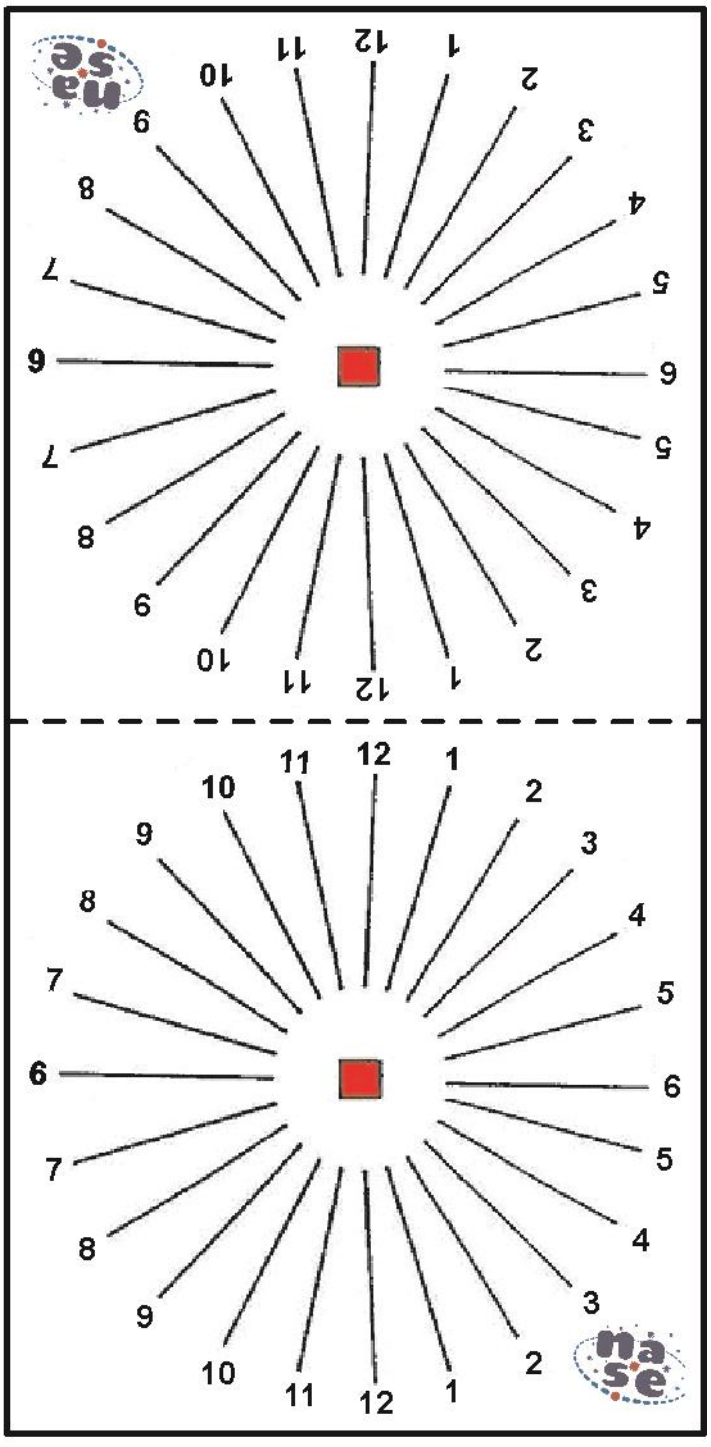
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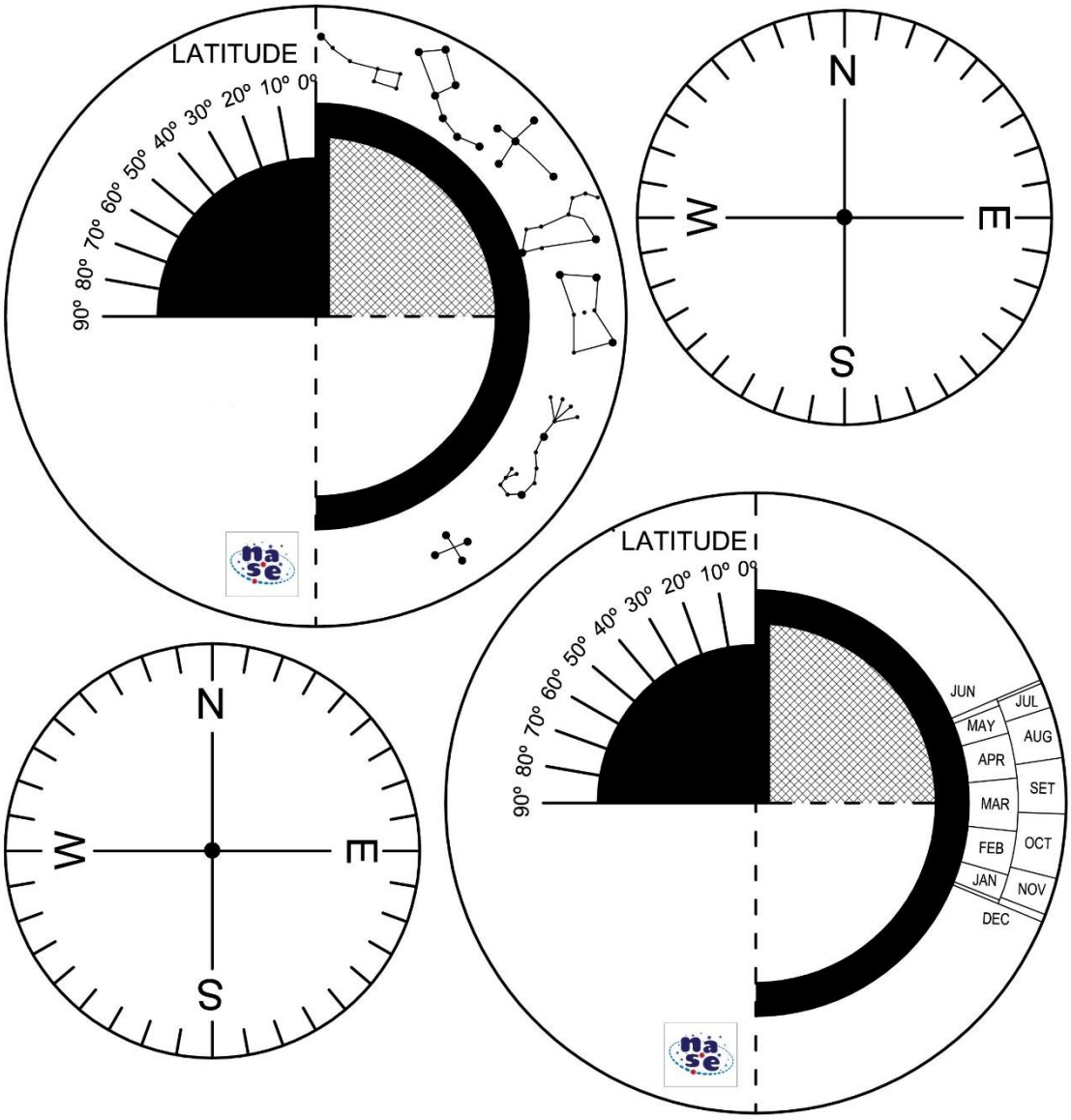
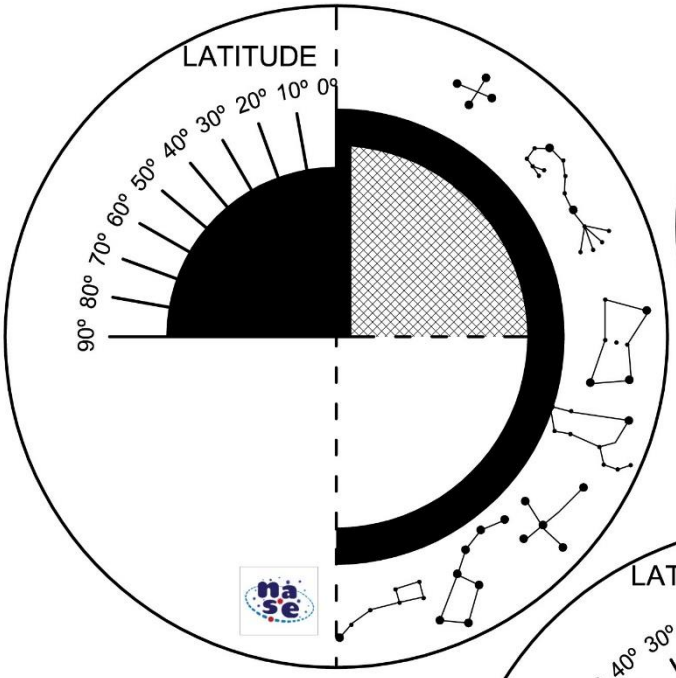
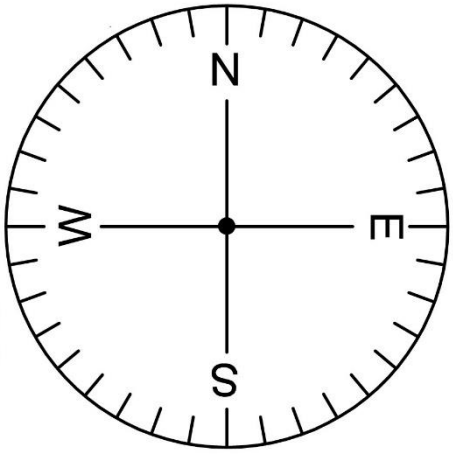
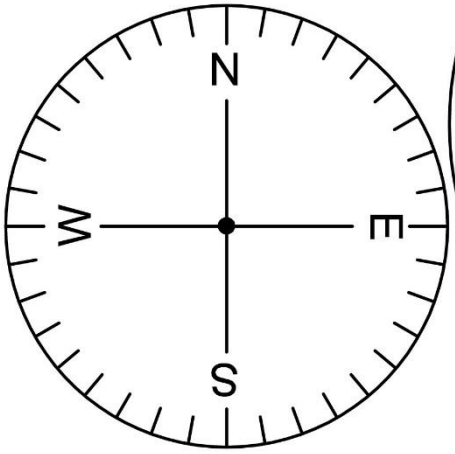
WORKSHOP 2 NORTE

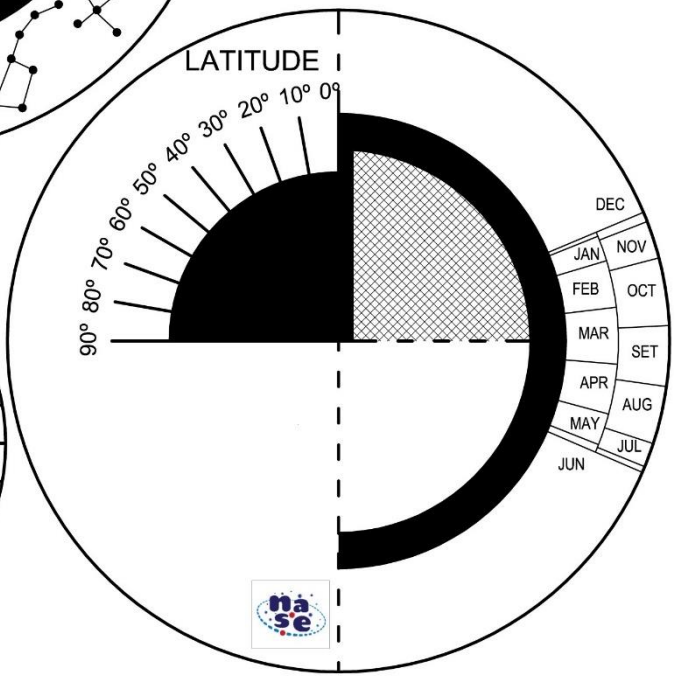


WORKSHOP 2 SUR









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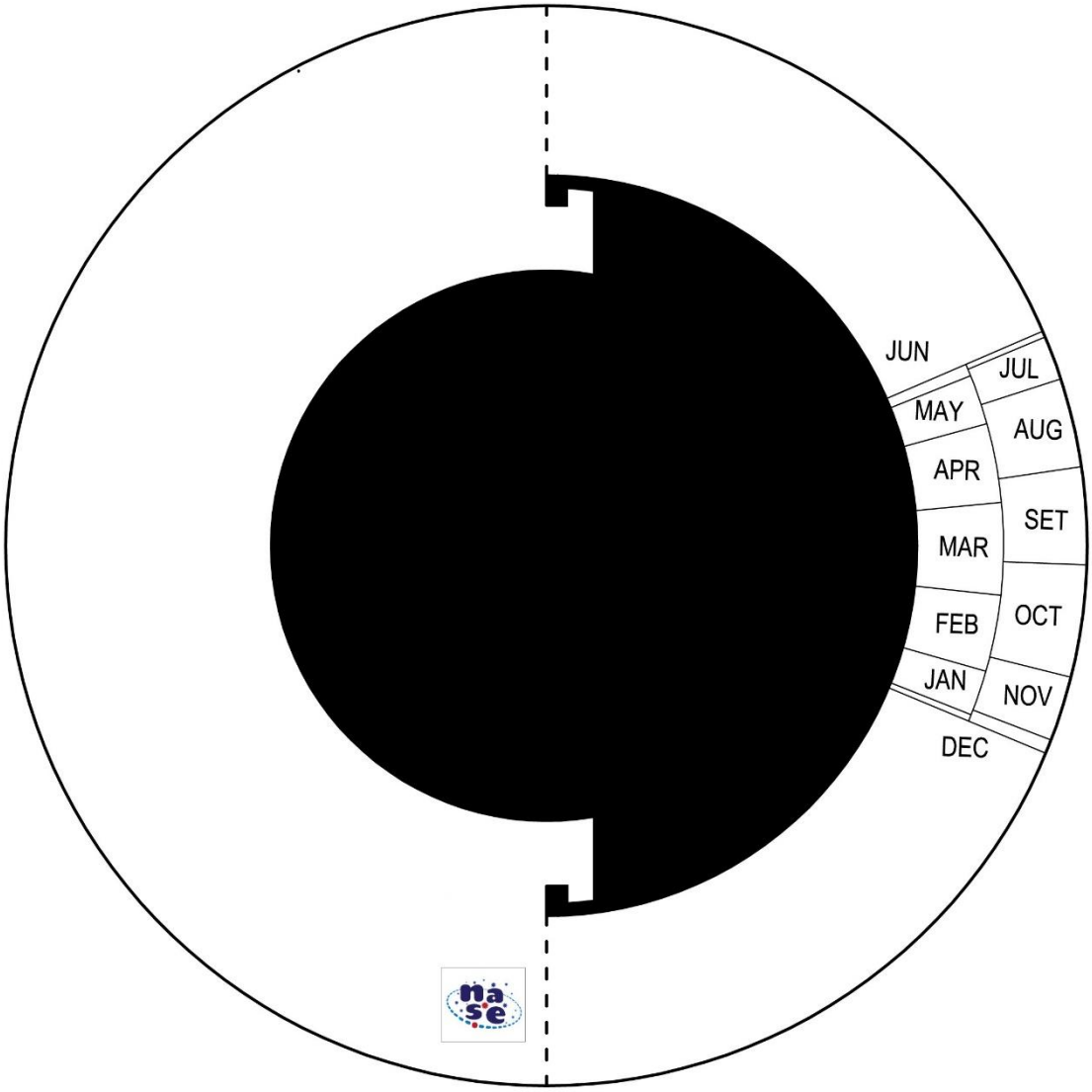

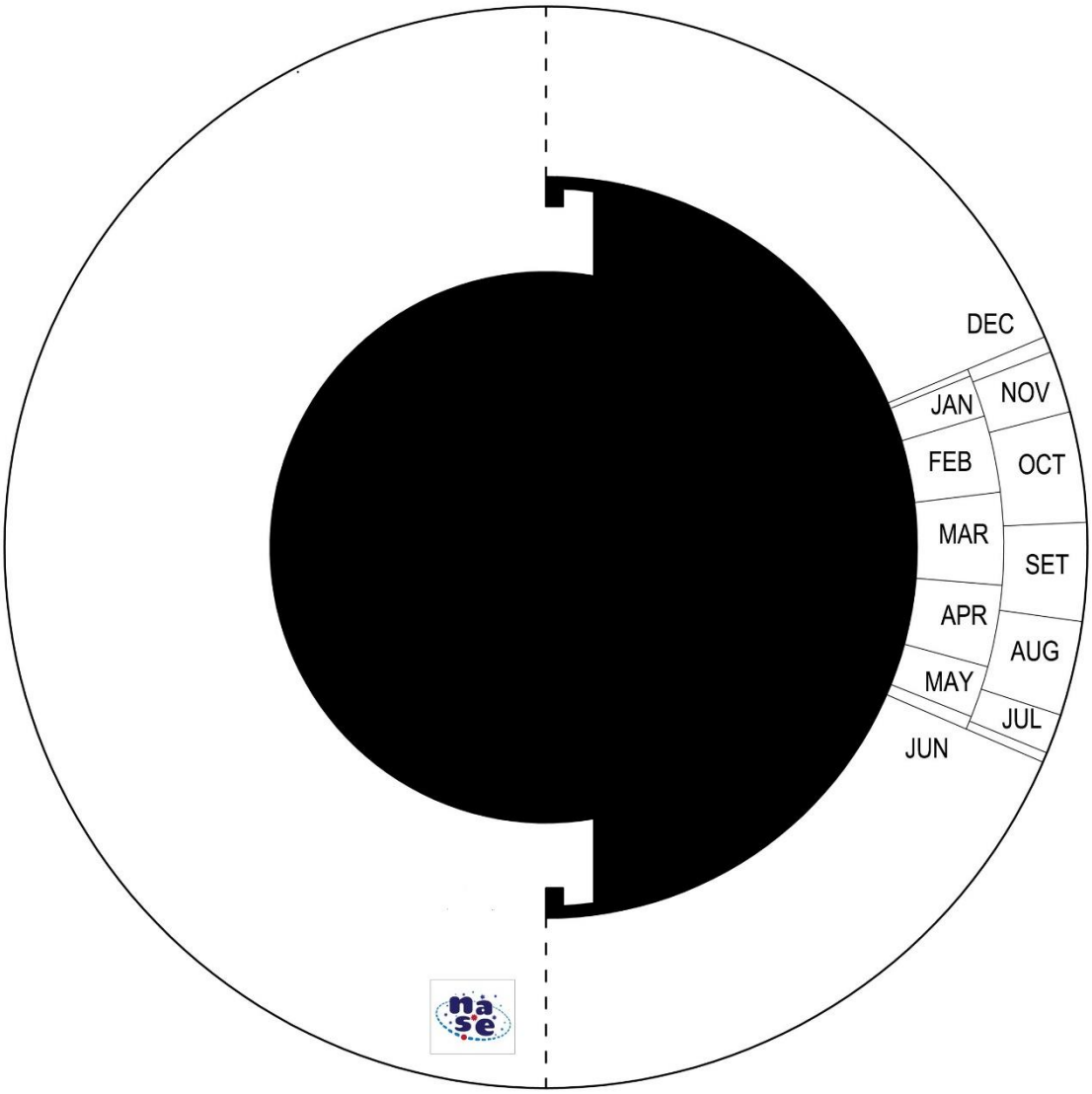

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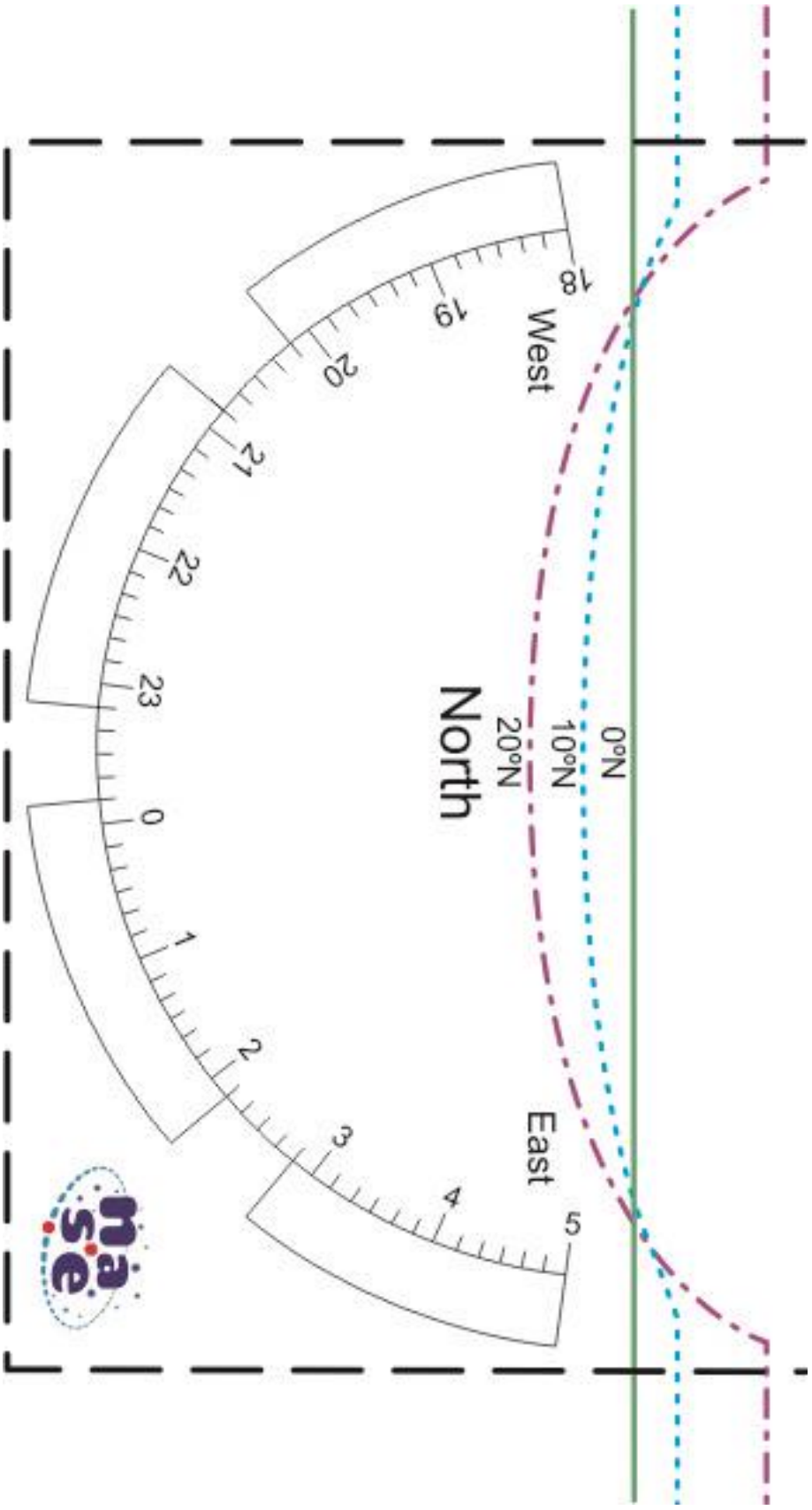

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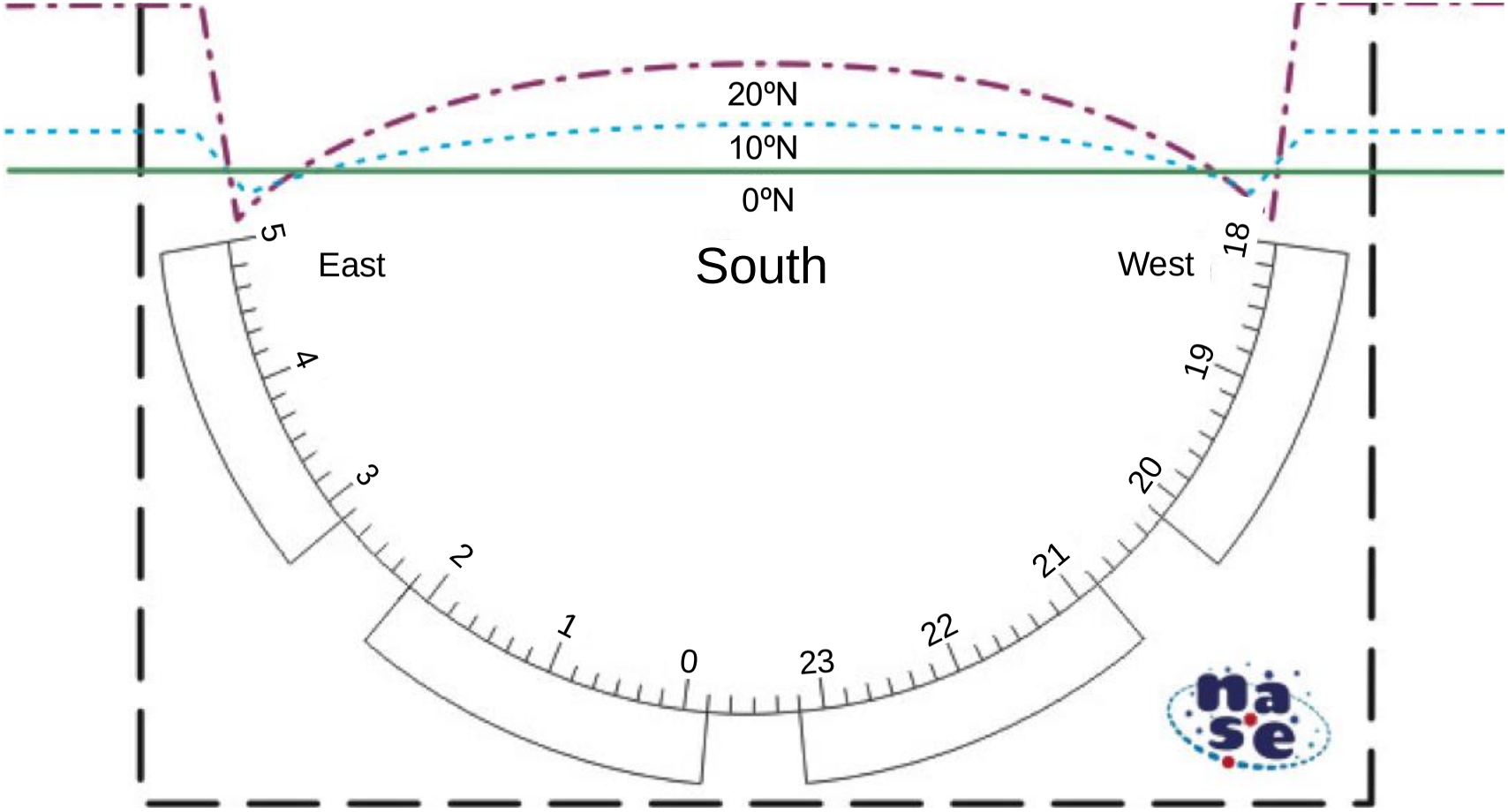
20ºN
10ºN
0ºN
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21
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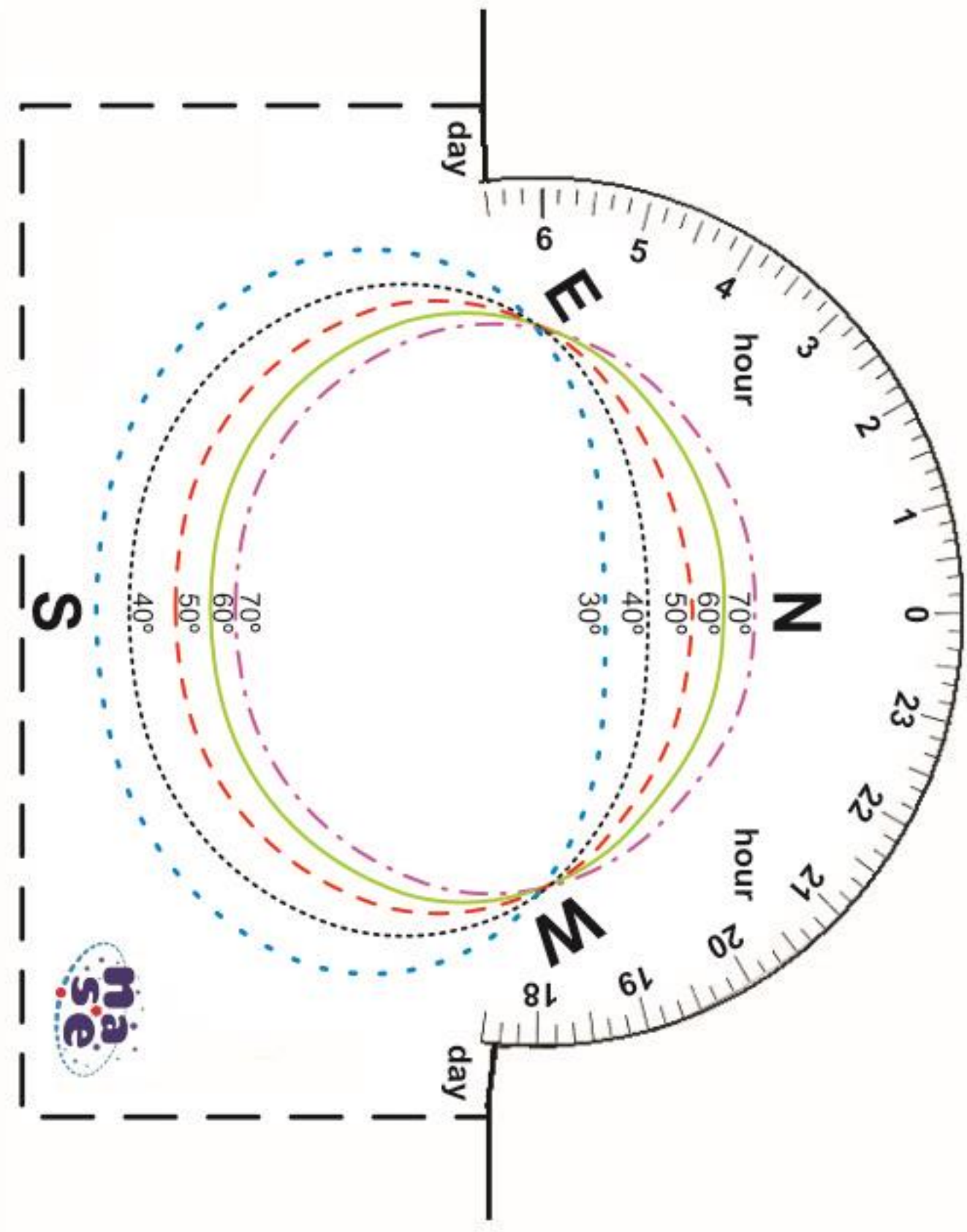
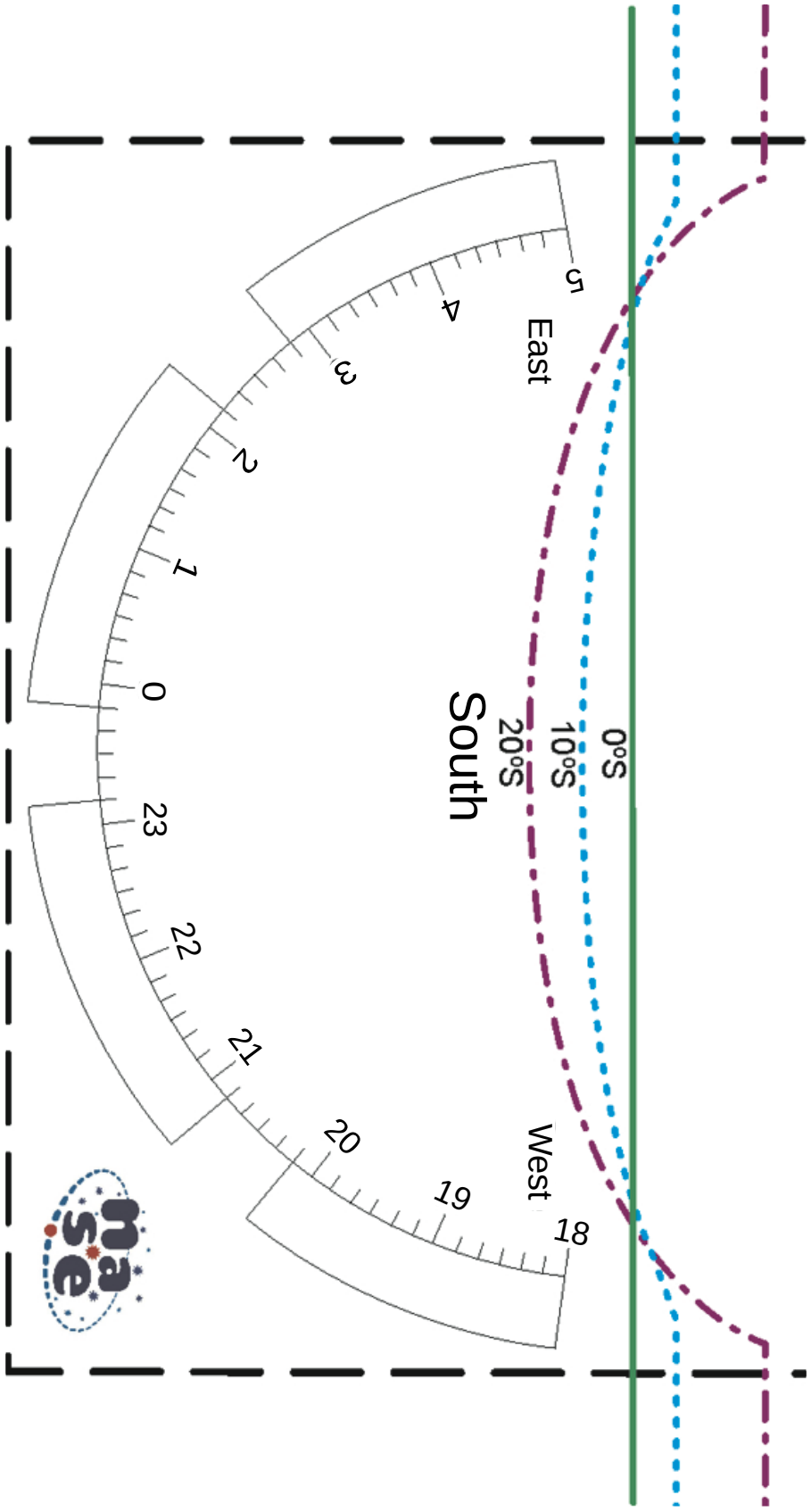
18

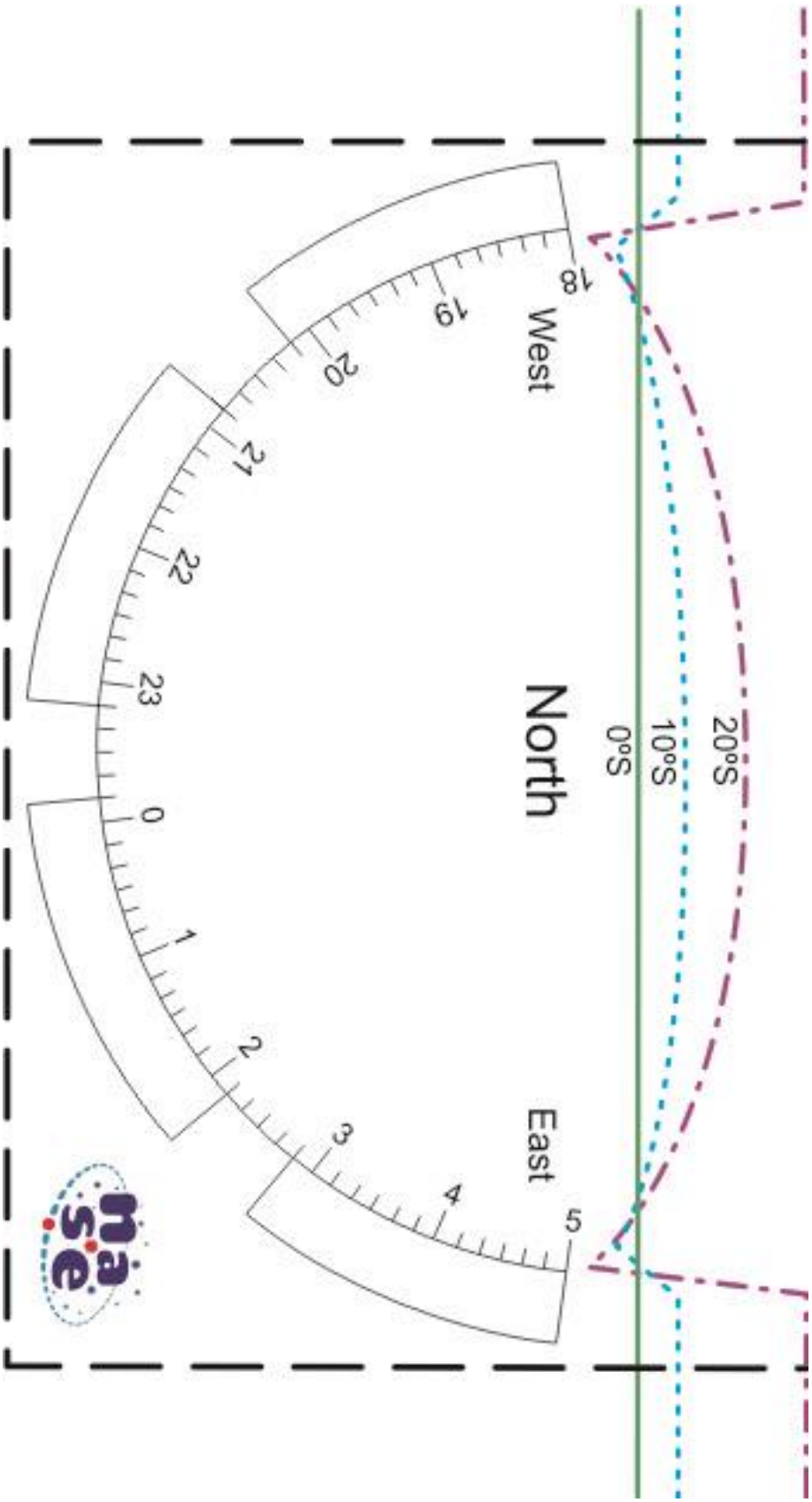
WORKSHOP 4 NORTH 0-20N



WORKSHOP 4 NORTH 30-70N

WORKSHOP 4 SOUTH 0-20S





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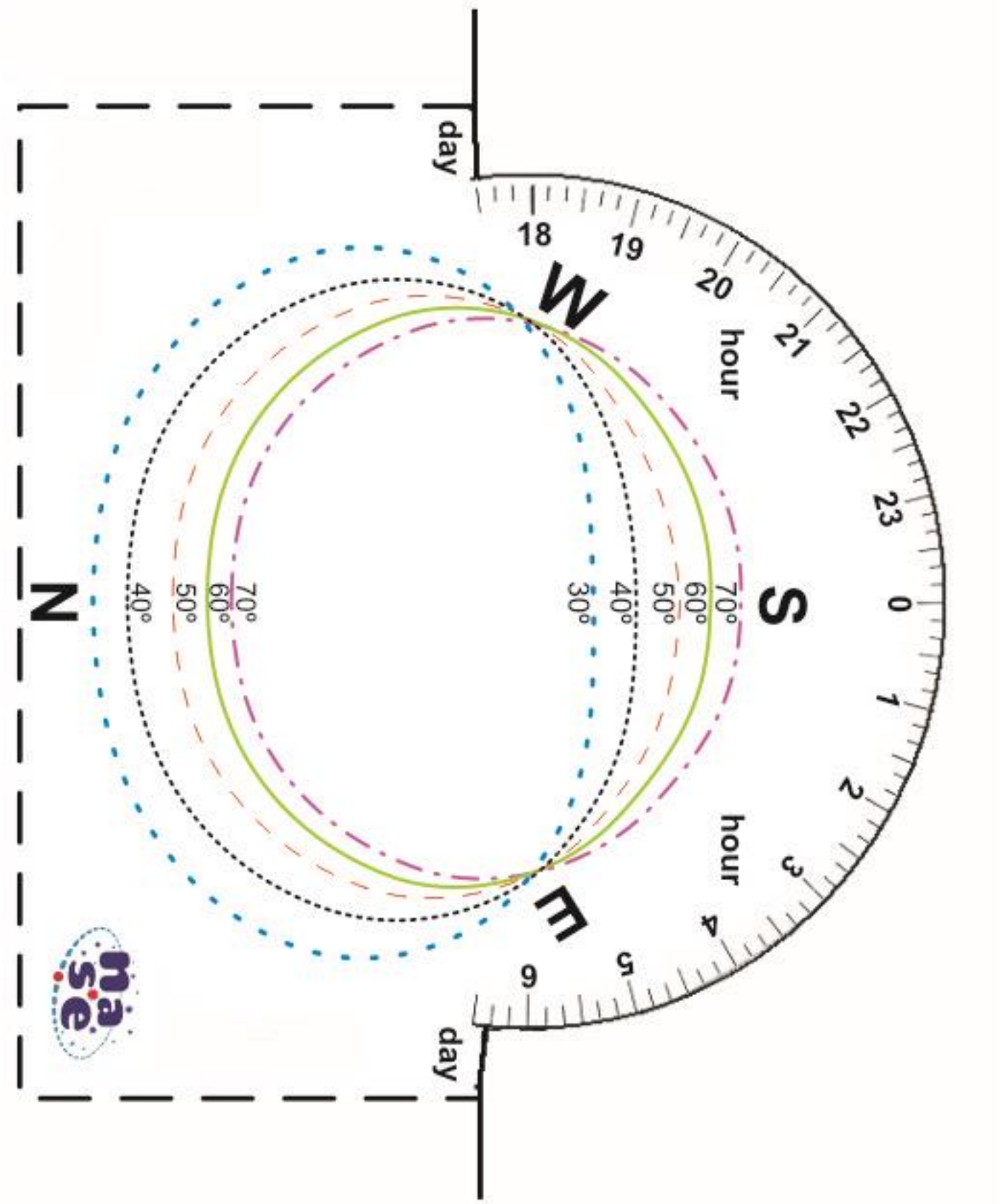
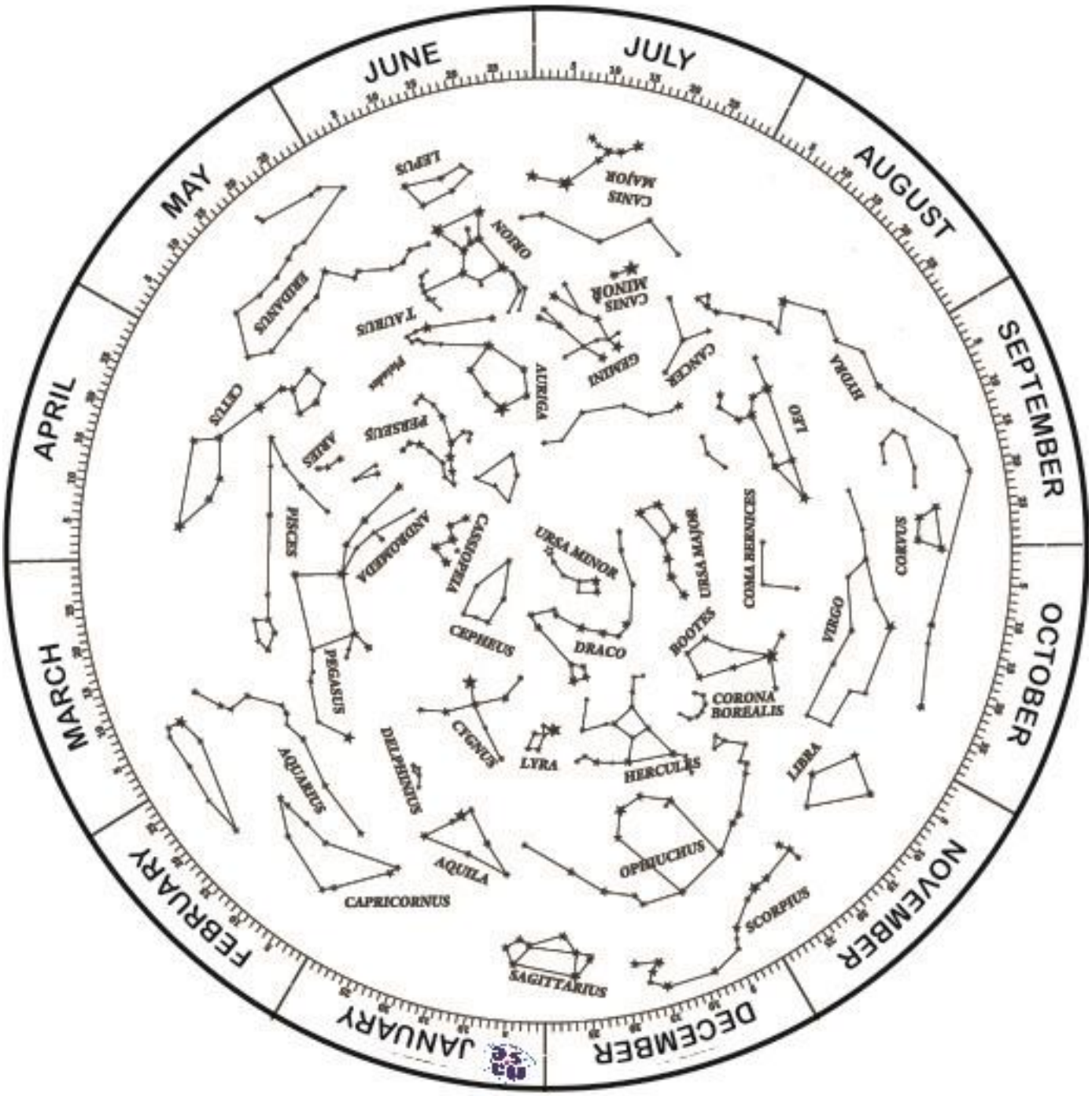
WORKSHOP 4 SOUTH 30-70S





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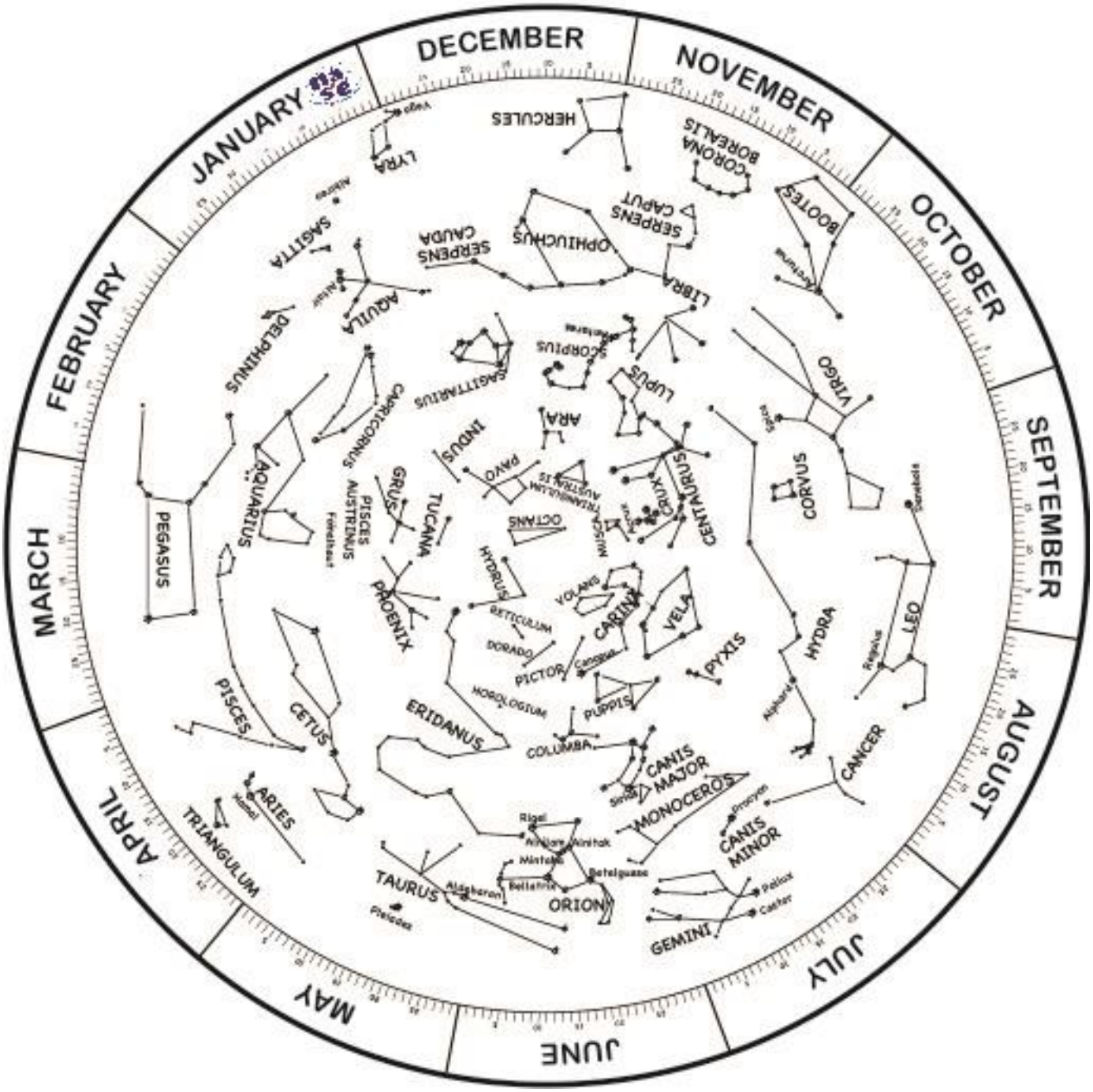
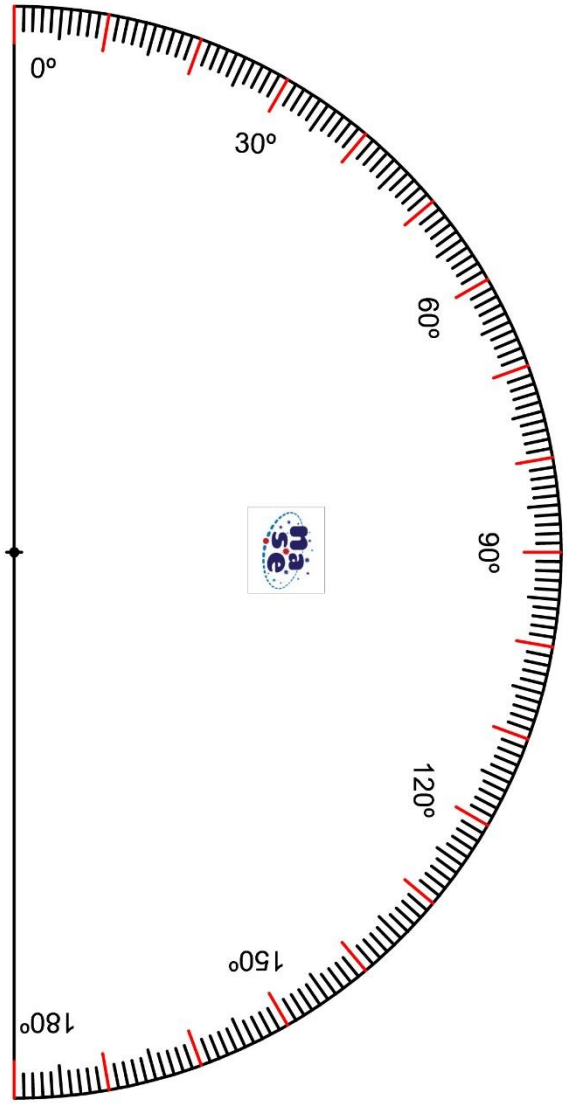


WORKSHOP 4 SOUTH

WORKSHOP 4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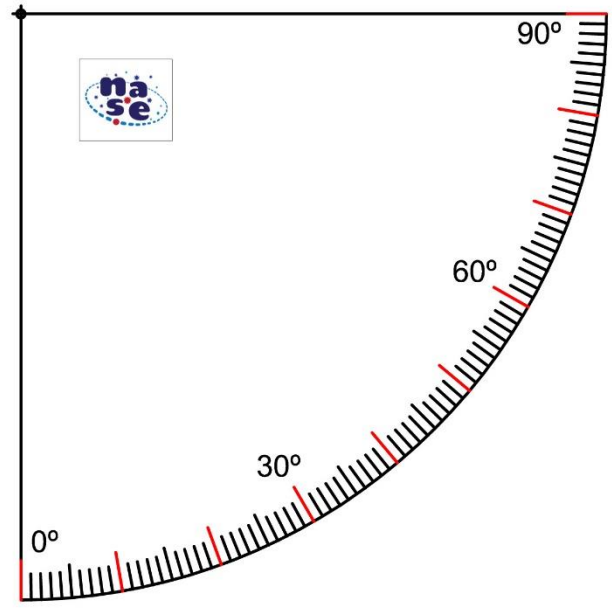
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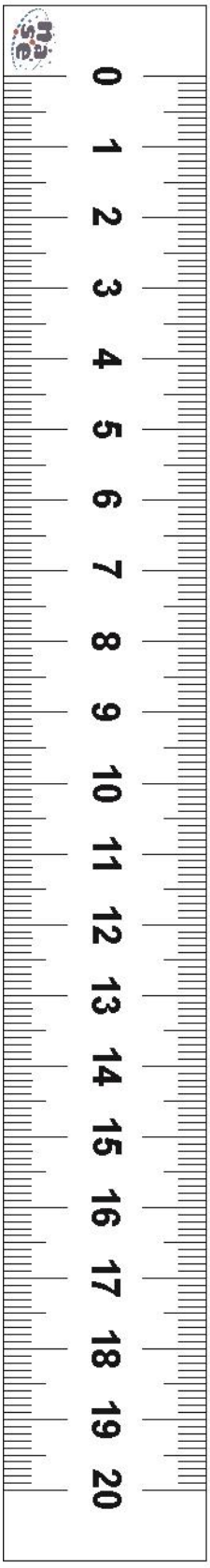
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