



## TEACHING TRAINING COURSE ON ASTROBIOLOGY

- **Lectures Topics**

- 1 – Evolution of the Stars
- 4 – Solar System

- **Workshops Topics**

- 4 – Young astronomer briefcase
- 7 – Astronomy beyond the visible
- 9 – Planets and exoplanets
- 10- Elements of Astrobiology

## **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 nail 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

## **WS7: Astronomy beyond the visible**

### Summary

Celestial objects radiate in many wavelengths of the electromagnetic spectrum, but the human eye only distinguishes a very small part: the visible region.

There are ways to demonstrate the existence of these forms of electromagnetic radiation that we do not see through simple experiments. In this presentation, you will be introduced to observations beyond what is observable with a telescope that can be used in a primary or secondary school.

### Goals

This activity aims to show certain phenomena beyond what may be observable with amateur telescopes, such as the existence of:

- Celestial bodies that emit electromagnetic energy that our eye cannot detect. Astronomers are interested in these other wavelengths because visible radiation alone does not offer a complete picture of the Universe.
- Visible emissions in the regions of radio waves, infrared, ultraviolet, microwave and X-rays.

## List of Materials

### Activity 1: Construction of a spectrograph (spectra)

- Template to make the spectrograph (provided)
- 1 CD out of use (or a DVD)
- Common adhesive or paper tape.
- Strong scissor
- Tack (cutter, stylet, scalpel) for fine cutting.
- Glue to be glued (preferably in a bar)

### Activity 2: Natural decomposition of light (rainbow)

- 1 hose with diffuser
- a patio or garden

### Activity 3: Infrared detection (Herschel)

- 1 large cardboard box (type of sheets for photocopier)
- 1 prism
- 4 laboratory thermometers.
- Common adhesive tape
- clock
- paper, pencil

### Activity 4: IR detection with the mobile

- 1 or more remotes with IR LED
- CCD camera of cellular phone (also serves the digital camera)

### Activity 5: IR detection through interstellar medium

- 1 flashlight with filament bulb (no led)
- a piece of cloth
- mobile phone camera

### Activity 6: Constellation with LEDs

- IR LEDs
- base for installing LEDs
- wire and resistance

### Activity 7: Constellations with remote controls

- Several remote controls (depends on the constellation you want to play)

### Activity 8: Detection of radio waves.

- 1 9V battery
- 2 wires with peeled tips, 20 cm long
- a radio receiver.

### Activity 9: Uses of UV (Black light)

- 1 black light bulb (365nm recommended)
- bills, cards, passports

#### Activity 10: Filter UV radiation (Black light)

- 1 black light bulb (365nm recommended)
- fluorescent material
- piece of glass or glass goggles
- plastic or organic glasses, tickets

## WS9: Planets and exoplanets

### Summary

This workshop provides a series of activities to compare the many observed properties (such as size, distances, orbital speeds and escape velocities) of the planets in our Solar System. Each section provides context to various planetary data tables by providing demonstrations or calculations to contrast the properties of the planets, giving the students a concrete sense for what the data mean.

At present, several methods are used to find exoplanets, more or less indirectly. It has been possible to detect nearly 4000 planets, and about 500 systems with multiple planets.

### Goals

- Understand what the numerical values in the Solar System summary data table mean.
- Understand the main characteristics of extrasolar planetary systems by comparing their properties to the orbital system of Jupiter and its Galilean satellites.

### List of Materials

#### Activity 1: Scale of distances to the Sun

- 1 piece of calculating machine paper of just over 4.5 meters
- 1 roll of toilet paper of more than 30 units

#### Activity 2: Diameter model

- 1 piece of yellow paper or yellow cloth to cut a circle of 1.39 m in diameter
- Paintings to draw the planets or paper with different colors to cut the disks of different sizes

#### Activity 3: Model of distances and diameters

- 1 basketball ball
- 2 pins of 1 mm head
- 2 pins of 2 mm head
- 1 ping pong ball
- 1 golf ball
- 2 glass marbles

#### Activity 4: Model in the city

- 1 map of the city
- 1 calculator

#### Activity 5: Model of times

- 1 calculator

Activity 6: Sun from the planets

- 1 circles template

Activity 7: Density model

- 3 similar fragments of pyrite
- 3 similar fragments of sulfur
- 1 fragment of clay
- 1 fragment of pine wood
- 1 fragment of blende

Activity 8: Flattening Model

- Cardboard
- 1 stick 50cm long and 1cm in diameter

Activity 9: Rotational model

- 1 a meter string
- 1 lead or something that weighs a little and can be easily tied

Activity 10: Model of superficial gravities

- 1 mechanical bath scale (other than electronic) for each planet
- 1 pliers to open the scale
- 1 card
- 1 marker

Activity 11: Model of craters

- 1 pack of 1 kilo of flour
- 1 pack of 400 gr of cocoa powder. Those that are difficult to dissolve are better, those that are difficult to dissolve in the milk
- 1 fine sieve
- 1 old newspaper
- 1 soup spoon

Activity 12: Escape velocity model

- 1 tube of pills or medicines whose lid has no thread but is under pressure. It also serves a tube of food for fish, a capsule of photographic film
- Water and an effervescent pill
- Bicarbonate and vinegar
- Coca cola and mentos

Activity 13: Doppler Effect

- 1 transparent plastic box
- 1 stopper with chair
- Flash of 1 mobile

Activity 14: Transit simulation

- 1 large ball about 10 cm
- 1 small ball about 2 cm

#### Activity 15: Simulation of micro lenses

- 2 wine glass feet
- 1 small ball about 1 cm

#### Activity 16: Model of solar system and exoplanets

- 1 extensible meter
- 1 little ball of 0.2 cm
- 1 little ball of 0.3 cm
- 2 little ball of 0.6 cm
- 2 balls of 2.5 cm
- 1 ball of 6 cm
- 1 ball of 7 cm
- 1 paper lamp of 35 cm
- 1 ball of 5.5 cm
- 1 ball of 7 cm
- 1 ball of 9 cm
- 1 ball of 10 cm
- 1 paper lamp of 45 cm
- 1 little ball of 0.8 cm
- 1 little ball of 1.1 cm
- 1 little ball of 1.6 cm
- 1 ball of 10 cm
- 1 little ball of 0.7 cm
- 1 little ball of 1.7 cm
- 1 little ball of 1.8 cm
- 1 ball of 2 cm
- 1 ball of 2.4 cm
- 1 paper lamp of 22 cm
- 2 little ball of 1.0 cm
- 1 little ball of 1.2 cm
- 1 little ball of 1.3 cm
- 2 little ball of 1.4 cm
- 1 little ball of 1.5 cm
- 1 ball of 4 cm

## **WS10: Elements of Astrobiology**

### Summary

This workshop is essentially divided into two parts. The necessary chemical elements for life, a simple study of the periodic table corresponding to the objectives of this work and some concepts of astrobiology are introduced.

### Goals

- Understand where from or how the different elements of the periodic table arise
- Understand the main characteristics of extra-solar planetary systems.
- Understand the habitability conditions necessary for the development of life
- Study the minimum guidelines of life outside the Earth.

### List of Materials

Activity 1: Formation of the planetary system from gas and dust

- no material

Activity 2: Periodic table classification

- 3 basket (blue, yellow, red)
- 1 golden ring
- 1 drill bit coated with titanium
- a child's balloon with helium inside
- 1 pan scourers of nickel
- 1 mobile/button battery
- 1 car spark plugs
- 1 electric cooper wire
- 1 iodine solution
- 1 water bottle
- 1 old cooking pan
- 1 black pencil lead
- 1 sulfur for agriculture
- 1 can of soft drink
- 1 wrist watch of titanium
- 1 silver medal
- 1 pipe lead
- 1 zinc pencil sharpener
- 1 thermometer
- 1 matchbox

Activity 3: Children of the stars

- no materials

Activity 4: Liquid water on Mars?

- 1 disposable syringe of 10 ml
- Hot water close to boiling

Activity 5: Oxygen production by photosynthesis

- 1 punch
- 2 sheets of spinach
- 25g of sodium bicarbonate
- 1 disposable syringe of 10 ml
- 1 disposable syringe of 20 ml
- 1 foil of red cellophane paper
- 1 foil of blue cellophane paper
- 2 light bulb (not less than 70W) better led
- 2 lamps to put both light bulbs
- 1 tablespoon of yeats (to make bread)
- 10 tablespoon of sugar
- 1 glass of warm water (between 22°-27°)
- 6 zip bags
- 1 tablespoon of sodium bicarbonate
- 1 tablespoon of sodium chloride (common salt)



- 1 tablespoon of vinegar or lemon
- 4 or 5 ice's rocs
- 1 UV lamp (used to grow up vegetables)

Activity 6: Life in extreme conditions.

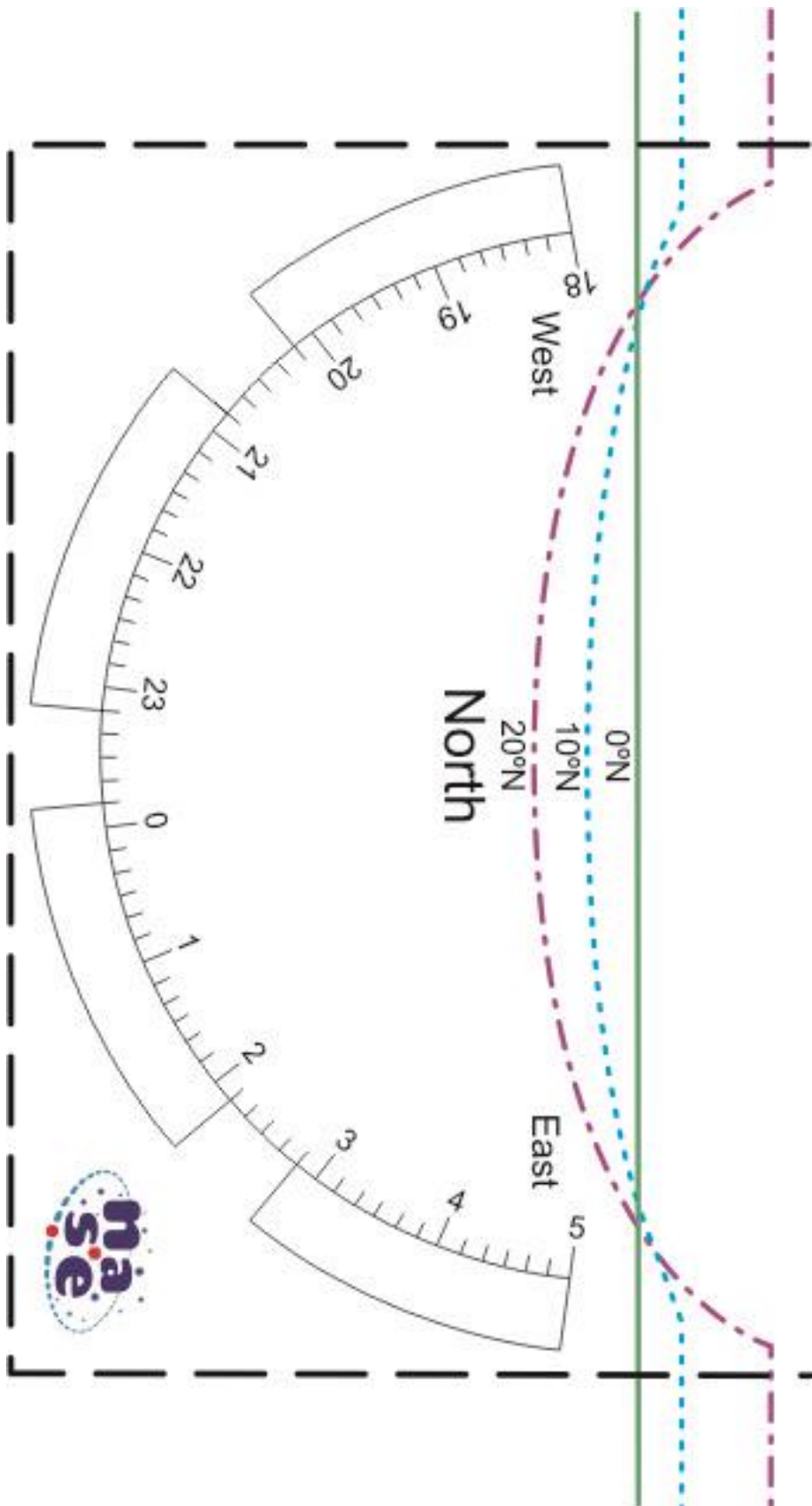
- 1 small packet of yeast to make bread (1 tablespoon is enough)
- 1 glass of warm water (between 22° and 27°)
- 10 tablespoon of sugar that will be consumed by microorganisms
- 1 disposable syringe of 20 ml.
- 6 zipper bags
- 1 tablespoon baking soda
- 1 tablespoon of sodium chloride (common salt)
- 1 tablespoon vinegar or lemon juice
- 10 or 12 pieces of ice
- 1 UV lamp (used to grow vegetables)

Activity 7: DNA extraction.

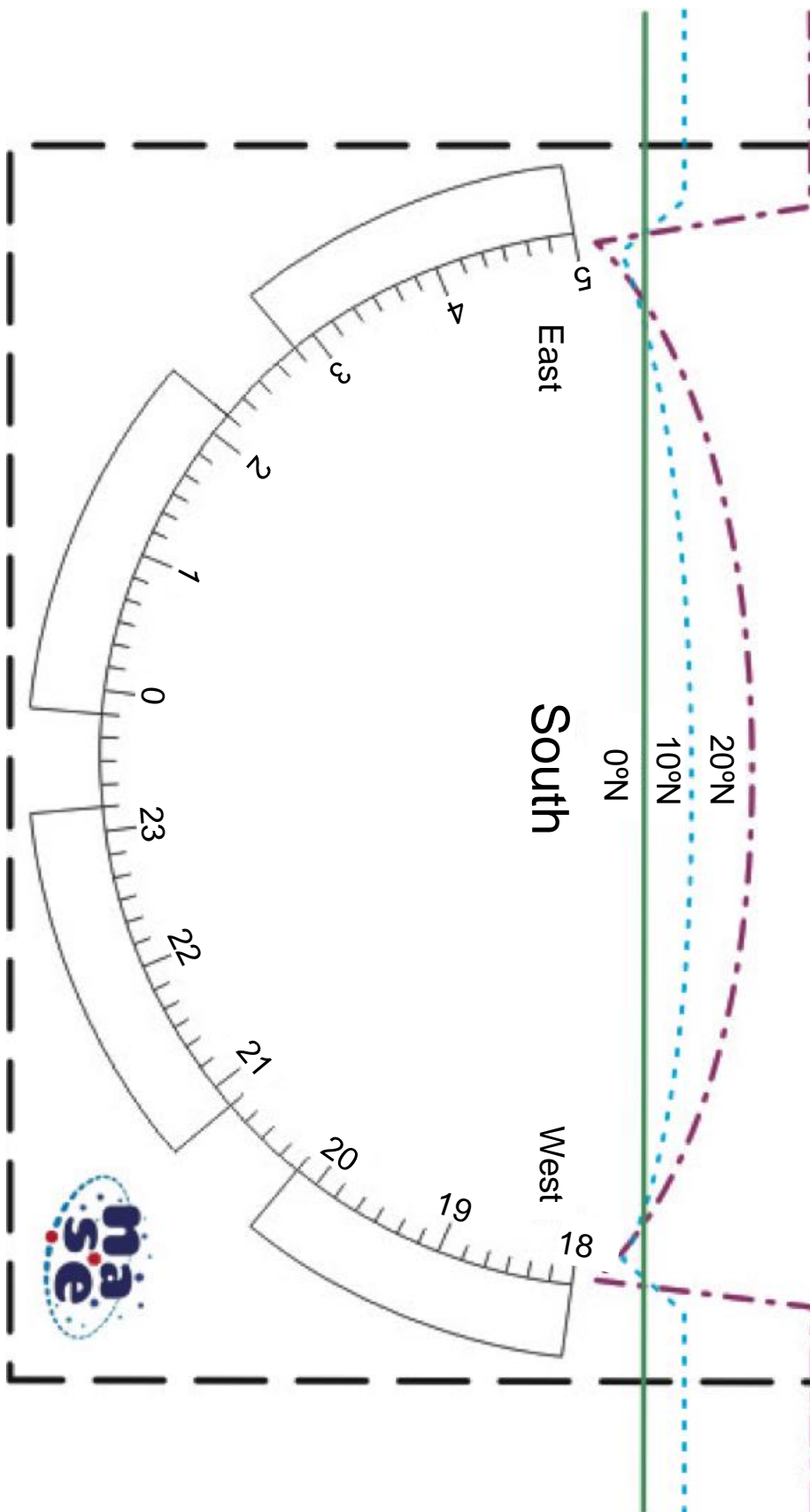
- ½ glass of water
- 1 tablespoon of salt
- 3 tablespoons of baking soda
- dishwasher jet
- 1 ripe tomato
- 1 spoon
- 1 fork
- 1 strainer
- 2 glasses
- 1 shot of alcohol

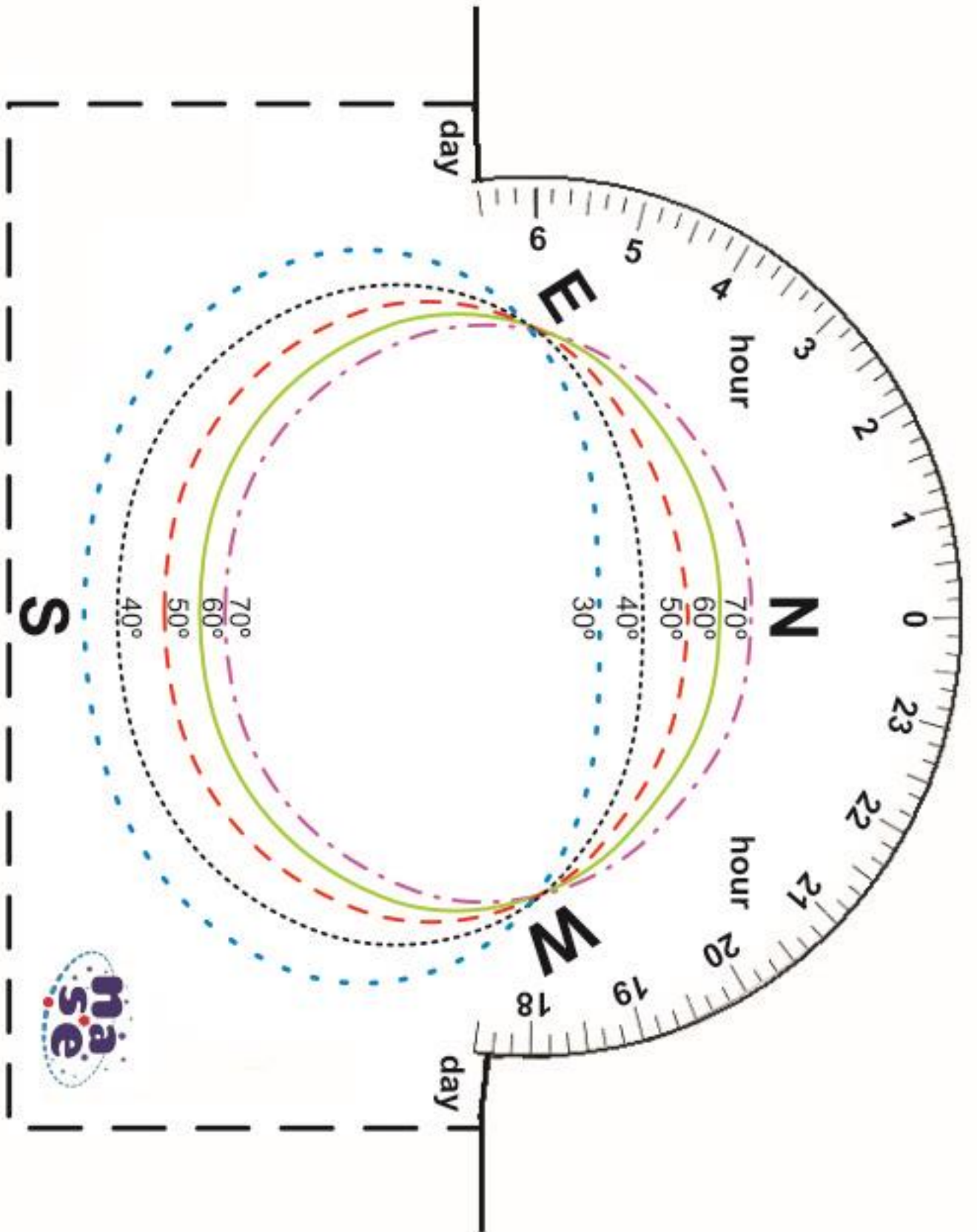
Activity 8: Looking for a second Earth

- no materials

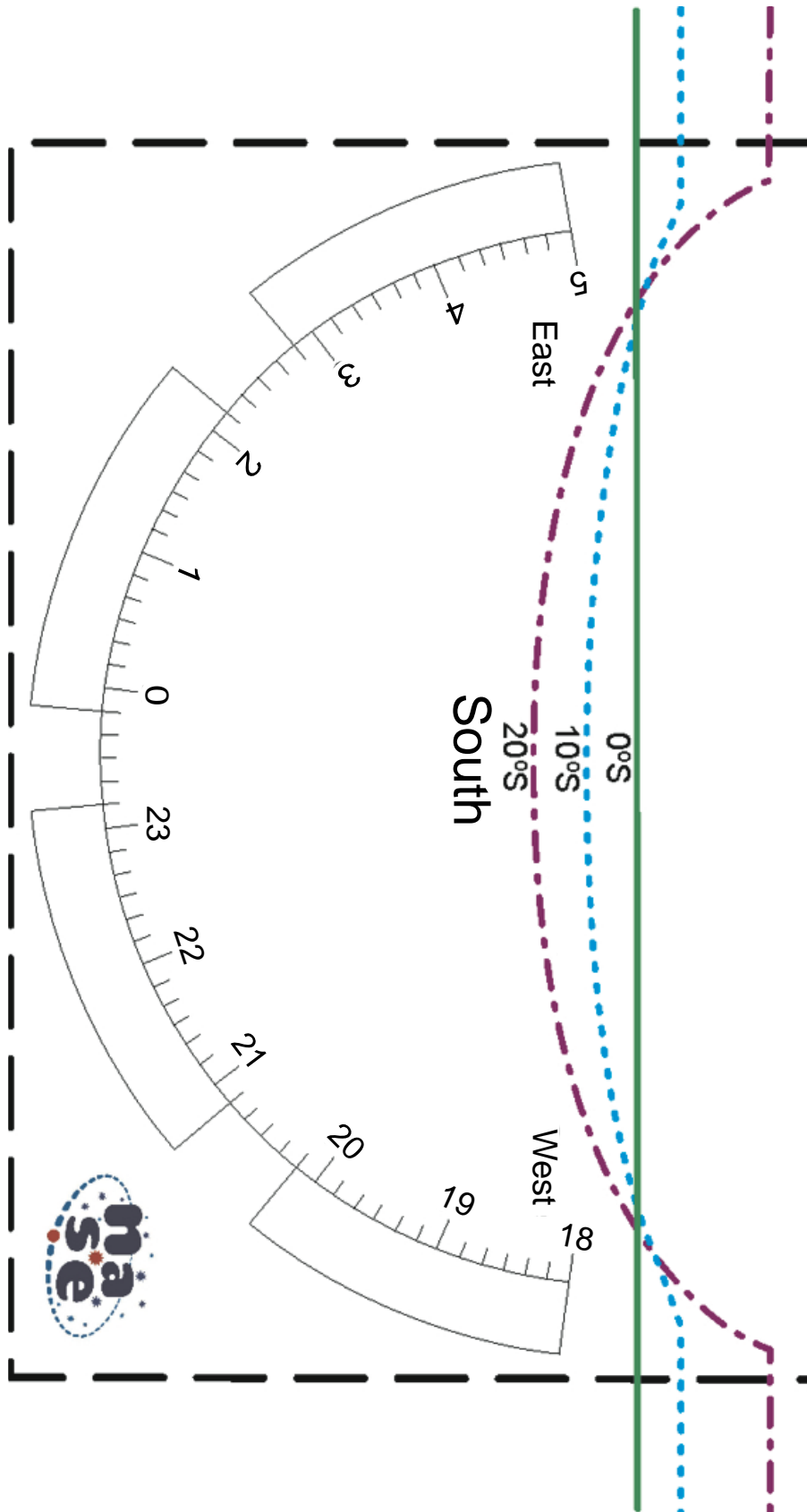


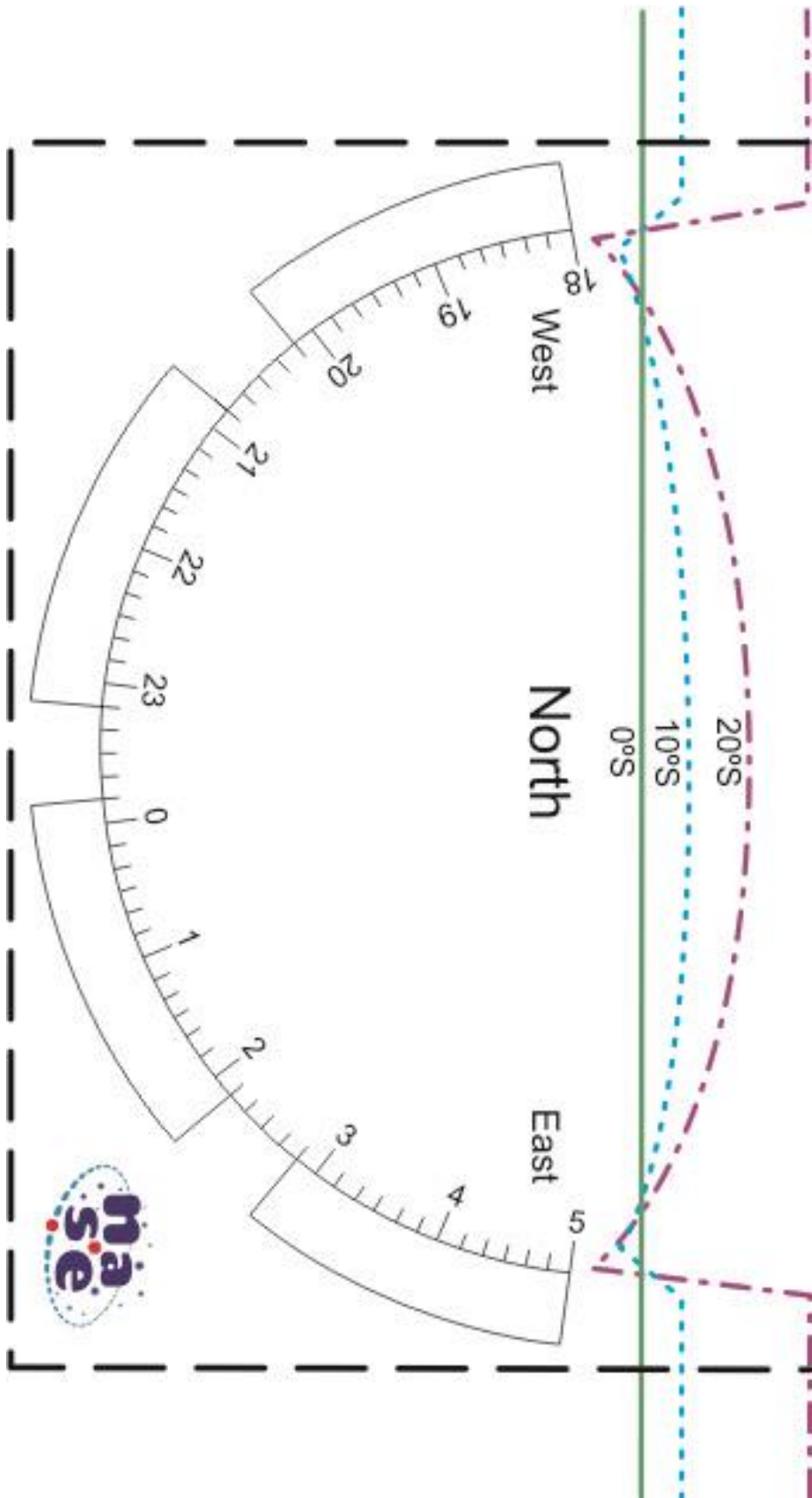
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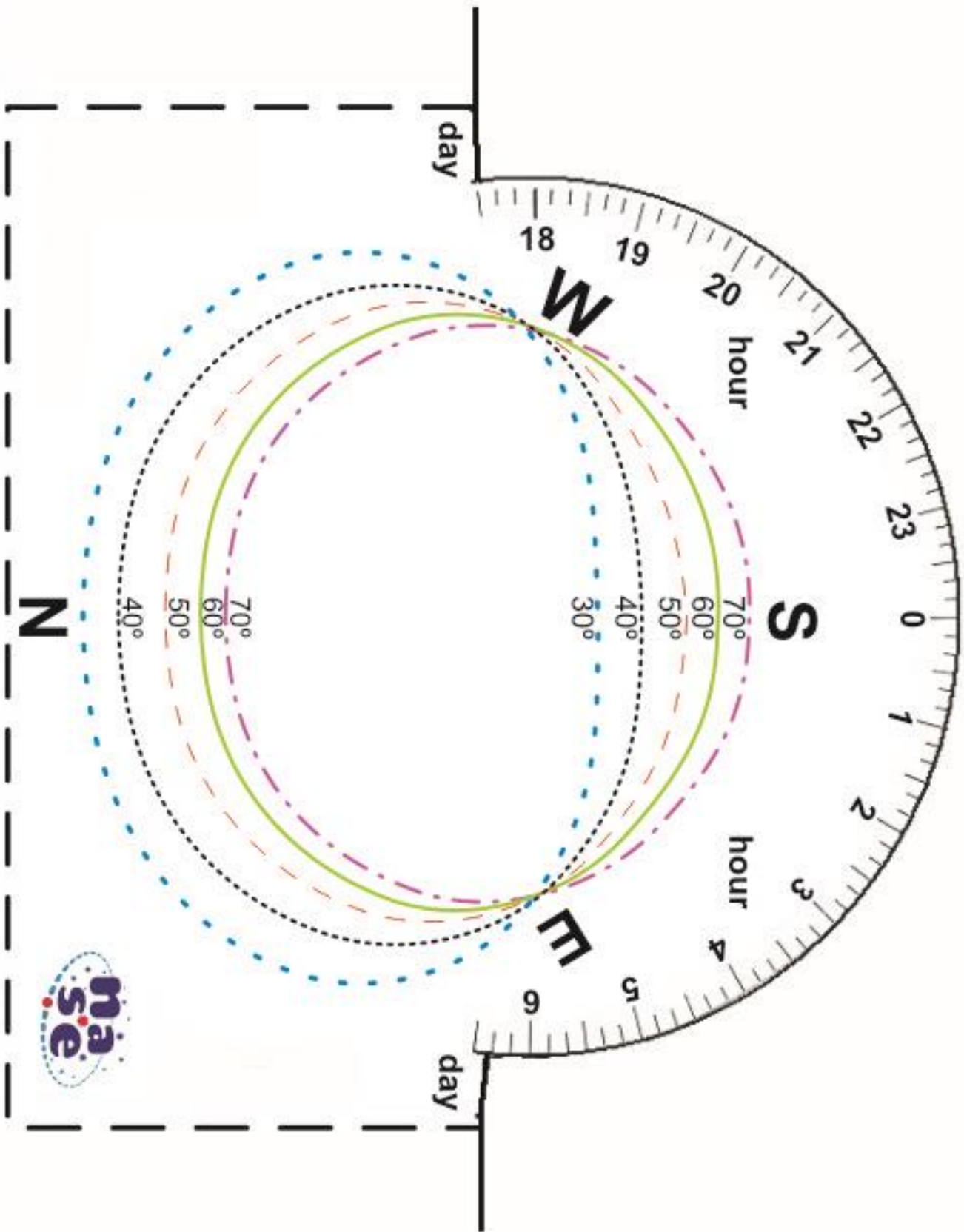
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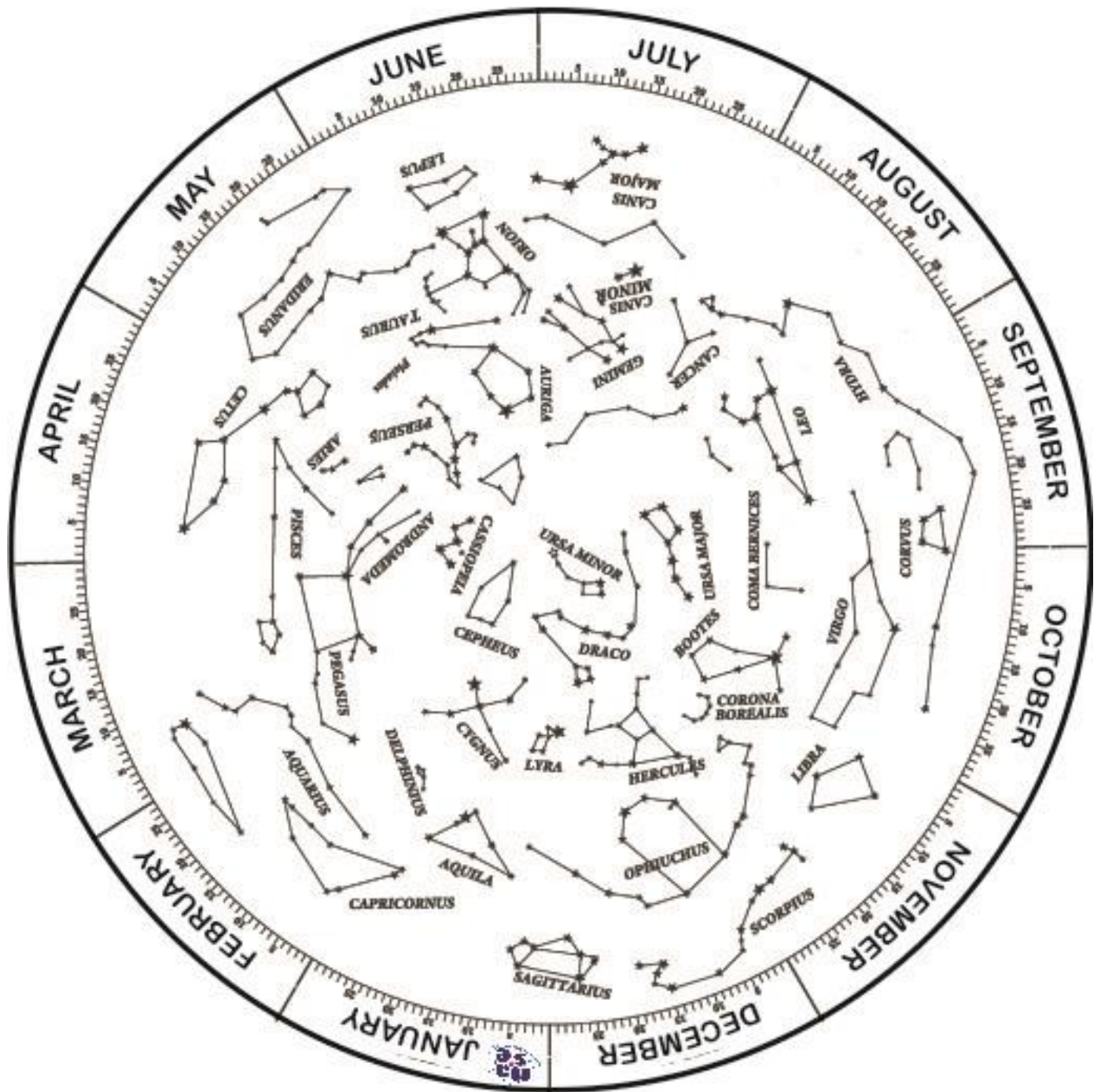




WORKSHOP 4 SOUTH 0-20N

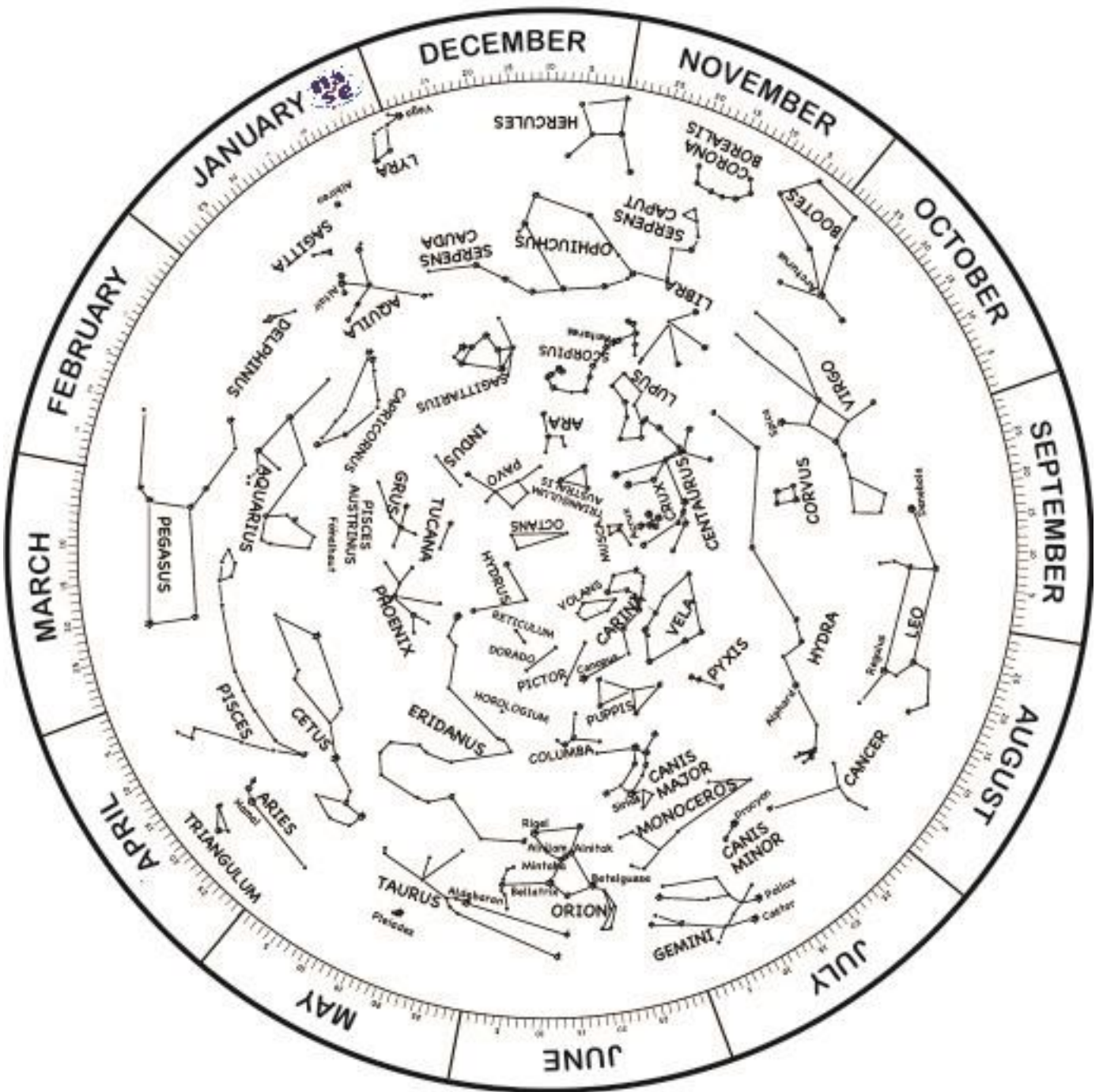
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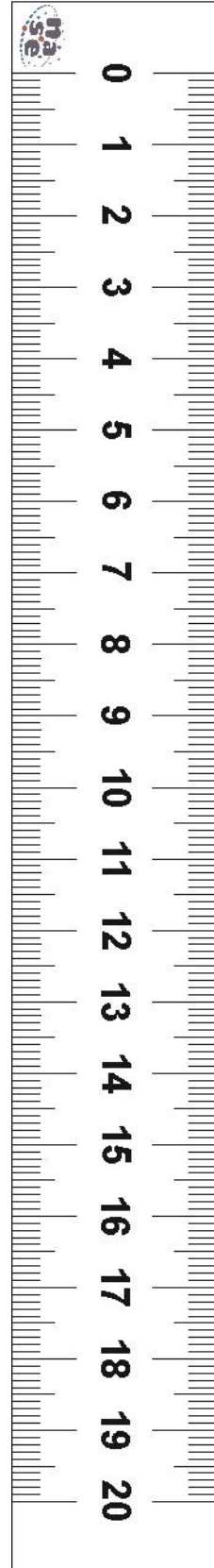
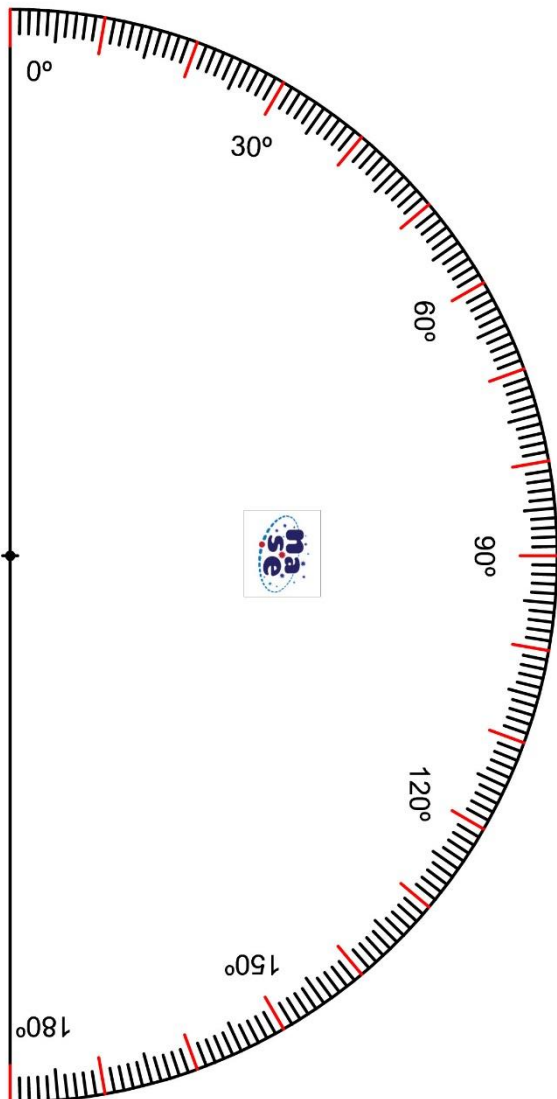
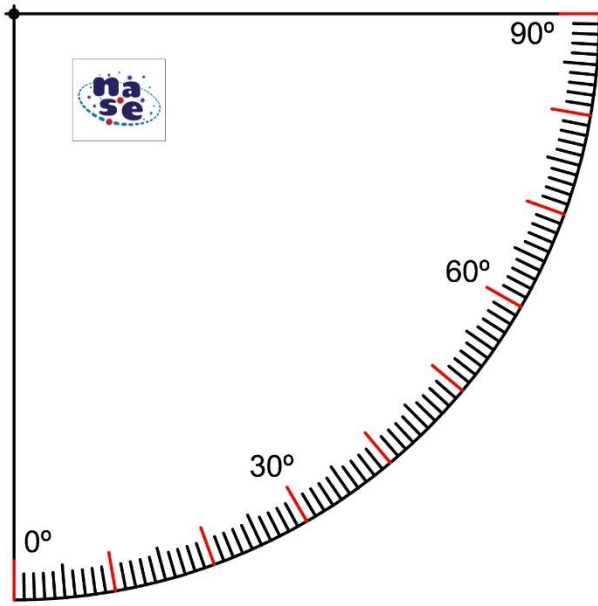
WORKSHOP 4 NORTH





WORKSHOP 4 SOUTH

WORKSOP 4



WORKSHOP 7

