VIRTUAL PATHWAYS

Galileo’s New World

Pre-visit

(Primary and Middle schools, age 9-13)

Introduction

This is the support document for the pre-visit phase of the Educational Pathway "*Galileo's New World*" aimed at both teachers and students.

Short description
The activity, structured in three phases (pre-visit, visit and post-visit) is an excursus on the history of astronomy from pre-telescopic era to the first Scientific Revolution, with a focus on Galileo's observations with the telescope.

Target audience
Teachers and students from last years of Primary school to the end of Middle school (age 9-13)

Estimated time required for the activity
In school: 5-6 hours (2-3 pre-visit and 3 post-visit)
In the museum (on site or virtually): 1,5 hour

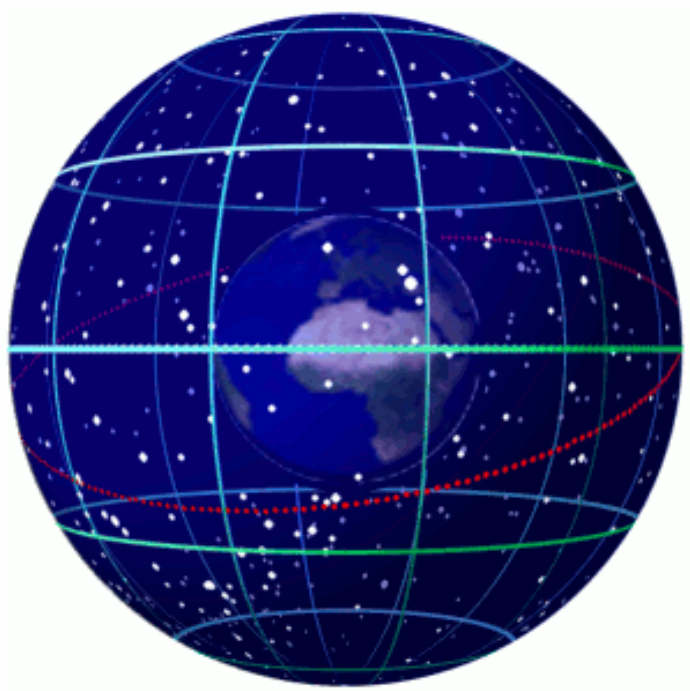
For more information visit:
https://www.virtualpathways.eu/

https://www.museogalileo.it/en/library-and-research-institute/projects/european-projects/2134-virtual-pathways.html

The Celestial Sphere, a Dome Above Us

What does the sky look like at night?

If we observe the sky on a bright starry night we will notice that the stars appear to be moving. They all move together in a uniform and regular way. It feels like a revolving dome, the celestial sphere, with thousands of lights embedded in it. Of course, this is an illusion: there is no dome above us, the stars are far away from us and very distant from each other. What we see is simply the effect of the rotation of our planet Earth on its axis.
In order to realize this, let us imagine we are on a merry-go-round at the amusement park: looking around we see the surrounding world spinning rapidly around us. While at the amusement park we do not need to remind ourselves that we are on a carousel, on our own planet this effect has deceived people for hundreds of years, giving them the illusion of a celestial vault that instead revolves around a motionless Earth in the center of the Universe.



Earth spinning within a celestial sphere.
CC BY-SA 3.0 Tfr000

Raffaello Sanzio, *Prime Mover* (ceiling panel), Stanza della Segnatura, Vatican Museums. The stars on the celestial vault were always represented as they would appear to someone observing the celestial sphere from the outside

The celestial sphere
https://catalogue.museogalileo.it/indepth/CelestialSphere.html

The Earth like a Spinning Top

If the Earth rotates on its axis and also revolves around the Sun in a continuous movement, why don't we fly off?

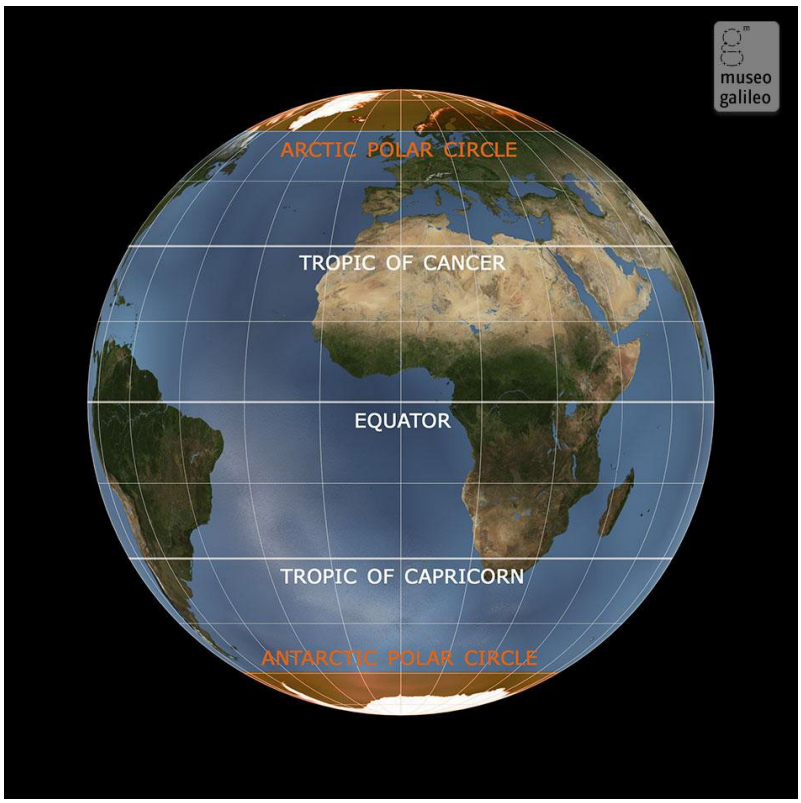
Our planet, just like a spinning top, rotates around its axis from west to east, that is counterclockwise, in 23 hours and 56 minutes and 4 seconds. This movement is known as rotational motion.
In addition to spinning on its axis the Earth also orbits around the Sun, at a speed of 30 km per second, in a continuous and constant motion called motion of revolution.
We do not fly off due to the force of gravity. The Earth, in fact, exerts on all objects that it contains a very strong attraction that keeps us anchored to the ground and prevents us from flying into space.
Furthermore, since the motion of rotation and the motion of revolution are constant, we who are on Earth do not notice either of the two movements except for the fact that every day is followed by night hours.

Gravitational force
https://catalogue.museogalileo.it/indepth/GravitationalForce.html

We need basic coordinates...

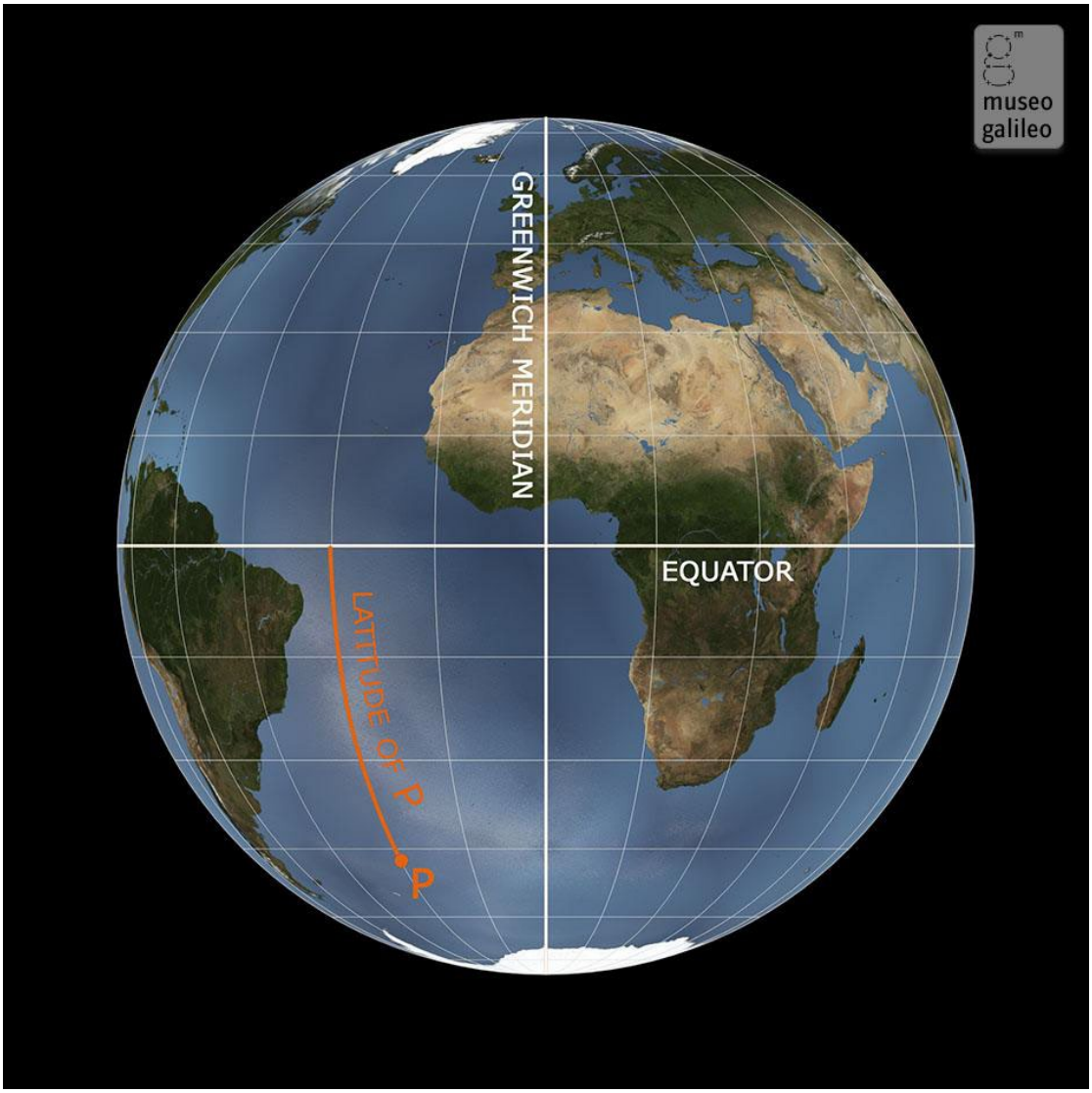
How do we determine a point on the Earth's surface?
What are the Earth's coordinates?

Meridians and Parallels are imaginary lines that map scholars, known as cartographers, have drawn on the Earth's surface to help us orient ourselves. They divide the surface of the Earth as if it were a grid into many horizontal and vertical lines.
The horizontal lines are the Parallels; they constitute the circumferences parallel to the equator, the line perpendicular to Earth's axis. The equator is the fundamental parallel and, by convention, divides the Earth into two hemispheres, the Northern Hemisphere where we live, and the Southern Hemisphere.
Other very important parallels are the Tropic of Cancer (north of the Equator) and the Tropic of Capricorn (south of the Equator), which correspond to the places of the summer and winter solstices, i.e. where the sun's rays fall perpendicularly on the occasion of the two astronomical events.



Parallels. Museo Galileo, Florence

The distance of a point from the Equator is called latitude, it is measured in degrees. It is North if the point is above or South if it is below it.



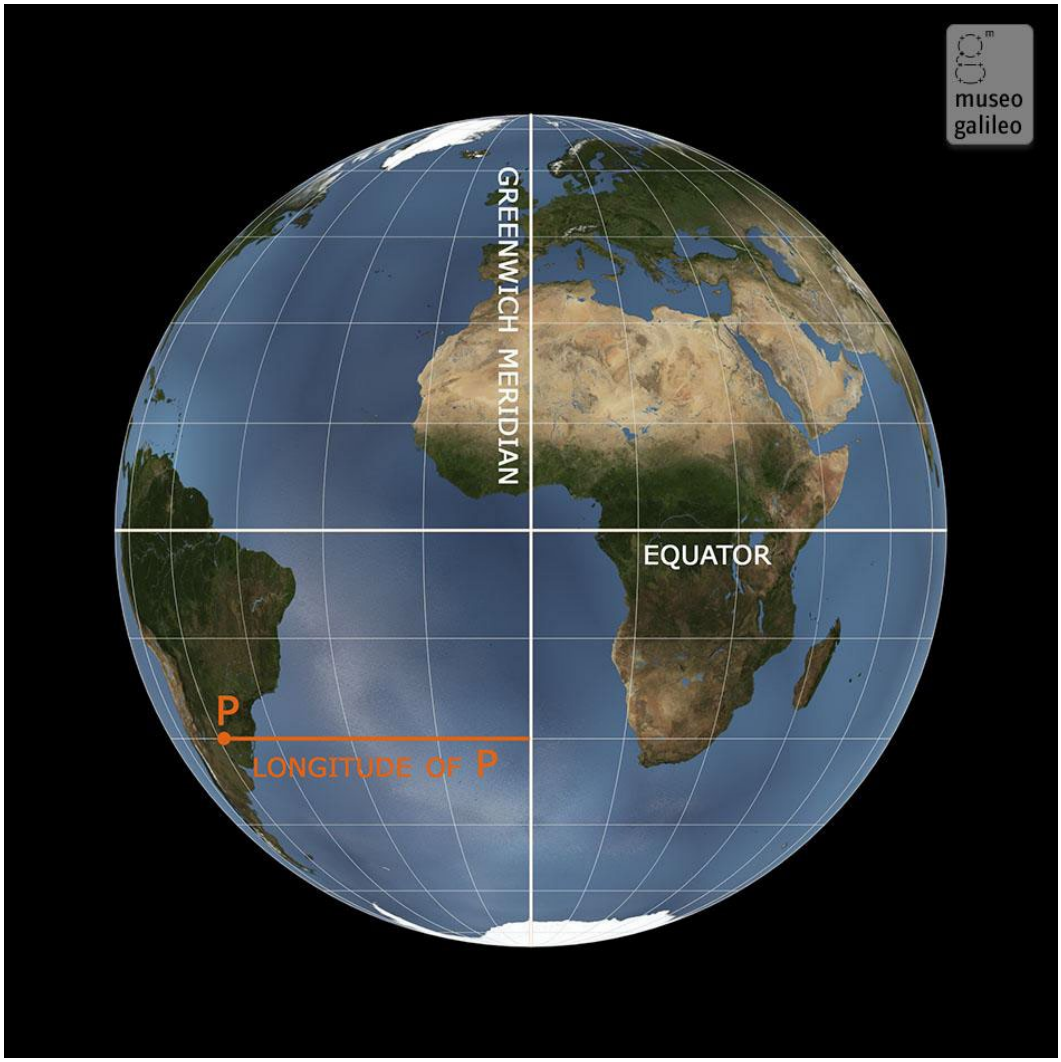
Latitude. Museo Galileo, Florence

The vertical lines, the Meridians, are imaginary circles that connect the Earth's North Pole with the South Pole; they are all of equal lenghts and therefore to identify them the meridian through Greenwich, near London, was chosen as the Prime Meridian, at zero degrees of longitude.

Do not forget that the Earth is spherical and therefore for each point there is another exactly opposite on the other side of the planet.
By convention, each circle is divided into two opposite semicircles: we will have

the meridian, the semicircle that goes from the North Pole to the South Pole and the antimeridian, the semicircle exactly opposite the meridian.

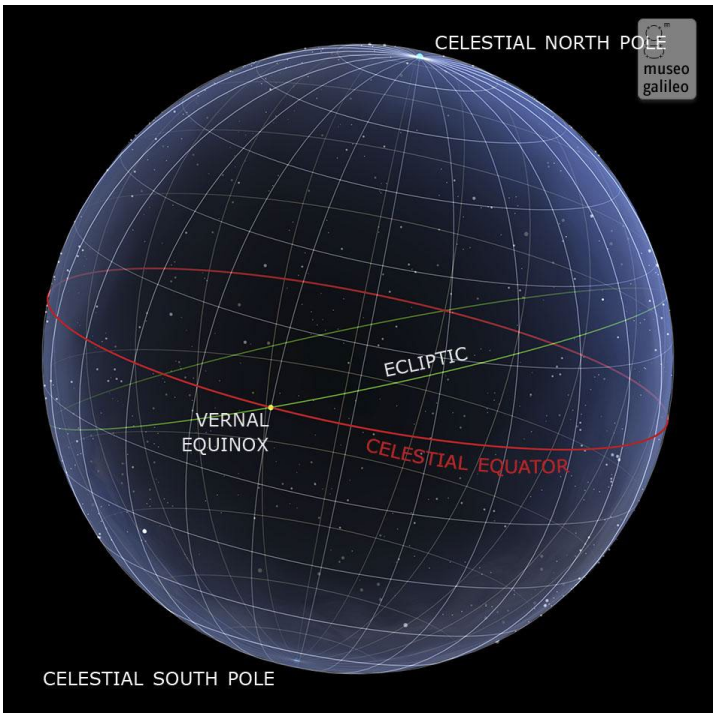
The distance of a point from the Greenwich meridian is called longitude, it is measured in degrees and will be East if the point is on the right or West if it is on the left. Specifically it indicates the angular distance of a point from the above mentioned meridian. It is measured in degrees.



Longitude. Museo Galileo, Florence

What about the celestial coordinates and why is it important to know about the celestial sphere?

Because the celestial sphere is used in astronomy to determine the distance of a point from the Earth and its celestial coordinates which, just like the terrestrial ones, are latitude, longitude and altitude. The terrestrial equator is also ideally prolonged on the celestial sphere and called the celestial equator which divides it into two hemispheres, the northern one and the southern one. The same happens also for the meridians and for the terrestrial parallels that are extended to the celestial sphere and are therefore also considered as "celestial".



Celestial equator. Museo Galileo, Florence

Latitude / longitude
https://catalogue.museogalileo.it/indepth/LatitudeLongitude.html

Latitude
https://mostre.museogalileo.it/framauro/en/land-and-sea/latitude.html

Longitude
https://mostre.museogalileo.it/framauro/en/land-and-sea/longitude.html

Introduction to Galileo

Who was Galileo?

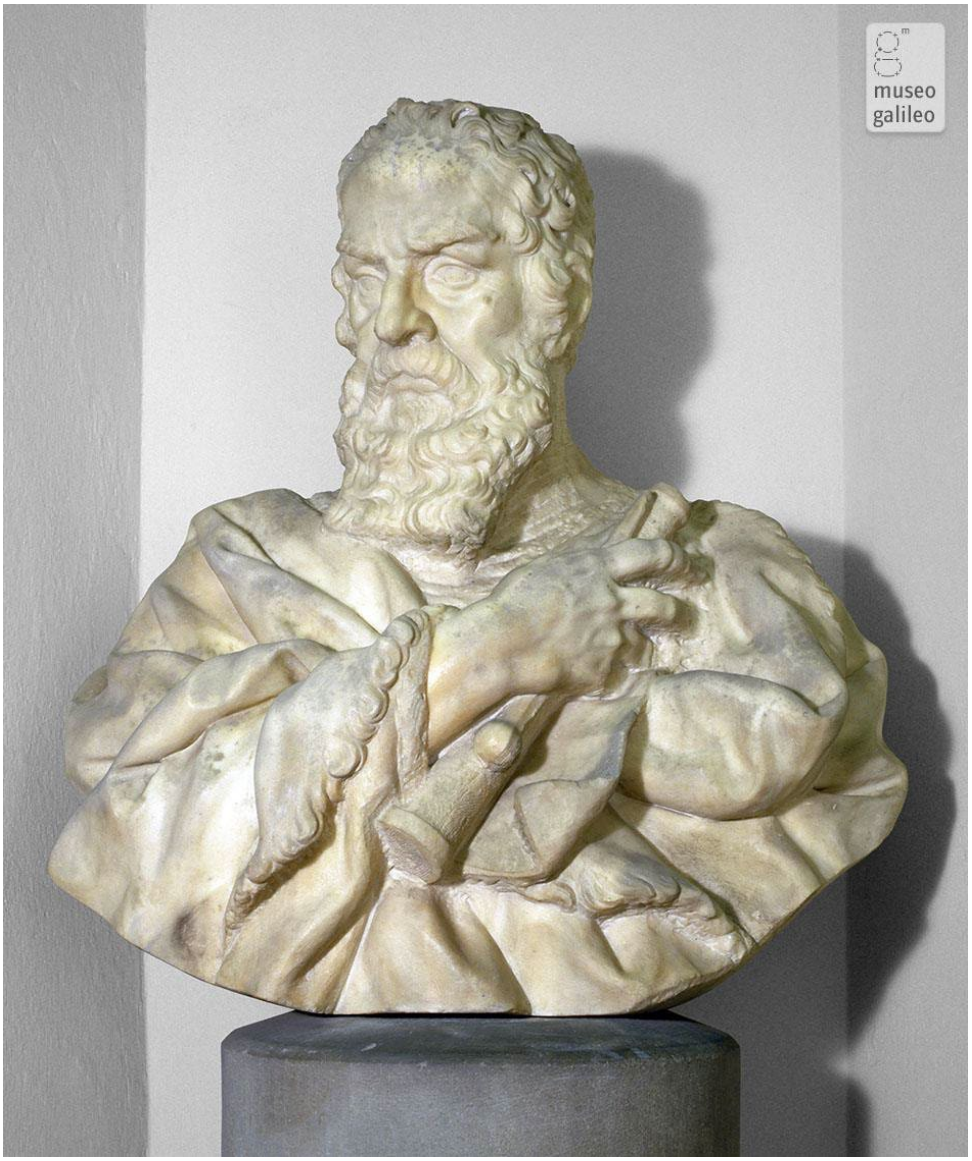
Born in Pisa on February 15, 1564, Galileo is considered the father of modern science for a number of reasons:

- the importance of his astronomical discoveries
- his intuitions about the motion of bodies
- his idea and ability to demonstrate experimentally the direct observation of phenomena

In the spring of 1609 Galileo came into possession of an innovative object that was sold in Venice as a toy: a short tube with two lenses at each end that allowed distant objects to be seen as if they were at a closer distance.

He was fascinated by it and set about perfecting it, quickly achieving very positive results. As early as November of the same year, he succeeded in making a telescope capable of magnifying 20 times, far more powerful than any other telescope circulating in Europe at the time.

With his telescope, Galileo made observations that changed the way we see the world.



Carlo Marcellini, Bust of Galileo Galilei. Museo Galileo, Florence

Galileo Galilei
https://catalogue.museogalileo.it/biography/GalileoGalilei.html