



PRESENTATION OF THE EXHIBITION ON THE SCIENCE OF GALILEO GALILEI

GALILEO GALILEI

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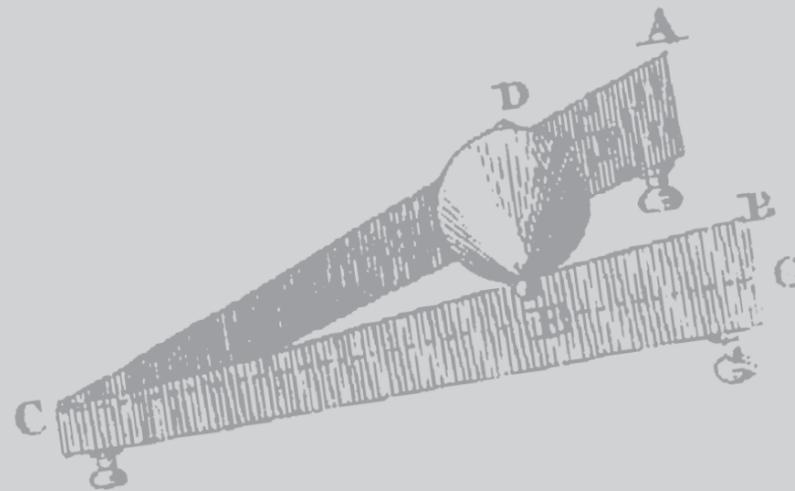
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INTRODUCTION

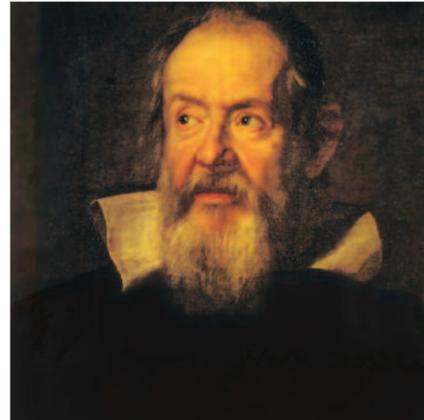
Galileo Galilei was an Italian natural philosopher, astronomer and mathematician who made fundamental contributions to the sciences of motion, astronomy, strength of materials and to the development of the scientific method. His formulation of (circular) inertia, the law of falling bodies, and parabolic trajectories marked the beginning of a fundamental change in the study of motion.

He changed the study of natural philosophy from a verbal, qualitative account (the Aristotelian way) to a mathematical one. He followed in the footsteps of Archimedes, and his discoveries are just as revolutionary. Experimentation combined with mathematics became a recognised method for discovering the facts of nature. Finally, his discoveries with the telescope paved the way for the acceptance of the Copernican heliocentric system (Sun in the centre of the planetary system). These revolutionary ideas resulted in an Inquisition against Galileo and imprisonment, for which the Church apologised in the 1990s.





THE LIFE OF GALILEO (CONDENSED)



Galileo Galilei was born in Pisa (which was at that time part of the Duchy of Florence) Italy, on 15 February 1564, to Florentine parents Vincenzo Galilei, a famous lutenist, music theorist and composer of the court, and Giulia degli Ammannati.

In 1581 he enrolled at the University of Pisa to study Medicine and became interested in Physics.

In 1583 Galileo conceived the Theory of pendulum isochronism, while observing the oscillations of a chandelier in the Cathedral of Pisa

In 1586 Galileo invented the Hydrostatic balance.

In 1588 Galileo was appointed to the chair of mathematics at the University of Pisa, writing his treatise "De Motu" (On Motion).

In 1592 Galileo was appointed to the chair of mathematics, geometry and astronomy at the University of Padua, turning his attentions towards the Copernican theory of planetary motion.

In 1602 Galileo conducted experiments on accelerated motion using pendulums.

In 1606 Galileo invented the Thermoscope, a primitive thermometer.

In the following years he devoted himself to the study of hydrostatics and resistance of materials and described the parabolic trajectories of projectiles.

In 1609 Galileo began to take an interest in a new instrument that was built in Holland: the telescope. After making improvements to it, Galileo made a series of observations of the

moon sketching the first ever images of the mountains on the moon. Later that year he observed the "bright little stars" orbiting Jupiter that were later named: Europa, Io, Ganymede and Callisto.

In 1611, Galileo was admitted to the Accademia dei Lincei. By that time it was clear that Galileo's discoveries supported the Copernican theory (including the orbit of the Earth around the Sun) and refuted the Ptolemaic theory of motion that had been officially adopted by the wider scientific and religious communities of the day. This caused disputes to arise and the Roman Inquisition declared Copernican theory as heretical and Pope Paul V formally forbade Galileo from supporting it.

In April 1630, Galileo finished writing his treatise "A dialogue on the two greatest systems of the world", in which he compares Copernican and Ptolemaic theories. He later agreed that changes be made to his work by the Vatican in order for his treatise to be published.

In 1632 Pope Urbano VIII, after having examined Galileo's treatise, prohibited its distribution and ordered the Inquisition to bring forth a formal trial against Galileo for heresy.

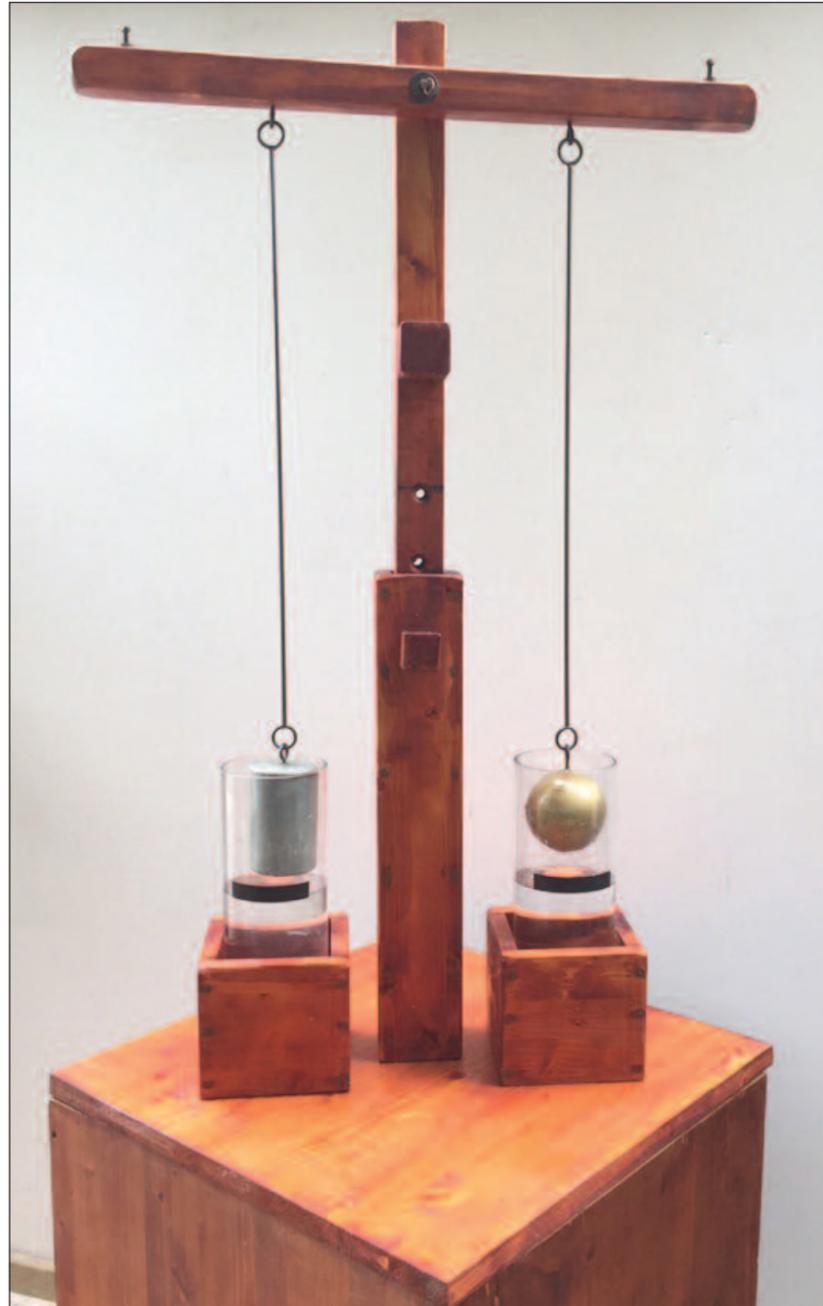
In 1633, Galileo was tried and forced to publicly renounce Copernican theory before being sentenced to life in prison. As he was elderly and sick by this time Galileo was allowed to serve his sentence in his villa near Florence.

Galileo Galilei died on January 8, 1642, in his house in Arcetri, Tuscany aged 77.

MODELS

HYDROSTATIC BALANCE

Galileo invented a method to calculate the specific mass density of objects by resuming the studies begun by Archimedes on floating bodies. He improved it by attaching a scales system that measures the hydrostatic thrust (force) caused by the water displaced by body inserted in the water.



STEELYARD SCALES

This set of scales (still used in markets today) balances unequal weights by using a beam with unequal arms, a fixed fulcrum, a counterweight and a single pan. The measurement of the weight is possible because of the Law of Levers.



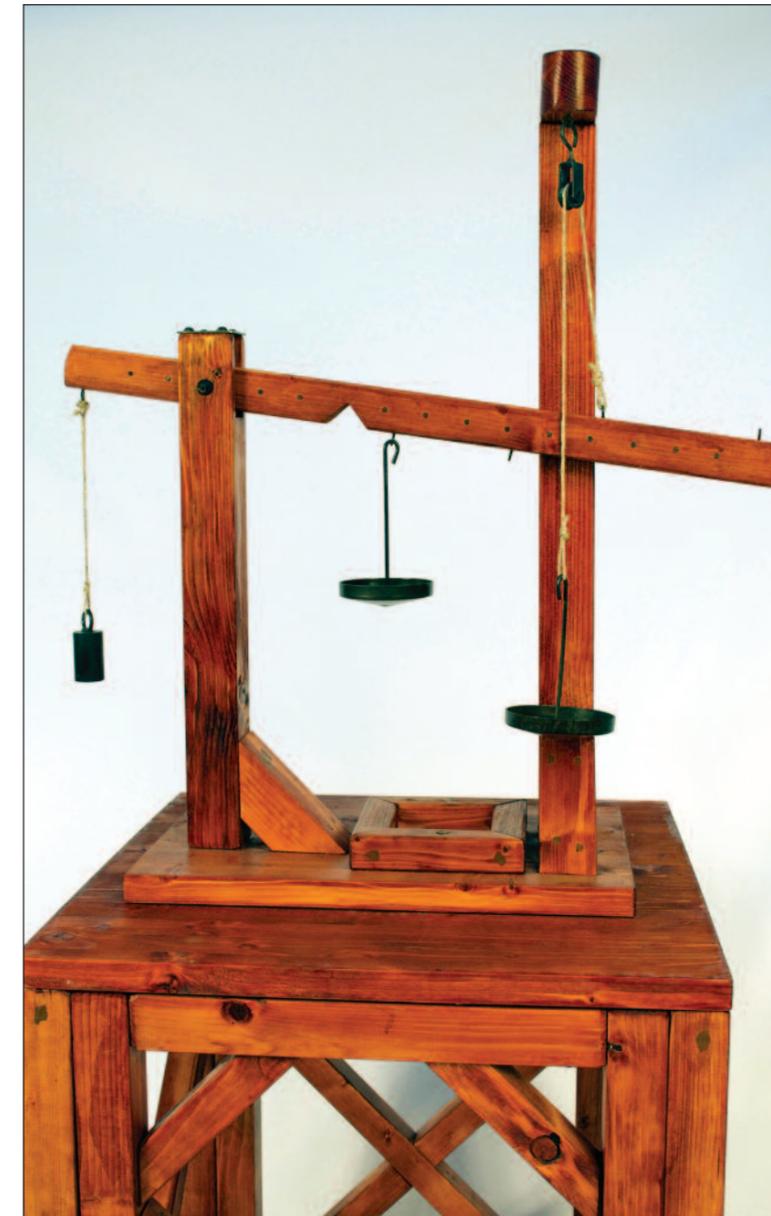
GALILEO'S BALANCE - 1ST ORDER

The balance (scale) is an instrument based on the lever. There are 3 types of levers hence there are 3 orders of scales. With this model Galileo demonstrates a first-order scale. In the first lever type the fulcrum (F) is located on the beam between the effort (E) and the load (L). This scale is commonly called steelyard because the two lever arms on either side of the fulcrum are of different length. It serves to show that despite the arms being joined at an obtuse angle, the weight and counterweight can be made to balance.



GALILEO'S BALANCE - 2ND ORDER

With this model Galileo demonstrates a second-order scale, based on a second-type lever where the load (L) is applied between the fulcrum (F) and the effort (E). An example of this is the wheelbarrow.



GALILEO'S BALANCE - 3RD ORDER

With this model Galileo demonstrates a third-order scale, based on a third-type lever where the effort (E) is located between the fulcrum (F) and the load (L).
An example of this is your arm or a tool that extends your arm (such as the broom).



TESTING THE LAW OF GRAVITY

Using inclined planes and geometry, Galileo examined the motion of objects under gravity by:
a) rolling a small ball down an inclined plane and measuring the time taken against the distance travelled;
b) rolling a heavier ball and measuring the time taken against the distance travelled. Astonishingly he found that regardless of their weight, both balls fall faster and faster at the same rate (i.e, same acceleration).

You can test this fact by letting go of the 2 balls simultaneously (at the same time). One is made of light wood and the other of stone. Make sure each ball is in one of the two tracks of the inclined plane provided. What happens?



VARIABLE INCLINED PLANK

A wooden plank is hinged to a horizontal board. The upper end of the plank is pegged on two supporting arms in the form of an arc. The inclination of the plank can be changed by pegging it along the arc with a metal peg. A string connects a counterweight through a pulley to a cylinder that rolls down the inclined plank. By changing the plank's angle one can examine the changes in the motion of the cylinder due to the action of three forces: gravitational force on the counterweight, the frictional force between the plank and cylinder and the pull of the weight of the cylinder.



THE CYCLOID TRACK

This unusual inclined plane was used by Jacques Bernoulli (1654-1705) to demonstrate Galileo's idea that the shortest path of a falling body (starting from an orbital position) due to gravity is not a straight line but a curve called a cycloid. This is significant because it means that the time it takes for an object to fall through a cycloid curve is shorter than in a straight path fall.



ARCHIPENDULUM

The Archipendulum (whose name is composed of the words Arc and Pendulum) is a simple topographic tool to measure the inclination of a surface to predict ballistic paths. It is made up of a rigid frame in the shape of the letter A, at the top of which a plumb line is hung over a crosspiece with a graduated scale. The pendulum wire indicates on the scale the horizontality or the inclination of the surface.



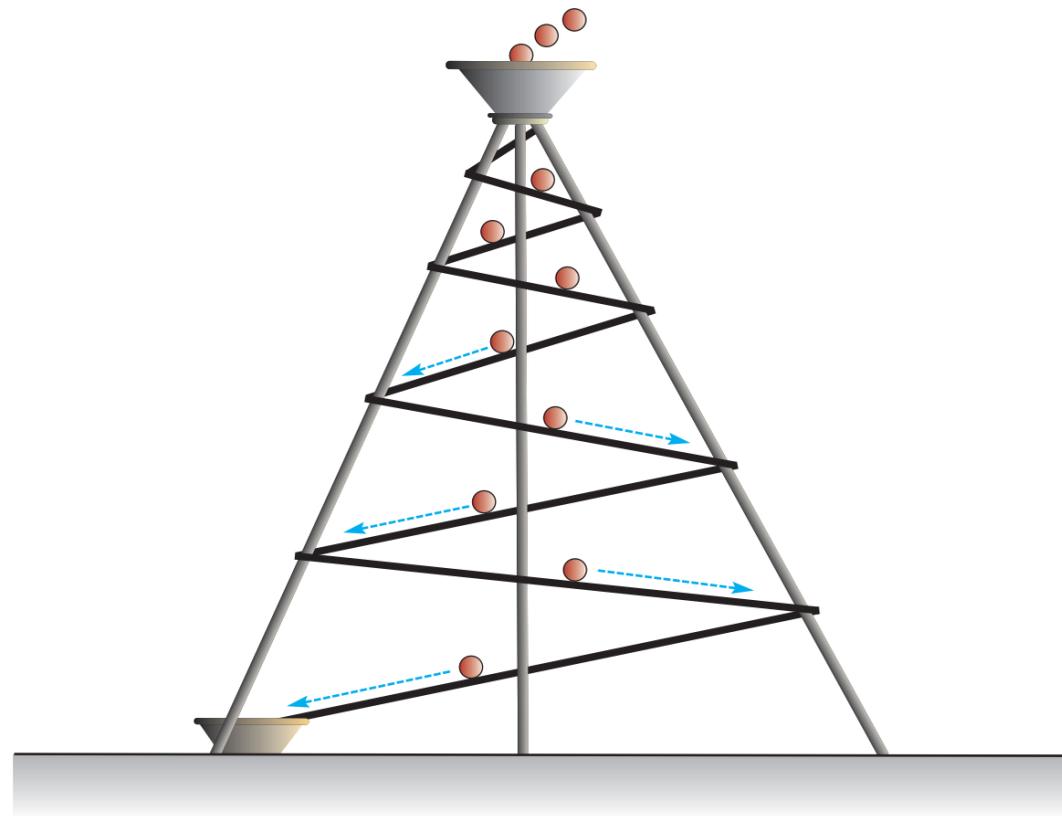
CLEPSYDRAS

The clepsydras is an ancient clock consisting of two superimposed containers, connected by a very small opening and containing water or sand. The passage of time was measured by the amount of water or sand flowing from the upper to the lower vessel. As the volume of water or sand decreased, the pressure also decreased and this prevented the regularity of the flow, jeopardizing the accuracy of the measurement. Later models of clepsydras became more refined and provided the continuous filling of the top container to keep the pressure constant.



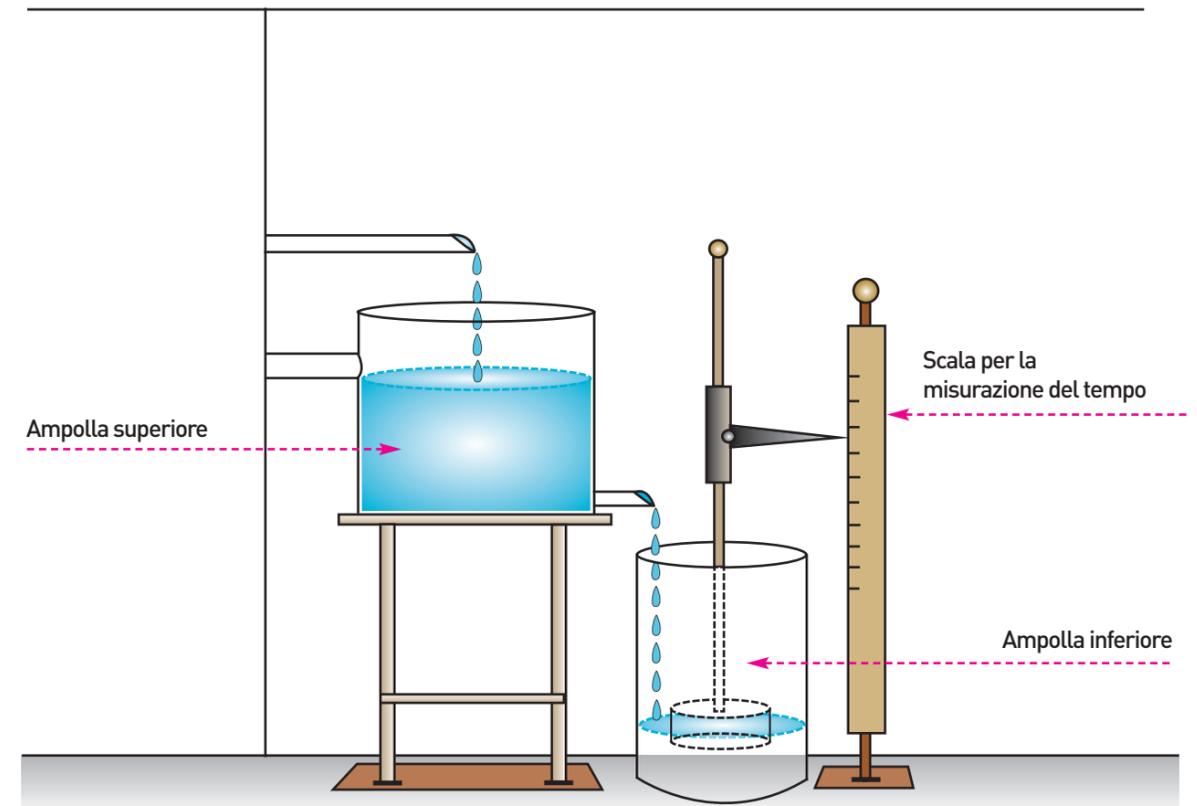
SPIRAL FREE FALL

A ball is dropped into a funnel that directs it along a spiral rail. When it passes the first loop, a second ball is dropped into the funnel. It is noted that on each loop, whose length increases according to a progression of odd numbers from 1 (i.e. 1,3,5,7...), the run by the two balls take exactly the same time per loop, as envisaged by the Galilean Law of Natural Motion. The apparatus consists of a hexagonal wooden base onto which are fixed curved brass rods, which, when joined to the top form a paraboloid. A pair of metal wires form a spiral rail that rises from the base to the top of the apparatus.



WATER CLOCK

This ancient time-keeping instrument consists of two glass containers one above the other. Water flows from the upper to the lower container. Reversing the containers restarts the cycle. These clocks can be made to measure longer times, by adding more containers in battery formation.



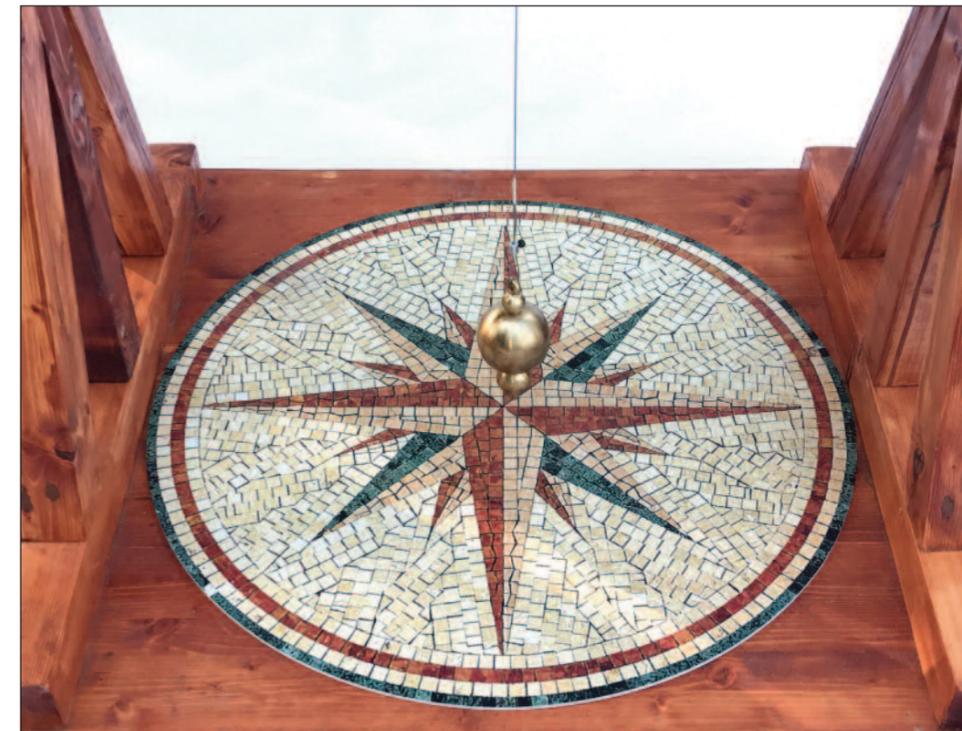
COPERNICAN PLANETARIUM

This early planetary model of the solar system was constructed to demonstrate the Copernican model of the solar system. At the centre is the sun. The other rings represent the paths of different planets with their satellites known at the time: Mercury, Venus, the Earth with the Moon, Mars with two satellites, the Asteroid belt, Jupiter with three satellites (one is missing), and even Saturn with its rings. The model can be spun by hand or may be operated by a gear system.



GALILEO'S PENDULUM

Galileo discovered that the movement of the pendulum is periodic (i.e, repeats regularly over time even though air friction progressively dampens the oscillations). The regularity of the pendulum, known as isochronism, was noted by Galileo while observing a candelabra in the Cathedral of Pisa. Galileo realized, making a comparison with his heartbeats, that the oscillations of the candelabra (a gigantic pendulum) had the same time duration even when they diminished in amplitude (i.e, widths of swing).



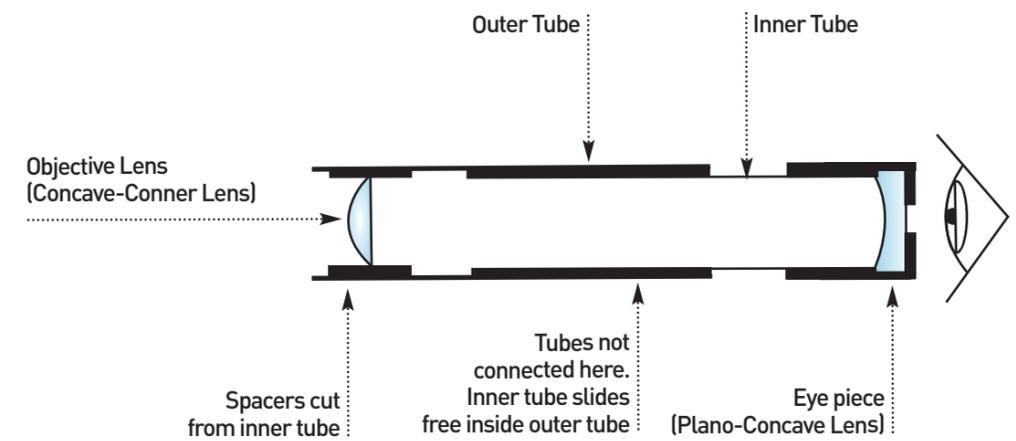
TELESCOPE

Galileo's was the first scientist to use the telescope to observe and describe the phases of the moon, the solar spots, four satellites of Jupiter (giving them Italian names: Io, Europa, Ganymede and Callisto) and even the rings of Saturn.



TELESCOPE

Replica of the Galilean telescope having one convex lens and one concave lens. The concave lens serves as the ocular lens, or the eyepiece, while the convex lens serves as the objective. The lenses are positioned on both ends of a tube in such a way that the focal point of the ocular lens is the same as the focal point of the objective lens.



TELESCOPE LENS

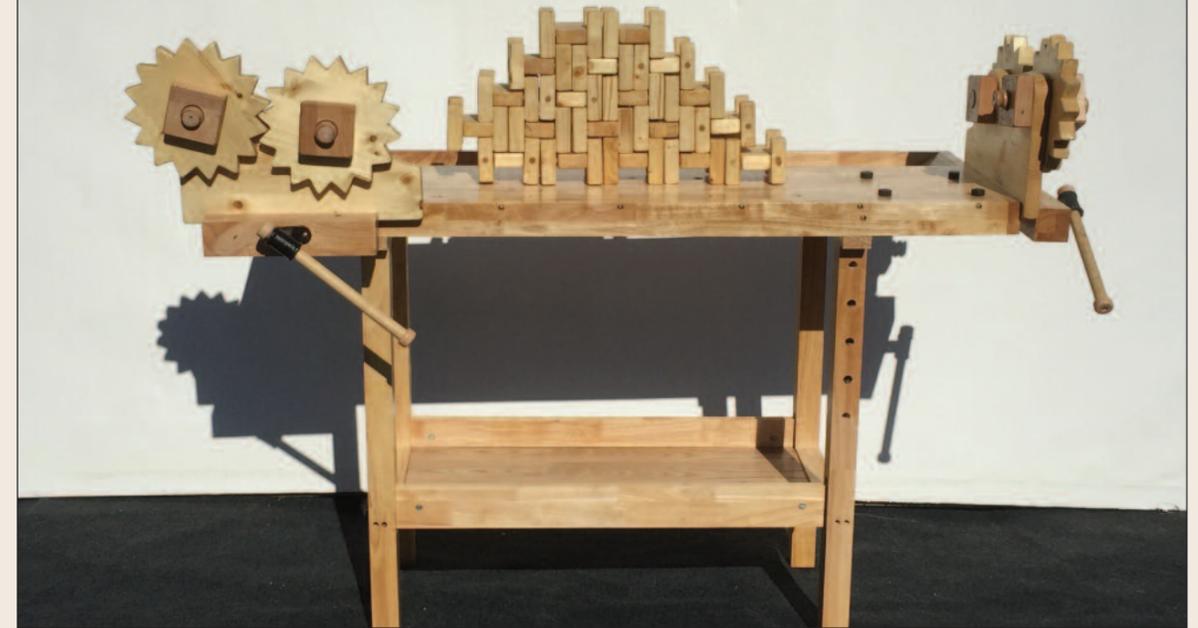
The model explains how to construct a Galilean telescope using tubes and graduated lenses.

ASTROLAB

This 17th century astronomical instrument was designed to locate or calculate the position of celestial bodies such as the sun, the moon, the planets, and the stars. It could also determine local time by knowing the latitude of the viewer location. The name derives from ancient Greek meaning 'star grabber' (aster=star, labio=to grab). Its maritime use was made redundant when mechanical clocks became more accurate and reliable.



Two work benches 140x50x100cm



<p>1564</p>  <p>Galileo Galilei nasce a Pisa il 15 febbraio del 1564, dal filosofo Vincenzo Galilei, musicista e compositore di corte, e di Giulia Amigoni.</p>	<p>1585</p>  <p>Va a Firenze senza aver completato gli studi e comincia a dedicarsi alla fisica e allo movimento, dando anche lezioni private.</p> <p>1586</p>  <p>Inventa la bilancia sormontata.</p>	<p>1589</p> <p>Conosce Marina Gamba, che gli darà tre figli: Maria Celeste, Andrea, e Vincenzo.</p> <p>1602</p> <p>Esordisce alcuni esperimenti sui pendoli, durante una visita nel monastero di Santa Maria del Fiore.</p> <p>1606</p>  <p>Inventa il termometro primitivo.</p>	<p>1609</p>  <p>Mentre Kepler pubblica la sua "Teoria dei satelliti", che contiene la prima descrizione di un telescopio, Galileo costruisce il suo telescopio di legno, con lenti di vetro e un occhio di pecora. Poco a poco comincia ad inventare nuovi telescopi con lenti migliori. Dopo avergli appurato dal signorile, ne presenta al Senato di Venezia un esemplare, al quale dà il nome di "periscopium".</p>	<p>1609</p>  <p>Mentre Kepler pubblica la sua "Teoria dei satelliti", che contiene la prima descrizione di un telescopio, Galileo costruisce il suo telescopio di legno, con lenti di vetro e un occhio di pecora. Poco a poco comincia ad inventare nuovi telescopi con lenti migliori. Dopo avergli appurato dal signorile, ne presenta al Senato di Venezia un esemplare, al quale dà il nome di "periscopium".</p>	<p>1609</p>  <p>Mentre Kepler pubblica la sua "Teoria dei satelliti", che contiene la prima descrizione di un telescopio, Galileo costruisce il suo telescopio di legno, con lenti di vetro e un occhio di pecora. Poco a poco comincia ad inventare nuovi telescopi con lenti migliori. Dopo avergli appurato dal signorile, ne presenta al Senato di Venezia un esemplare, al quale dà il nome di "periscopium".</p>	<p>1610</p>  <p>Mentre Kepler pubblica la sua "Teoria dei satelliti", che contiene la prima descrizione di un telescopio, Galileo costruisce il suo telescopio di legno, con lenti di vetro e un occhio di pecora. Poco a poco comincia ad inventare nuovi telescopi con lenti migliori. Dopo avergli appurato dal signorile, ne presenta al Senato di Venezia un esemplare, al quale dà il nome di "periscopium".</p>	<p>1611</p>  <p>Mentre Kepler pubblica la sua "Teoria dei satelliti", che contiene la prima descrizione di un telescopio, Galileo costruisce il suo telescopio di legno, con lenti di vetro e un occhio di pecora. Poco a poco comincia ad inventare nuovi telescopi con lenti migliori. Dopo avergli appurato dal signorile, ne presenta al Senato di Venezia un esemplare, al quale dà il nome di "periscopium".</p>	<p>1632</p>  <p>Papa Urbano VIII, chiamato il "Quinto", ne pubblica la dimostrazione e il calcolo del fenomeno un preceduto entro Galileo.</p> <p>1633</p> <p>Lo scienziato, già sotto il giudizio, viene interrogato a Roma dove viene processato e gli viene ordinato di abdicare la teoria copernicana. In prigione è maltrattato e costretto a confessare di aver fatto un errore. Galileo viene costretto ad abdicare pubblicamente e viene condannato alla prigione a vita, ma poi gli viene concesso di recarsi in un luogo sicuro dove si dimetta, recato a Firenze. Nel luglio dello stesso anno, comincia a scrivere il "Discorso e dimostrazione di alcune sue nuove scoperte intorno alla meccanica e al movimento locale".</p> <p>1642</p>  <p>Muore il geniale nella casa di Arcetri.</p>
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Thematic panels with a timeline of Galileo's life 200x150cm



educational models per workbench



EUREKA

AN INTERACTIVE HISTORY
OF SCIENCE FOR CHILDREN

THE EXHIBITION

CONCEPT, RESEARCH

In this sixth international traveling exhibition Artisans of Florence's have achieved an even more satisfying fun and interactive way to inspire a new generation of students by introducing them to modern science's most important and fundamental principles in a meaningful and memorable way from a historical perspective. The exhibition begins with the first truly "modern" scientist Archimedes, continues with the first large scale mass application of technology by the very practical Roman Empire (as recorded by Roman engineer Marcus Vitruvius), and culminates with the science and innovation of the Renaissance through the eyes of its visionary master Leonardo da Vinci. By examining the science of these three important scientific periods and the genius of these influential individuals we can experience the scientific leaps upon which our modern science is based. This exhibition of "small" interactive exhibits contains very big historical and educational value: with workshops, structured games and open-ended activities that are interactive and self-guided, raising awareness among the younger generation that is fundamental for the acquisition of knowledge and the promotion of learning in a profound and lasting way.

We do it by retracing the footsteps of Archimedes, Vitruvius and Leonardo, because these giants of science represent the peak of human intellect through their invention of the first "simple" machines.

Our goal is to bring young audiences closer to our world's most important scientific heritage, brought together in a small area so that they can explore and learn together. From these exhibits and workshops children can become familiar with the geometric shapes of Archimedes, learn about Leonardo's simple machines, and be introduced to the amazing engineering secrets of the great Roman Empire. Despite the apparent simplicity of their designs, these mechanisms are still in wide use today and tell the fascinating story of the collective scientific journey of mankind culminating with the achievements of perhaps the greatest mind in recorded history Leonardo da Vinci, whose unfettered imagination, brilliant intellect, and simplicity in presentation demonstrates the capability within each of us to understand our contemporary world through observation and experimentation in order to equip us to one day become active participants to its further exploration and development. Suitable for children and families and a great asset for education in schools, science centers, museums, libraries and educational institutions, the Eureka - Interactive History of Science Exhibition for children is an easy to install, fun, interactive, educational exhibition comprised of historically accurate scientific models for even the most budget conscious venues and a place where the next generation of scientists can experience their first Eureka moment!



The Eureka - Interactive History of Science Exhibition for Children covering the major eras of scientific innovation throughout history is divided into three engaging themes: Archimedes and the science of the Hellenistic Era, Ancient Rome – Building an Empire as described by Marcus Vitruvius, and Leonardo Da Vinci - the greatest genius of the Renaissance.



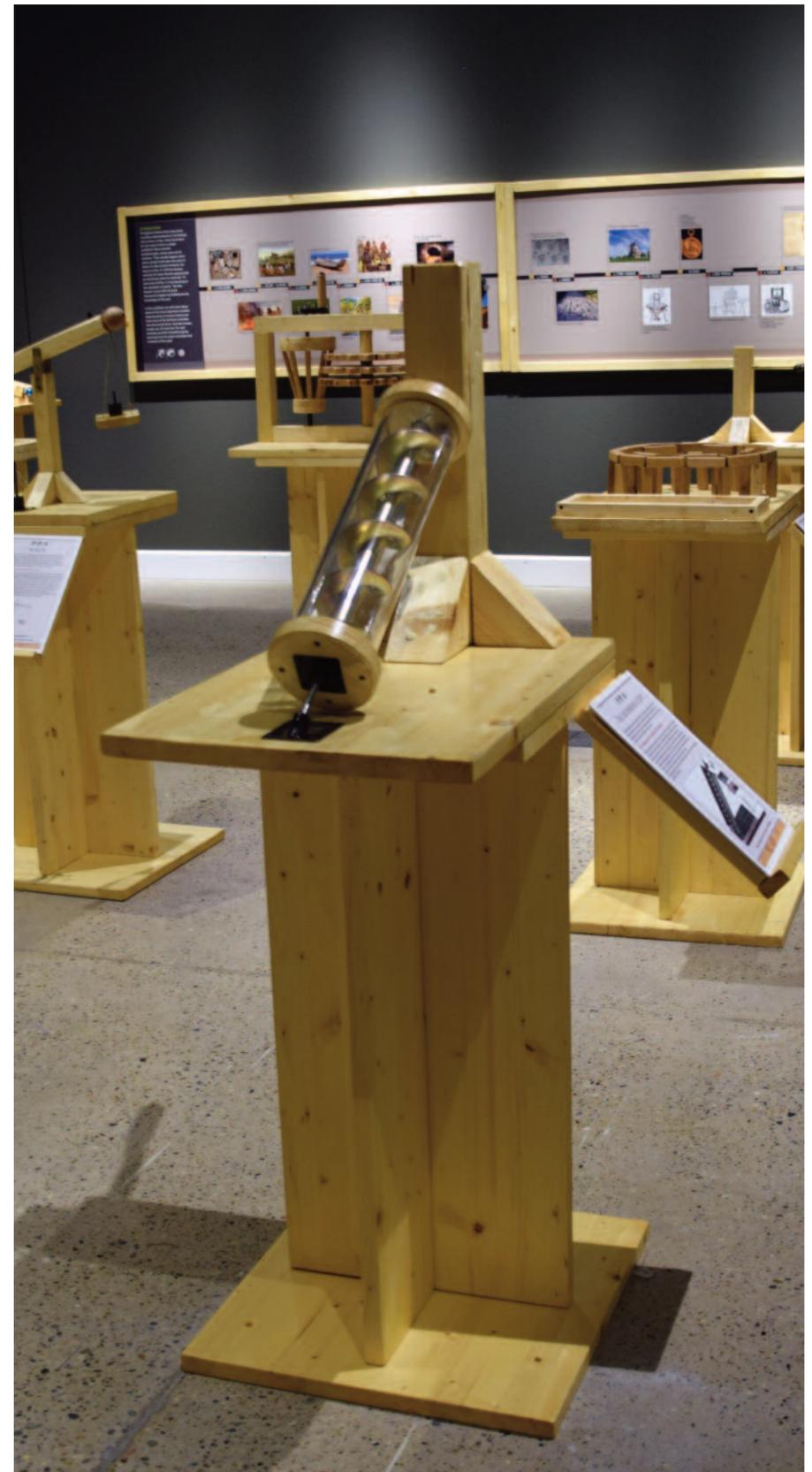
With a focus on fun, interactive learning in the fields of science, mechanics, physics, mathematics and engineering, The Eureka - Interactive History of Science Exhibition for Children is the exhibition where the next generation of young scientists can experience their first Eureka moment!



Modular exhibits and educational workbenches along with learning materials for each theme create an easy and fun platform for STEM teaching.



A sample of other exhibits in the exhibition designed to teach complex scientific concepts in a simple and fun way. !





• PHOTO OF THE EUREKA INTERACTIVE EXHIBITS FOR CHILDREN



● PHOTO OF THE EUREKA INTERACTIVE EXHIBITS FOR CHILDREN



• PHOTO OF THE EUREKA INTERACTIVE EXHIBITS FOR CHILDREN

