

## Antikythera Mechanism: The oldest computer-tablet and the laws of physics

*'Pythagoras doctrine is that numbers have maximal power to describe and understand nature and he is always referred to numbers, as for example the periods of celestial bodies, Plutarch'*

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The Antikythera Mechanism is the oldest known computer that in fact was originally called tablet (PINAKIDION in Greek which means little table, i.e. tablet, in Greek). It is a relatively accurate and realistic clockwork Cosmos, a Planetarium, most probably an astronomical clock. It is an instrument probably made during the second half of the 2nd century BCE, somewhere in the Greek World. It works with carefully designed bronze gears that perform the appropriate mathematical operations to predict astronomical phenomena, like the position of the Sun and the Moon in the sky, the age (phase) of the Moon, the beginning of the month, the solar and lunar eclipses.

The Antikythera Mechanism is the epitome, i.e. the best example, of Greek Philosophy, the Natural Philosophy of the Greek philosophers mainly the natural philosophers, the Ionian philosophers and the Pythagoreans, because to conceive the construction of such a machine, a computer, an automaton, which reproduces the movements of celestial bodies, is required for a civilization to have: a) the notion of determinism, b) that there the laws of nature, c) that the laws of nature are expressed with precision only with appropriate mathematics, d) that natural phenomena are understood and interpreted with the laws of physics, e) and sometimes predicted by the laws of nature.

To construct such a mechanism a civilization has to develop what is now called modelling in science, i.e. in reality to conceive, develop and put in operation the doctrine of the Pythagorean philosophy that everything is described with mathematics.

The mechanism is much more advanced than astronomical clocks that appeared in Western Europe for the first time around the 14th century. The mechanism is exhibited in the National Archaeological Museum in Athens, where many other treasures found in an ancient shipwreck that sunk in the 1st century BCE near the little Greek island of Antikythera, between Peloponnese and Crete, in a spot that was in the sea route between Greece mainland, and Asia Minor, the Aegean Sea in general, and Italy, Rome most probably was the destination of the huge ship full of treasures.

The gears have been designed to perform appropriate mathematical operations to predict all the then known astronomical phenomena. It really is realistic clockwork Cosmos, with the Moon following Keplers second law. The mechanism probably was very luxurious in appearance, with ornaments like a Rococo clock, because the taste of that era was similar. The mechanism is the dream of any astronomer of that time or even of today.

The study of the mechanism permits to understand much better the way humans use science in antiquity and one of our conclusions is that the level of mathematics, mechanics and astronomy is much higher than estimated so far by the global scientific community, even by specialists. The mechanism

predicts solar and lunar eclipses. It predicts both solar and lunar eclipses and shows the result on two dials one spiral dial that lasts a Saros cycle of 18 years and 11 days and 8 hours and an Exeligmos cycle of 54 years and a month. The phase of the moon and the month in a Greek calendar that lasts 19 years which is Metons cycle.

Another surprise was the Olympiad dial and circular display lasting 4 years with indications of important Greek festivities, the Olympic Games (assumed that they have started in 776 BCE), the Pythian the Isthmian the Naan and the Isthmian games. The games included theatrical, musical, poetical and other artistic competitions and they had big political influence.

A planetary gear that predicts the motion and position of planet Jupiter using an equivalent of Fourier series with two terms, a method used to simulate lunar motion with a good approximation of Kepler second law, if not all the three.