Diving into the Secrets of the Antikythera Mechanism

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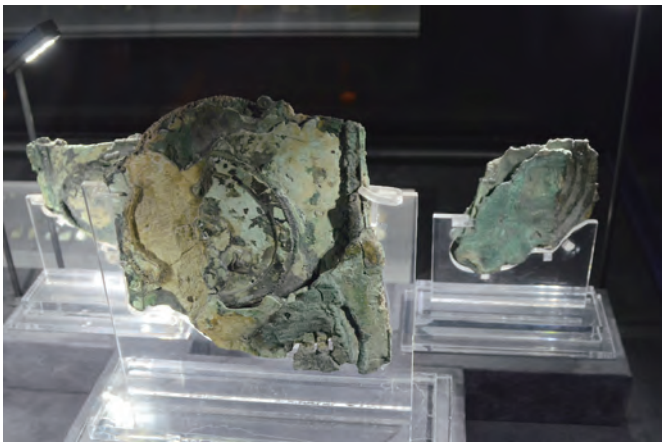
The 2nd International Conference on the History of Physics took place in Pöllau, Austria, from 4-6 September 2016. During the event, Yanis Bitsakis, historian of sciences and member of the Antikythera Mechanism Research Project, presented this extraordinary device and the results recently released.

The Antikythera Mechanism is the oldest astronomical instrument known in the world. It was found on a shipwreck near the Greek island of Antikythera, located between Crete and the Peloponnese.

In 1900, sponge divers discovered the remains of this luxury cargo, probably heading from Greece to Rome with thousands of goods on board. Jewellery, glassware, statues and coins are only part of this underwater treasure dated around 70-60 BC. Among them was an intriguing piece of bronze. First thought to be part of a statue, it was asserted in 1902 by the German philologist Albert Rehm that the fragments belonged to an astronomical device. Inscriptions like Venus, a ray, the Sun and a set of gears were clear evidence of this, though its function was not clearly established.

The first detailed research was led by the British physicist Derek de Solla Price. In the early fifties, he stated that the mechanism was a kind of calculating machine. About twenty years later, he associated the Greek radiophysicist Caralambos Karakalos with his study. The device was scanned using gamma rays and the results revealed 30 gears and 800 signs. This helped to determine the number of teeth on the gears and thus establish what kind of astronomical cycles were represented on the device (Babylonian, Hellenic, Egyptian, etc.) However, Price was not able to build a working model.



Main fragments of the Antikythera Mechanism, displayed at the National Museum of Archeology in Athens.

In 1953, Captain Jacques-Yves Cousteau organised a first expedition to Antikythera to confirm where the shipwreck occurred. In 1976 he led a second expedition. This time, he launched an underwater search with his famous ship Calypso. He brought back new artefacts from the wreck, but no additional piece of the mechanism.

Although the device has raised some public interest on and off since its discovery, only a few specialised articles have been released. For more than a century there was no international consensus on its function, and it was almost forgotten in the storage sheds of the National Archeological Museum of Athens. Was it an astrolabe, an orrery (a clockwork model of the solar system), or a navigational instrument? No one would know or have a real interest in the answer for a long time.

2005 was a decisive year when an international team of passionate researchers from fields as varied as astrono-

A model of the Antikythera Mechanism displayed at the Musée des Arts et Métiers in Paris.

my, philology or history joined together to work on the mechanism. They obtained a grant from the Leverhulme Trust, under the aegis of the Hellenic Ministry of Culture and the National Archaeological Museum in Athens. To study the 82 pieces of the device, a 2-ton X-ray scanner was installed inside the museum, as the fragile instrument could not be moved.

State-of-the-art techniques like Computed Tomography [CT], Polynomial Texture Mapping [PTM] or 3D imagery gave the researchers the ability to collect more than one terabyte of data. The analysis took over ten years to find some clues to help solve this mystery. In June 2016, new results were released by the team after thousands of signs were deciphered and analysed. The instrument represents the cosmos and is able to predict celestial events such as lunar and solar eclipses as well as the movement of 5 planets known by the Ancient Greeks. Even the dates of Olympic Games can be foreseen by the device. The inscriptions on the plates surrounding the wheels provide a model for the astronomy as practised between 150 and 100 BC in Ancient Greece. It is remarkable that so much information could be revealed from a piece of bronze as small as 180 mm × 300 mm. Together with 81 other fragments, it represents less than the half of the entire instrument.

A new diving expedition took place in August 2016. It is the latest in a series started in 2012, usually during the summer to avoid wind, storms and strong sea currents. Professional divers explore the surroundings of the 50 metres long ship and dig the sea bed to bring new artefacts back to the surface. The ancient cargo in Antikythera, still full of goods, is located at a depth of around 60 metres, making the work of divers particularly difficult. They only have 20 minutes to explore the sea. To help them, a set of submarine drones are currently being developed for next year. They will detect metal and make real-time analyses of the data collected (see video on the submarine drones).

Since 2005 the enthusiasm raised by the Antikythera Mechanism has not decreased. From cutting-edge research to mechanics or history of physics, the diversity of the fields covered as well as the fascinating on-site explorations make the subject interesting to a very wide audience. The international team of researchers has evolved in terms of participants and of techniques involved. Together with the divers, they continue their investigations while exhibitions on the treasures of the luxury ship are regularly organised.

The long-term studies on the device provide the world with precise and precious information about history and give the Antikythera Mechanism a place in the timeline. They help us to better understand Greek astronomy, but also raise new questions: who made it, when and where was it manufactured and for whom? A pupil of Archimedes, Hipparque himself or Poseidonios? To get the answers, we will have to be patient and closely follow this breathtaking inquiry.

More info

- Antikythera Mechanism Research Project
- Return to Antikythera (diving expeditions)
- September 2016: Ancient skeleton discovered at the Antikythera shipwreck
- Exhibitions