The content of the press release and paper in* Nature *is embargoed until 1800 London time / 1300 US Eastern Time on 30 July, the day before publication.

World's oldest calculating machine showed ancient Greek *Olympic Games* cycle.

"We knew that this 2,100 year-old ancient Greek mechanism calculated complex cycles of mathematical astronomy. It really surprised us to discover that it also showed the four-year cycle of ancient Greek games, including the Olympic Games," reports research scientist, Dr Tony Freeth. "The first clues that suggested a link with the ancient cycle of Greek games came when the word 'NEMEA' was read near a small subsidiary dial on the Mechanism." This was the site of the Nemean Games, one of the prominent 'crown' games, which were part of the Olympiad cycle. "Other names followed, 'ISTHMIA' for the games at Corinth, 'PYTHIA' for the games at Delphi and finally the hard-to-read 'OLYMPIA' for the Olympic Games."

A newly published paper in the prestigious science journal *Nature* reveals surprising research on the ancient Greek calculating machine, known as the 'Antikythera Mechanism'. It is named because of its chance discovery near the tiny island of Antikythera, between Crete and mainland Greece. In 1900, Greek sponge divers found the wreck of a 1st Century BC Roman merchant vessel, stuffed full of Greek treasures—including beautiful bronzes, amphorae, glassware and pottery. In the subsequent archaeology organized by the National Archaeological Museum in Athens, they also recovered a corroded and calcified lump, about the size of a large dictionary. Disregarded at the time, it has proved to be one of the deepest mysteries from the ancient world. The Antikythera Mechanism is now split into 82 fragments—the main fragments being on display at the National Archaeological Museum in Athens. It is an agglomeration of bronze gearwheels, dials and inscriptions that has puzzled and amazed scientists for more than a hundred years. "The Mechanism is full of surprises," says Professor Alexander Jones, "and the latest revelations for the first time establish its cultural origin."

The new research paper has four authors: Dr Tony Freeth (Images First Ltd, UK), Professor Alexander Jones (Institute for the Study of the Ancient World, USA), Dr John M. Steele (Durham University, UK, moving to Brown University, USA) and Yanis Bitsakis (Athens University & Centre for History and Palaeography, Athens, Greece)

Using 3-D X-rays, the researchers have managed to read all the month names on a sophisticated 19-year calendar on the back of the Mechanism. "It has always been assumed that the Mechanism came from the Eastern Mediterranean, probably Rhodes, but these month names are from the Corinthian family of months—suggesting an origin on the other side of the ancient Greek world," asserts Professor Jones. One possible place of origin is Syracuse in Sicily, which in ancient Greece was a Corinthian colony. "People may rush to make a link with the great scientist, Archimedes, who lived in Syracuse and died there in 212 BC." says Professor Jones, "But the Mechanism itself was almost certainly made many decades after he died and the most we can say is that there is a possible link with a heritage of scientific instruments that might have originated with Archimedes."

The remarkable Antikythera Mechanism dates to around 150 to 100 BC. It was previously shown to display the date, positions of the Sun and Moon (including its variable motion), the phase of the Moon, a complex 19-year calendar and sophisticated eclipse prediction dials. Now it is known to have also shown the cycle of ancient Greek games. "It is more complex than any other known device for the

next 1,000 years," says leading astronomer, Professor Mike Edmunds (Cardiff University, UK). To unravel its mysteries, eight years ago he set up a new organization, the *Antikythera Mechanism Research Project*, which included two of Greece's most prominent astronomers, Professor John Seiradakis (Thessaloniki University, Greece) and Professor Xenophon Moussas (Athens University, Greece). Professor Seiradakis advocates that, "It is as important for the history of science and technology as the Acropolis is for architecture." In 2005, the project worked with the National Archaeological Museum in Athens and two cutting-edge technology companies to gather critical new data on the Mechanism. Hewlett-Packard (USA) used an ingenious technology to examine its surfaces in fine detail. X-Tek Systems (UK) carried out high resolution 3-D x-rays to look inside the fragments of the Mechanism. As reported in an earlier paper in *Nature*, not only did the data lead to an astonishing new theory of how the Mechanism worked, but also to the reading of inscriptions, unseen for more than 2,000 years. "Using this 3-D X-ray technique, for the first time we have been able to read inscriptions inside the Mechanism and the results have been a revelation," said Yanis Bitsakis, an Athens-based scientist, who is one of the authors of the new paper. "I have been working on these inscriptions with Dr Agamemnon Tselikas, and it has been very exciting. The inscriptions are like an 'Instruction Manual', telling the user the underlying way the machine worked."

Another aspect of the new work has been a deeper understanding of how the Mechanism predicted eclipses. "The basic idea was to use a cycle of repeating eclipses (the Saros Cycle) that was known in Babylonian astronomy hundreds of years before the Mechanism was made," says Dr Tony Freeth. "This cycle is just over 18 years and there is a large dial on the Mechanism that follows its progress." The eclipse predictions are marked on this dial and tell the user whether an eclipse is lunar or solar and what the time of day the eclipse should happen. "It has been a real struggle to understand the organization of these predictions since they don't conform to the pattern we might have expected from Babylonian astronomy," says another of the paper's authors, Dr John M. Steele. "The Saros cycle of eclipses means that each time an eclipse repeats it happens eight hours later in the day. The Mechanism also includes a small dial that tells the user how to make this time adjustment."

"The work of the *Antikythera Mechanism Research Project* has been a major collaboration between a team of research scientists from Greece, the UK and the USA, the National Archaeological Museum in Athens, and two world-class technology companies, who have provided the data on which the new work depends." says Dr Tony Freeth. "Research progress has been really exciting. The Antikythera Mechanism is of crucial importance for the history of science and technology. It tells us of a revolution in human thought in ancient Greece—the earliest known example of a machine for making calculations, of a machine for predicting the future. And now we are beginning to get clues to the cultural origins of this extraordinary Mechanism."

The Antikythera Mechanism is on display at the National Archaeological Museum in Athens. An exhibition discussing the instrument and the history of research opens at the Whipple Museum of the History of Science in Cambridge on the 31st of July 2008. There will also be an exhibition at the Ionic Centre in Athens (Greece) from mid-October 2008.

For more information:

Please consult the *Antikythera Mechanism Research Project* website at:

www.antikythera-mechanism.gr

Contacts:

Authors of *Nature* paper:

Dr Tony Freeth, +44 20 8579 6848, tony@images-first.com
Professor Alexander Jones, +1 212 992 7816, alexander.jones@nyu.edu
Dr John M. Steele, +44 191 3343642, j.m.steele@durham.ac.uk
Yanis Bitsakis, +30 6974 082 062, bitsakis@gmail.com

Nature Press Office

Ruth Francis, +44 20 7843 4562, press@nature.com

Nature has selected this story to feature in one of their monthly videos. Please see:

www.nature.com/nature/videoarchive/index.html

This video may be downloaded for short TV news reports. Please go to:

www.antikythera-mechanism.gr (EXACT URL TO BE DEFINED)

References:

Freeth, T., Jones, A., Steele, J. M. & Bitsakis, Y., Calendars with Olympiad display and eclipse prediction on the Antikythera Mechanism. Nature **454**, July 31st 2008.

Freeth, T. et al. Decoding the ancient Greek astronomical calculator known as the Antikythera Mechanism. Nature **444**, 587-591, November 30th 2006.