BLACKROCK CASTLE OBSERVATORY
The Space For Science

SKYMATTERS

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November 2020

Things to watch out for

November 10

Mercury reaches its Greatest Western Elongation on this date. This is the best time to view Mercury since it will be at its highest point above the horizon in the morning sky. Look for the planet low in the eastern sky just before sunrise.

November 11/12

The Northern Taurids Meteor Shower will peak on these dates. This is a minor meteor shower producing only about 5-10 meteors per hour. However, it is famous for producing a higher than normal percentage of bright fireballs. The shower runs annually from October 20 to December 10. Best viewing will be just after midnight from a dark location.

November 15

The New Moon falls on this night. The Moon will located on the same side of the Earth as the Sun and will not be visible in the night sky. This is the best time of the month to observe faint objects because there is no moonlight to interfere. It is well timed for the meteor showers this month.

November 16/17

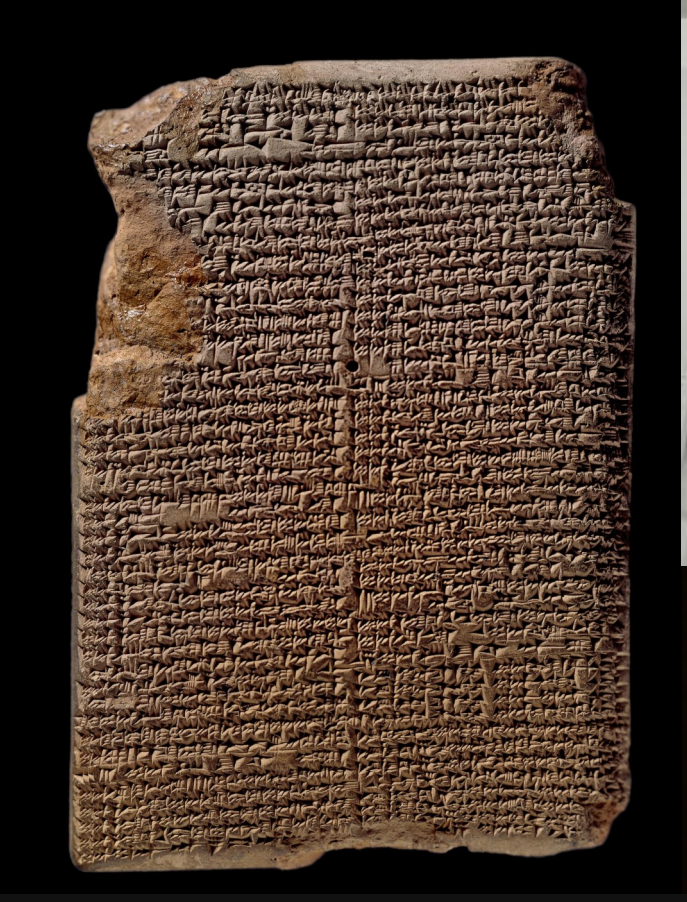
The Leonids Meteor Shower will peak on these dates. This is an average shower, producing up to 15 meteors per hour at its peak. The shower runs annually from November 6-30. Best viewing will be from a dark location after midnight.

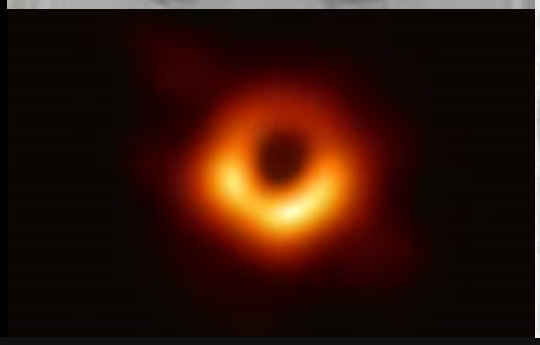
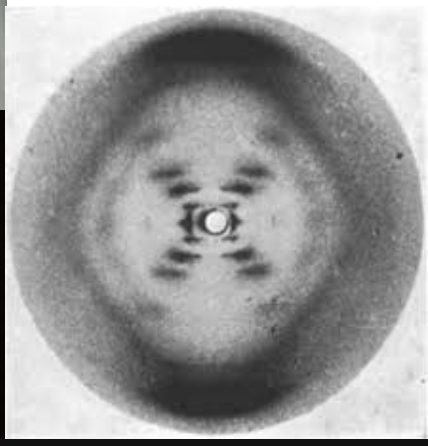
November 30

The Full Moon falls on this date. The Moon will be located on the opposite side of the Earth as the Sun and its face will be will be fully illuminated.
This Full Moon will see a Penumbral Lunar Eclipse. This type of lunar eclipse occurs when the Moon passes through the Earth's partial shadow, or penumbra. The Moon will darken slightly but not completely. The eclipse won't be visible from Ireland, but from parts of the Pacific Ocean.

To the right, is sunrise on the 10th of November. Mercury reaches its greatest elongation on this date, making it a great date to observe the smallest planet. Mercury will quickly become difficult to see, while Venus remains visible all month.

The bottom image shows sunset on the 10th of November. Mars, Jupiter and Saturn will remain visible all month, Mars also becomes much more an evening planet, vanishing from the sky before sunrise. Jupiter and Saturn will also set earlier and earlier each night.



Left Image: This is the MUL.APIN, a Babylonian text describing the north star and other astronomical phenomena.
Top center we see a seismograph based on an ancient Chinese design, the dragons on the urn dropped metal balls into the frogs mouths if disturbed by seismic activity.
Top right is a sketch of Arabic mathematician Ibn al-Haytham, who made important contributions to physics.
Bottom right is the result of a DNA double-helix diffracting X-rays. Bottom center is the first ever image of a blackhole taken in 2019.

The History of Science

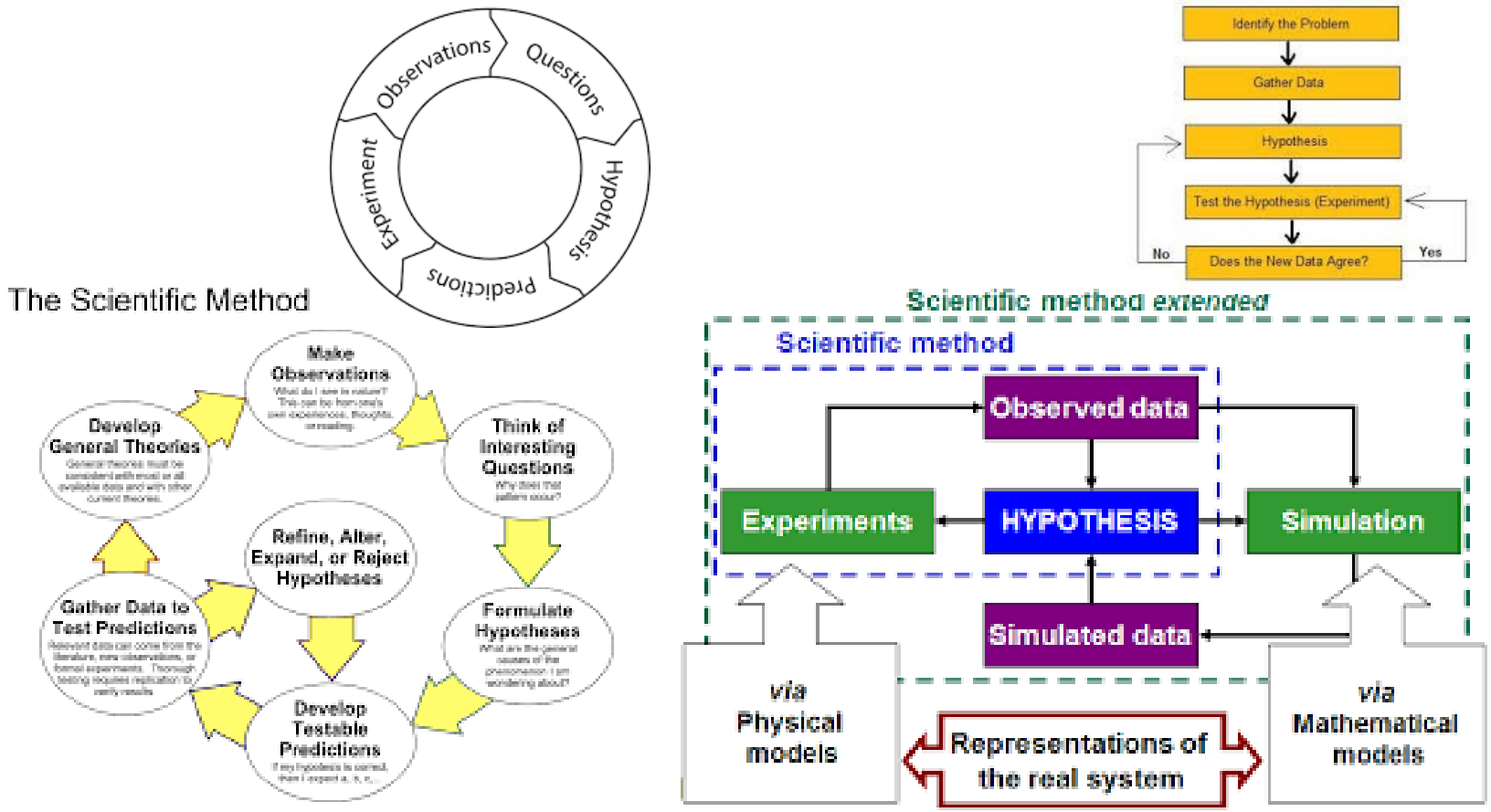
The European view of the story of science often begins with the Ancient Greeks. This may be a little unfair, as the earliest texts from Central America, the Middle East and the Far East also contain references to mathematics and astronomy. In truth, the very earliest people who made observations and drew conclusion most likely did so before written language, and without any records it is hard to give them credit. The most reliable sources we have from ancient times are written texts and the earliest of these texts come from Babylon and Ancient Egypt. Although records are sparse, Babylonian astronomy influenced the more well known Ancient Greek astronomers, and some of the earliest mathematical formulas stem from Egypt. However, with such sparse records, some of the most recognised early scientist were Greek philosophers such as Archimedes and Socrates. Around the same time, in the Middle East, India and the Far East, some other early scientists were working in fields as modern as seismology and linguistics.

The Renaissance is often expounded as the dawn of the age of scientific inquiry, as the collapse of the Roman empire in the 400s AD led to an apparent stall in scientific progress in Europe, often referred to as the Dark Ages. However, the Byzantine empire saw continued growth, including writings on physics and an attempt to surgically separate conjoined twins in the 900s. In the Islamic world, Ibn al-Haytham explained the importance of testable and reproducible experimentation in his “Book of Optics,” which is still a prominent concern of science today. The fall of Constantinople, the capitol of the Byzantine empire, in 1453, caused many philosophers and scientist to flee to Northern Italy, feeding into the growth of the Renaissance.

The time period between the 1400s and 1800s is sometimes referred to as the Scientific Revolution. Some of the most commonly referenced names in science, Galileo Galilei, Edmond Halley, Robert Hooke, Christiaan Huygens, Tycho Brahe, Johannes Kepler, Gottfried Leibniz, Blaise Pascal, Benjamin Franklin, Leonard Euler, and Isaac Newton made their contributions during this time. Even the philosophers of this time are well remembered today, such as René Descartes and Immanuel Kant.

From the 1900s till today, science has grown and diversified rapidly. It was in the early 1900s that quantum physics began to emerge from the work of scientists such as Max Planck, Albert Einstein, Niels Bohr. It was only in the 1950s and 60s that the theory of plate tectonics developed, and just 1953 when James D. Watson, Francis Crick and Maurice Wilkins showed the double-helix structure of DNA. The human race went from the first heavier than air flight, by the Wright brothers on the 17th of the 12th of 1903, to the first manned Moon landing in just 65 years 7 months and 7 days.

In the relatively short time since the 2000s began, science has grown and diversified even further, with robotic landings on distant moons, human technology reaching the edge of our solar system and the discovery of thousands of planets around other stars. The first mapping of the human genome has been published, gravitational waves have been detected and a black hole imaged. This is without mentioning the huge advances in computing, such as going from the first ever USB at 8 megabytes to the release of a 2 terabyte USB, 250,000 times bigger, in just 17 years.



The Scientific method can be described in many different ways, as shown above. Some of the diagrams add steps, others simply rename them. One thing that these diagrams have in common is that they all show a loop. The scientific method is generally though of as self perpetuating, with the answers to one question creating whole new questions in need of answers. As can be seen in the bottom right diagram, the scientific method can be extended, and in the bottom left diagram we can see a subloop, highlighting the need to repeat experiments.

What is Science?

The word “science” can trace its origin back to Latin “scientia”, which meant a knowledge or understanding, closer to the modern usage of skill or expertise. This usage continued right into English as late as the 1400s, though it began to take the meaning of collected human knowledge, or knowledge acquired by methodical study, competing with the term natural philosophy in the 17th century. Science really only began to mean what we mean of it today in the 19th century.

So what do we mean by science? Most of us today have at least some vague idea of hypothesising, experimenting and basing conclusions off of results. Indeed, this is the basis of the hypothetico-deductive method, what many people mean when they refer to the scientific method. It is underpinned by a series of steps: Question, Hypothesize, Predict, Experiment, Analyse. For example, when questioning if light travelled in straight lines, an Arabic mathematician hypothesised that it did. He predicted that a hole that allowed light through would allow less through at a constant rate if it was blocked at a constant rate, reasoning that the light would not flow around the blockage. The experiment was simple, two pinholes with moonlight passing through them, one of which was slowly blocked. Upon analysing the results of not one, but many controlled attempts, he concluded that it did and that the hypothesis was correct. Of course, Ibn al-Haytham was working in the Fatimid Caliphate, 500 years before Isaac Newton.

The scientific method as we know it today is still widely used and agreed upon, from chemists in labs to anthropologists in caves and linguists in libraries. It is finally becoming more widely accepted that white lab coats and goggles are not the only attire a scientist can wear. Thanks to advances in social sciences, it is clear that the scientific method can apply to not just biology and physics, but to a great range of disciplines such as psychology and economics. The great advances in computer science have made technology a day-to-day part of our lives, showing us constantly the benefits of research and development. Of course, what we mean by science may continue to change. As we push its usage, the scientific method may need to change too. Recent fields such as predictive analytics offer predictions of results from past data, often without a specific hypothesis or experiment. In astronomy, an observational science, many things are discovered and then studied, with changes made to existing theories if necessary, rather than a hypothesis being formed and then looking through the telescope. Of course there have also been issues with neural networks and AI, spitting out results which are correct, even if the human researchers involved can’t see how the AI reached that conclusion.

Science has existed for longer than we have had a word for it, but the way we do it changes and evolves constantly. As we move forward and face problems of greater and greater complexity, science may have to adapt and change. It still does not have all the answers, we still make mistakes and incorrect predictions. Despite its failings, we have used science to bring us a continuously deeper understanding of the world around us. Science is a tool, a way of thinking that we have worked on and established over time. Like any tool, we will continue to improve it, change it and change the way we use it for as long as it fulfils its function of helping us to discover more about the world around us.

Tips for trying the Scientific Method

The scientific method is widely used in science in order to further our understanding of the world around us. Put simply, it is a series of steps that can be followed to develop a possible answer to a question. This answer is usually tested over and over before being accepted, even then they could be challenged by new questions.

1. Question: Start with a simple question, it doesn't even matter if you know the answer already, it never hurts to check! It's a good idea to go with a question that already has established experiments first, before trying to develop your own. For example, does gravity work on pens? It's a silly example, but a good start.

2. Hypothesis: This is simply a proposed answer to the question. It doesn't have to be the right answer, just one you can check. In this example you could hypothesize no, gravity does not work on pens.

5. Prediction: This is what you predict will happen when you test the hypothesis. This step gives you something to compare your result against. For example, lets predict that a pen will not be pulled down by gravity.

4. Experiment: This is the test of the hypothesis. There are often many ways to test a hypothesis. For example, you could drop the pen from your hand, but how can you make sure you aren't pushing it down subconsciously? You could weigh the pen to see if gravity pulls it down onto the scales.

5. Analyze: This is looking at the result of your experiment and seeing what it means. If you see that the pen is pushing down on the weighing scales, that means you can answer the question with a yes, gravity does work on pens! It doesn't matter that your hypothesis is different, all that matters is the answer to the question. Then you can ask more questions, and new hypotheses and experiments to find answers.

Website of the month

www.sfi.ie/engagement/science-week

Science Week is coming! The SFI supported event will be running for its 25th year from 8 - 15 November. You can get involved, with resources for parents and teachers as well as details of upcoming events. We hope you all find a way to get involved and celebrate science.

Quote of the month

"Science doesn't purvey absolute truth. Science is a mechanism. It's a way of trying to improve your knowledge of nature. It's a system for testing your thoughts against the universe and seeing whether they match. And this works, not just for the ordinary aspects of science, but for all of life. I should think people would want to know that what they know is truly what the universe is like, or at least as close as they can get to it."

Isaac Asimov on *Bill Moyers' World Of Ideas* (21 October 1988)

Some Upcoming Events at CIT Blackrock Castle Observatory

The Space Careers roadshow will be running on the 19th this month, check this link for further details:

http://www.spaceweek.ie/for-organisers/for-teachers/space-careers-roadshow/

ESERO Space Career roadshows showcase the incredible diversity of careers that are available in the space industry. Astronauts, scientists, engineers, artists, and countless other professionals will show you what their dream job entails, and the path you can take to follow in their footsteps.

PUBLIC OPENING Hours: Depend on current government guidelines, please see bco.ie for latest updates.

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Blackrock Castle Observatory is operated by Cork Institute of Technology and is a partnership with Cork City Council.

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Collated by Caoimhín de Bhailís and the Blackrock Castle Observatory team