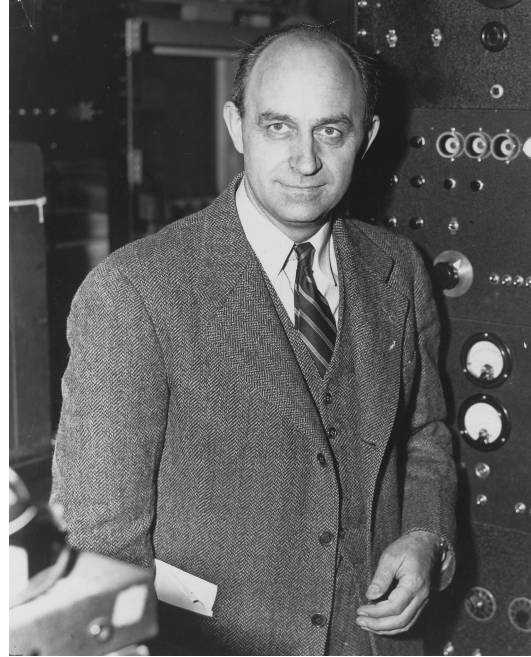
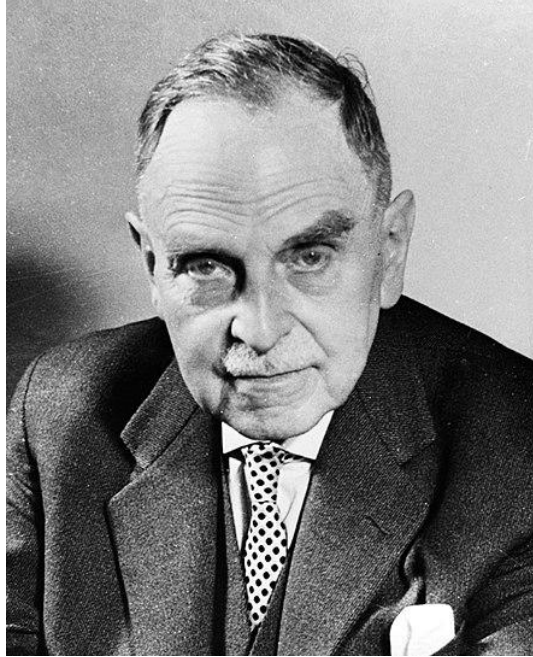


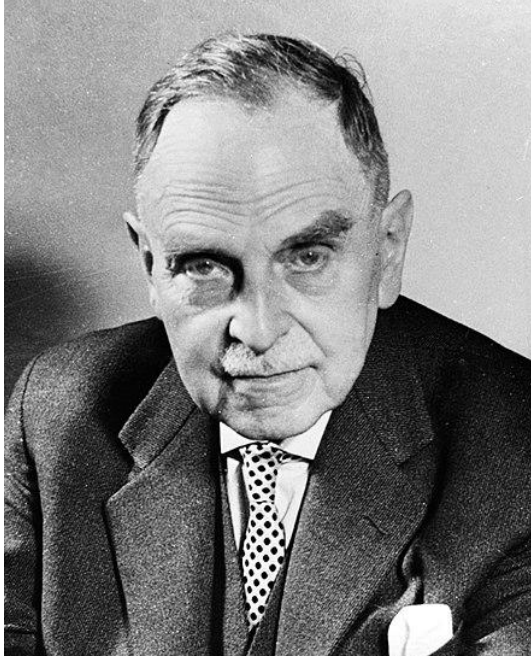


**Where's My
Nobel Prize?**

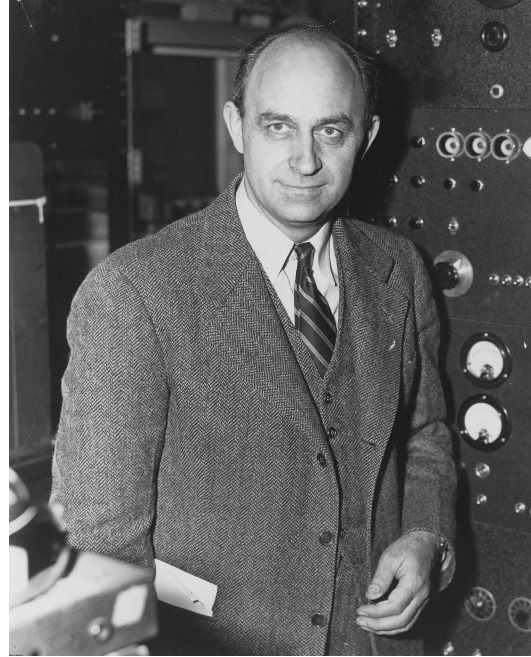
who are these people?



who are these people? what awards did they get?



Otto Hahn

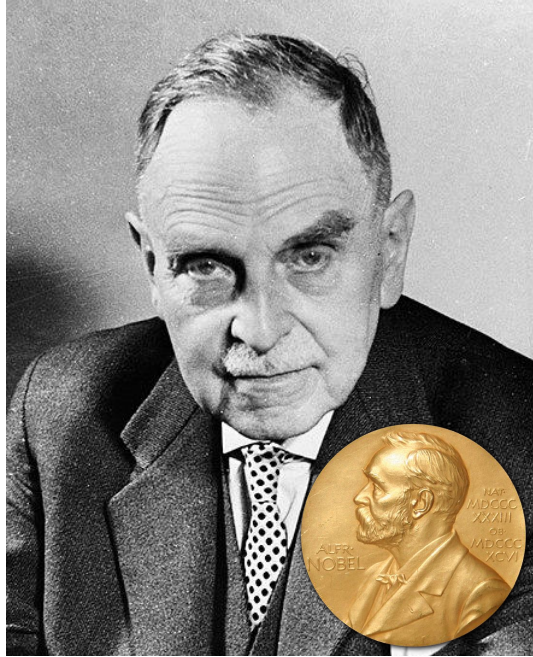


Enrico Fermi

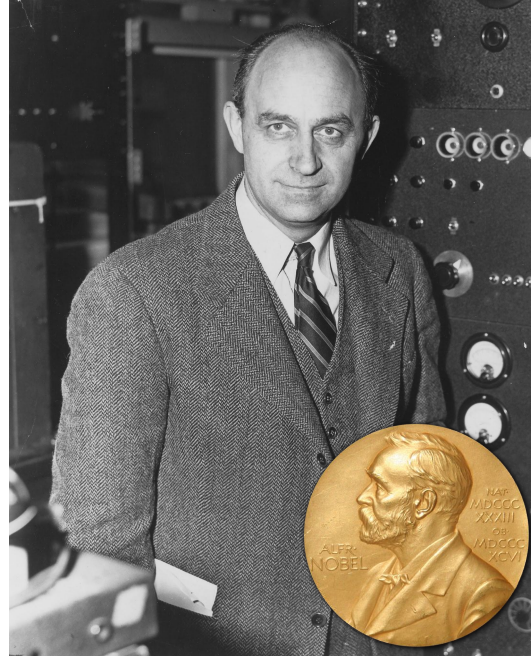


Lise Meitner

who are these people? what awards did they get?



Otto Hahn
Chemistry Nobel Prize, 1944



Enrico Fermi
Physics Nobel Prize, 1938



Lise Meitner
National Women's Press
Club award

This is a fairly common theme...

Hahn got the Nobel Prize for nuclear fission ...

... Meitner figured out what happened

Martin Ryle and Antony Hewish got the Nobel prize for discovering pulsars ...

... Jocelyn Bell Burnell noticed them first

... even though ...

Clyde W. Tombaugh discovered Pluto

.... Elizabeth Langdon Williams did all the maths

....

....

we're *not* saying that the people who did get awards weren't great scientist!

- but they didn't exist in a vacuum either
- and contributions of minorities are often forgotten ~~forgotten~~ **erased**
- if they are noticed, things get lost (Marie Salomea Skłodowska–Curie was *not* French)

some people who did get credit, really should be sidelined by history (Nobel Prize 1905 & 1919)

this lecture is not about these people though

Plan for these lectures

Theme 1

Credit being given to men for work done by families (wives, sisters, cousins, ...)

Example:

- Mileva Marić-Einstein
- Caroline Herschel

Homework

Find an amazing scientist who is not a rich white man and tell us what cool things they've discovered

Theme 2

Credit being solely given to European or American scientists and mathematicians instead of other equally-deserving people

Examples:

- Pascal's Triangle
- The Heliocentric Model

and many more...!

Wives & Families of Scientists

"Behind every man is a great woman"

What would you say if there was someone who;

- Takes care of everything in your house
 - Cooks, cleans, washes your clothes, do the shopping
 - (Take care of children)
- Types up and proofreads your papers, articles, books **#ThanksforTyping**
- Carries our experiments, takes measurements, and sometimes interprets results

Notice

We are not trying to discredit men.

We want to shed lights on the environment that allowed them to achieve what they did.

Highlight the efforts of the women in their lives that were erased by history.

Mileva Marić-Einstein



Caroline Herschel



Mileva Marić-Einstein

- Studied physics in Zürich with Albert Einstein
 - They both got final grades less than passing in their diploma exams
 - Einstein got higher average and he graduated
 - She failed (there are varied explanations to why...)
- Got pregnant before marriage with Albert's child (no-one knows what happened to her...)
- Failed exams again after that
- “From now on Mileva devotes herself entirely to her beloved husband and his career.”

Conditions from Albert to Mileva

The couple broke up but didn't want to divorce due to their sons, this was Einstein's demands.
They later got divorced.



A. You will make sure:

1. that my clothes and laundry are kept in good order;
2. that I will receive my three meals regularly *in my room*;
3. that my bedroom and study are kept neat, and especially that my desk is left for *my use only*.

B. You will renounce all personal relations with me insofar as they are not completely necessary for social reasons.

Specifically, you will forego:

1. my sitting at home with you;
2. my going out or traveling with you.

C. You will obey the following points in your relations with me:

1. you will not expect any intimacy from me, nor will you reproach me in any way;
2. you will stop talking to me if I request it;
3. you will leave my bedroom or study immediately without protest if I request it.

D. You will undertake not to belittle me in front of our children, either through words or behaviour.

Lovely Quotes

Book from a Museum about Albert Einstein

“Mileva is small, delicate, brunette and inconspicuous.”

Inconspicuous:
not easily or quickly noticed or seen, or not attracting attention

“She may not be particularly attractive, but she has charisma.”

(Originally written in German, but bad translations can only do so much...)

Letter from Albert to Mileva

“You made me laugh when you started threatening me with your recollections. Have you ever considered, even just for a second, that nobody would ever pay attention to your says if the man you talked about had not accomplished something important. When someone is completely insignificant, there is nothing else to say to this person but to remain modest and silent. This is what I advise you to do.”

Mileva Marić-Einstein

- Did she collaborate with Albert?
 - She proofread
 - Some mentions of “we” and “our work” in letters between them but never anything concrete

⇒ Conclusion: We don’t know
- A lot of people blindly “defending” Albert Einstein
- “The sole genius”
 - Someone to cook, clean, tidy, type up, take care of children, etc.
 - No wonder Albert Einstein had so much time to work

“

While Albert Einstein is remembered as the greatest genius of the twentieth century, we’ll never know the likely genius of Mileva Maric.

Caroline Herschel

- Had typhus, stunted growth (4 feet 3 inches or 1.30 m)
- Assumed that she would never marry
- Her older brothers were musicians
- Ran her brother William's household and sang with them
- William transitioned to astronomy
 - He discovered Uranus (thought it was a comet)
 - He became the private office of court astronomer to King George III
- Caroline helped with telescopes, recording and organising observations

"I did nothing for my brother but what a well-trained puppy dog would have done, that is to say, I did what he commanded me."

Caroline Herschel

Messier 110

- A dwarf elliptical galaxy
 - A satellite of the Andromeda Galaxy
- Charles Messier drew it but didn't recognise it as a galaxy
- Caroline independently discovered it (was called a nebula at the time)
 - Her brother William gave her the credit

Other Discoveries

- 8 Comets
- 3 Nebulae

“With her brother, she discovered over 2,400 astronomical objects”

Caroline Herschel

- First woman to be a salaried scientist
- Her brother William married
 - Caroline now had loads more time as someone else did the housework
- The Royal Society published Caroline's catalogue under William's name.
- Got a Gold Medal from the Royal Astronomical Society in 1828
 - Next woman to receive this was Vera Rubin in 1996
- Was honoured by several big important institutions
 - Always together with her brother though

How This Relates to Today?

Hidden Work

- Men's time is worth more than women's
 - **Modern equivalent:** Men not bothering to organise or do housework in relationships

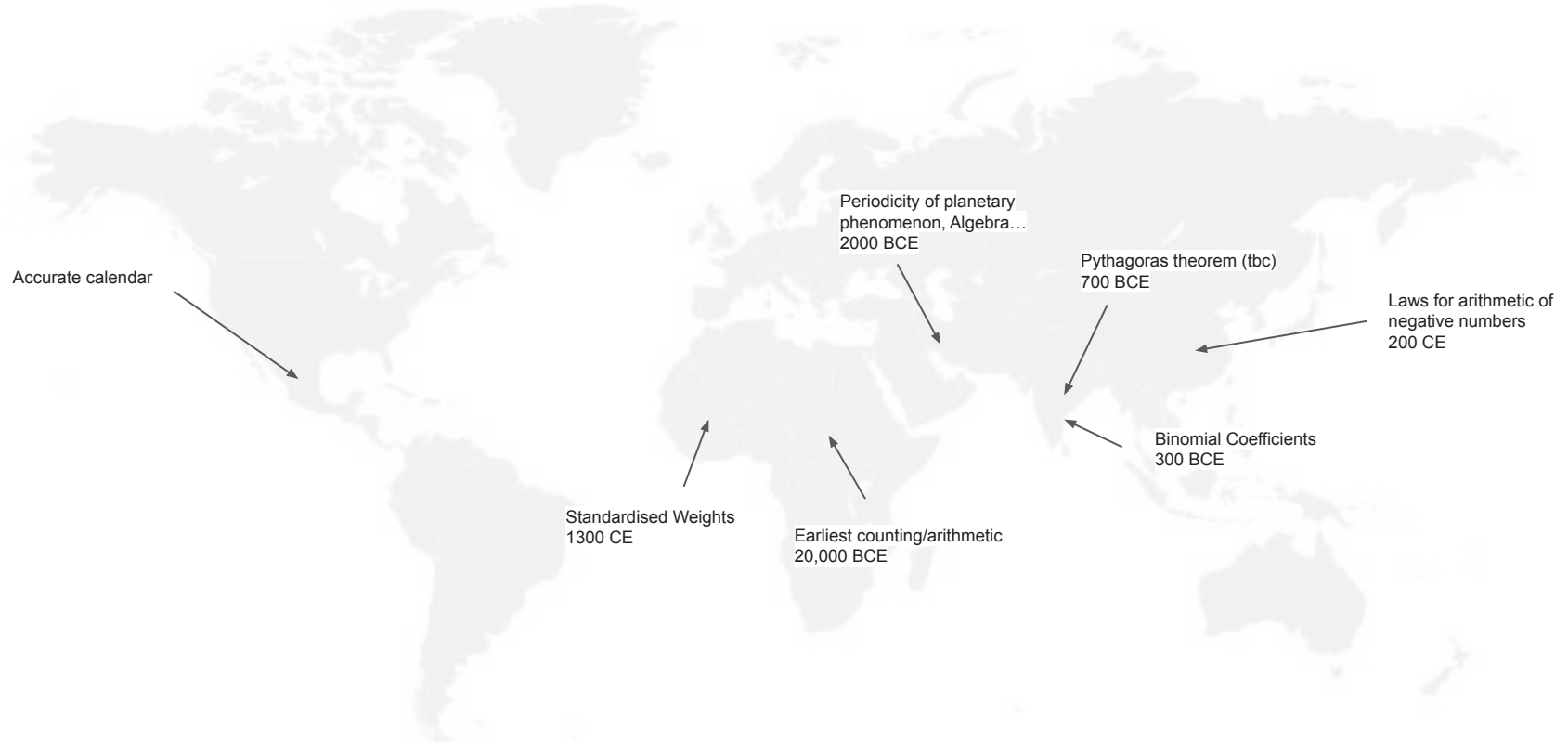
Gender Stereotypes

- Women are meant to be caring
- Assumed to take care of children
 - **Modern equivalent:** Men get a medal just for showing up
 - Dads “babysitting” their own kids....

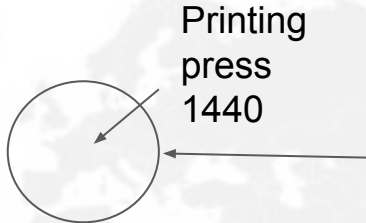
Further Reading:

Hidden work, Invisible work, mental load, hidden load

Eurocentrism in Maths & Physics



Eurocentrism in Maths & Physics



- c. 1500: Scipione del Ferro solves the special cubic equation $x^3 = px + q$ ^{[1][11][12]}
- 16th century: Gerolamo Cardano solves the general cubic equation (by reducing them to the case with zero quartic term).
- 16th century: Lodovico Ferrari solves the general quartic equation (by reducing it to the case with zero quartic term).
- 16th century: François Viète discovers Viète's formulas.

- Probability and statistics** ^[edit]
- 1564: Gerolamo Cardano is the first to produce a systematic treatment of probability^[12]
- Numerical mathematics and algorithms** ^[edit]
- 16th century: François Viète discovers Viète's formulas for π ^[12]

- Notation and conventions** ^[edit]
- Various pieces of modern symbolic notation were introduced in this period, notably:
- 1556: Niccolò Tartaglia introduces parentheses.
 - 1557: Robert Recorde introduces the equal sign.^{[12][16]}
 - 1591: François Viète's New algebra shows the modern notation of algebraic manipulation.
- Physics** ^[edit]
- Astronomy** ^[edit]
- 1543: Nicolaus Copernicus develops a heliocentric model, rejecting Aristotle's earth-centric view, would be the first quantitative heliocentric model in history.
 - Late 16th century: Tycho Brahe proves that comets are astronomical (and not atmospheric) phenomena.

- Biology and anatomy** ^[edit]
- 1543 - Vesalius: pioneering research into human anatomy

- Social science** ^[edit]
- Economics** ^[edit]
- 1517: Nicolaus Copernicus develops the quantity theory of money and states the earliest known form of Gresham's law ("Bad money drives out good")^[17]

- 17th century** ^[edit]
- 1600 – William Gilbert: Earth's magnetic field
 - 1608 – Earliest record of an optical telescope
 - 1609 – Johannes Kepler: first laws of planetary motion
 - 1610 – Galileo Galilei: Sidereus Nuncius: telescopic observations
 - 1614 – John Napier: use of logarithms for calculation^[18]
 - 1619 – Johannes Kepler: third law of planetary motion
 - 1620 – Appearance of the first compound microscope in Europe
 - 1628 – Wilheleord Snellius: the law of refraction also known as Snell's law
 - 1628 – William Harvey: blood circulation
 - 1638 – Galileo Galilei: laws of falling bodies
 - 1643 – Evangelista Torricelli invents the mercury barometer
 - 1662 – Robert Boyle: Boyle's law of ideal gases
 - 1665 – Philosophical Transactions of the Royal Society, first peer reviewed scientific journal published.
 - 1665 – Robert Hooke: discovers the cell
 - 1668 – Francesco Redi: disproved idea of spontaneous generation
 - 1669 – Nicholas Steno: proposes that fossils are organic remains embedded in layers of sediment, basis of stratigraphy
 - 1669 – Jan Swammerdam: epigenesis in insects
 - 1672 – Sir Isaac Newton: discovers that white light is a mixture of distinct coloured rays (the spectrum)
 - 1673 – Christian Huygens: first study of oscillating system and design of pendulum clocks
 - 1675 – Leibniz, Newton: infinitesimal calculus
 - 1675 – Anton van Leeuwenhoek: observes microorganisms using a refined simple microscope
 - 1676 – Ole Rømer: first measurement of the speed of light.
 - 1687 – Sir Isaac Newton: classical mathematical description of the fundamental force of universal gravitation and the three physical laws of motion

- 18th century** ^[edit]
- 1735 – Carl Linnaeus described a new system for classifying plants in Systema Naturae
 - 1745 – Ewald Georg von Kleinf first capacitor, the Leyden jar
 - 1749-1789 – Blaise Pascal: Histoire naturelle
 - 1750 – Joseph Black: describes latent heat
 - 1751 – Benjamin Franklin: lightning is electrical
 - 1750 – Immanuel Kant: Cosmological Hypothesis in Universal Natural History and Theory of Heaven
 - 1761 – Mikhail Lomonosov: discovery of the atmosphere of Venus
 - 1763 – Thomas Bayes: publishes the first version of Bayes' theorem, paving the way for Bayesian probability
 - 1771 – Charles Messier: publishes catalogue of astronomical objects (Messier Objects) now known to include galaxies, star clusters, and nebulae.
 - 1778 – Antoine Lavoisier (and Joseph Priestley): discovery of oxygen leading to end of Phlogiston theory
 - 1781 – William Herschel announces discovery of Uranus, expanding the known boundaries of the Solar System for the first time in modern history
 - 1785 – William Withering: publishes the first definitive account of the use of foxglove (digitalis) for treating dropsy
 - 1787 – Jacques Charles: Charles's law of ideal gases
 - 1789 – Antoine Lavoisier: law of conservation of mass, basis for chemistry, and the beginning of modern chemistry
 - 1796 – George Closter: Establishes extraction of a fat
 - 1796 – Edward Jenner: smallpox historical accounting
 - 1796 – Hananaka Seishō: develops general anaesthesia
 - 1800 – Alessandro Volta: discovers electrochemical series and invents the battery

- 1800–1849** ^[edit]
- 1802 – Jean-Baptiste Lamarck: teleological evolution
 - 1805 – John Dalton: Atomic Theory in chemistry
 - 1820 – Hans Christian Ørsted discovers that current passed through a wire will deflect the needle of a compass, establishing the deep relationship between electricity and magnetism (electromagnetism).
 - 1820 - Michael Faraday and James Stoddart discover alloying iron with chromium produces a stainless steel resistant to oxidising elements (rust).
 - 1821 - Thomas Johann Seebeck is the first to observe a property of semiconductors
 - 1824 – Carnot: described the Carnot cycle, the idealized heat engine
 - 1824 – Joseph Aspdin develops Portland cement (concrete), by heating ground limestone, clay and gypsum, in a kiln.
 - 1827 – Evaristo Galeati: development of group theory
 - 1827 – Georg Ohm: Ohm's law (Electricity)
 - 1827 – Annetta Ingebrigtsen: Ampère's law (Elec law)
 - 1828 – Friedrich Wöhler synthesized urea, refuting vitalism
 - 1830 – Nikolai Lobachevsky created Non-Euclidean geometry

The Classical Picture

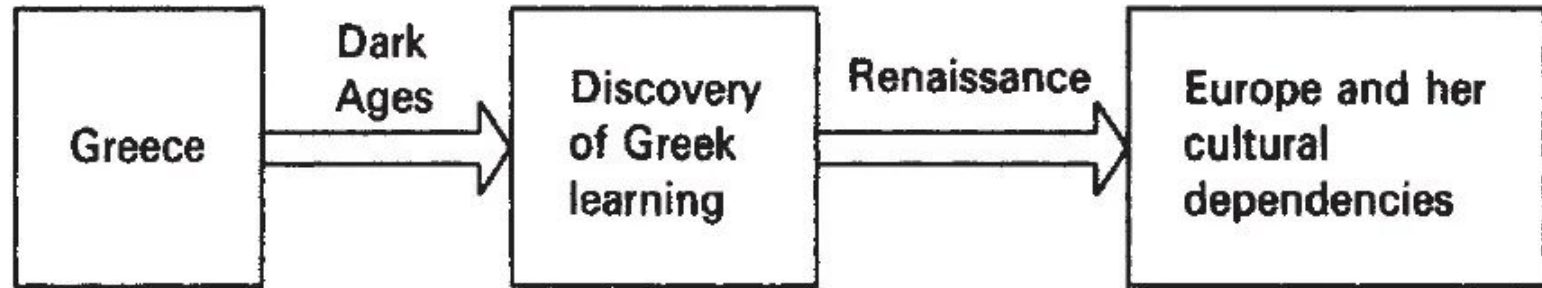


FIGURE 1.1: The “classical” Eurocentric trajectory

The Classical Picture

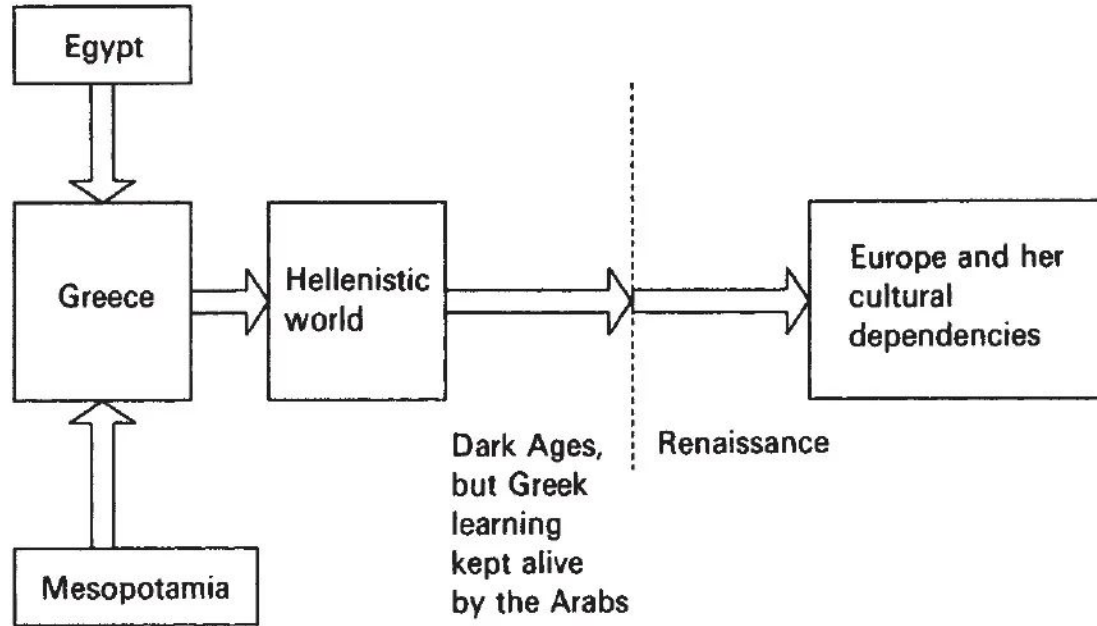


FIGURE 1.2: A modified Eurocentric trajectory

The Classical Picture

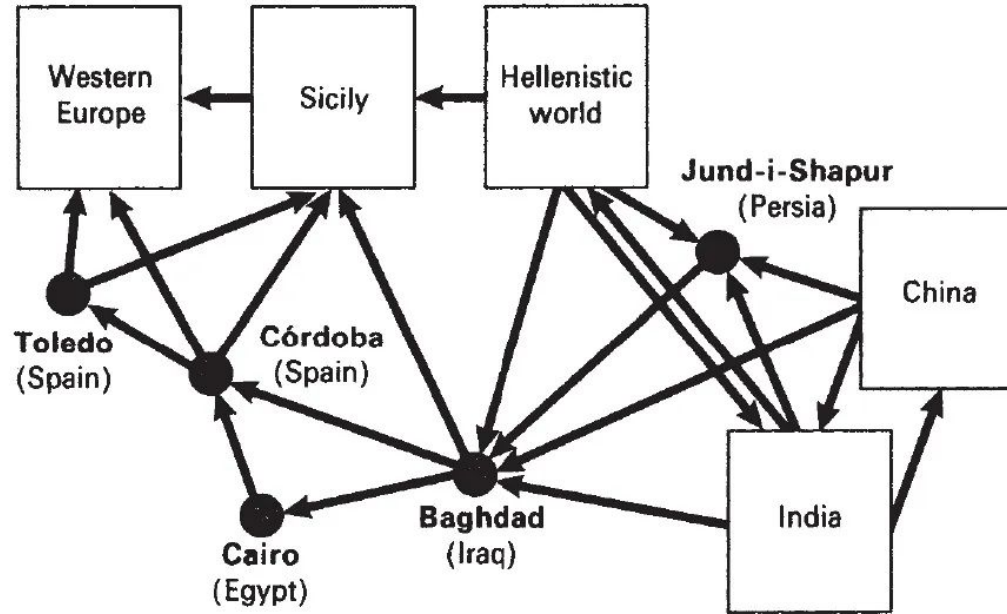


FIGURE 1.3: An alternative trajectory for the “Dark Ages”

The Classical Picture

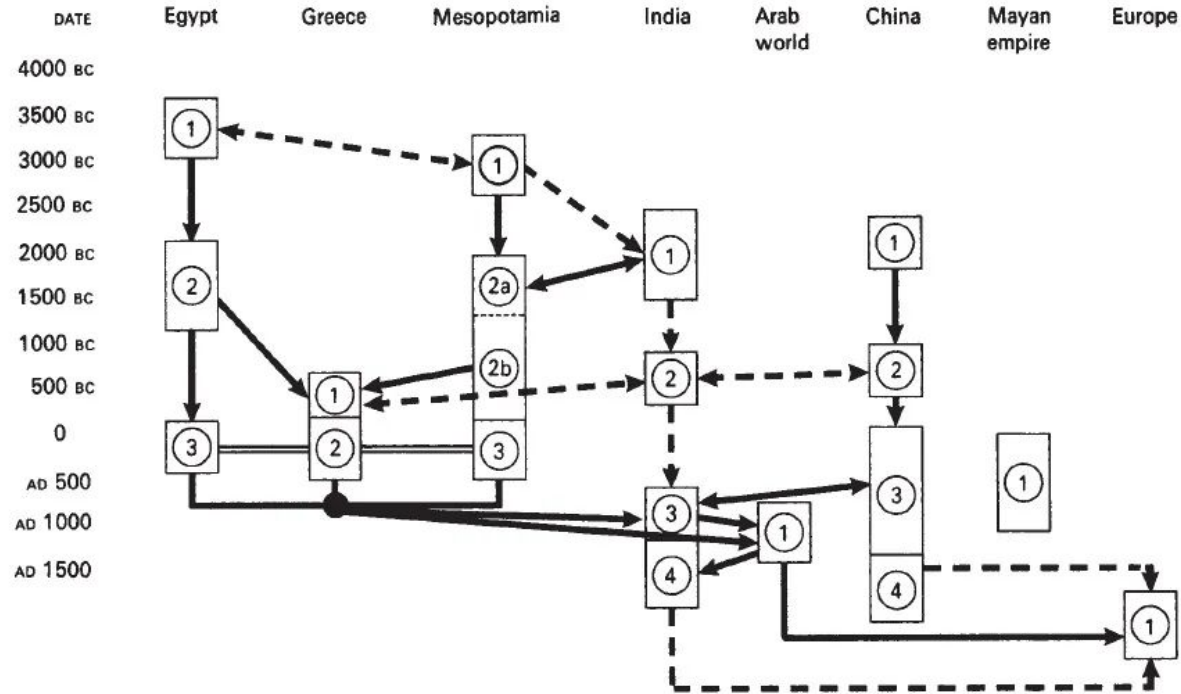


FIGURE 1.4: The spread of mathematical ideas down the ages

The Heliocentric Model



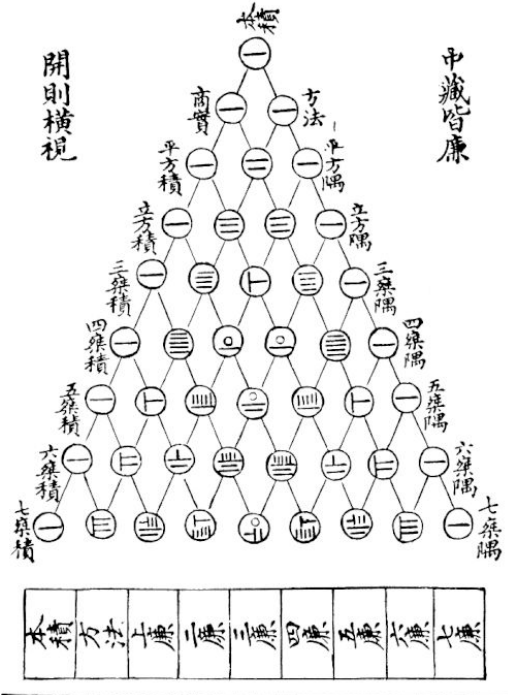
The Ancient Greeks were aware of the heliocentric model but Arabic astronomers were criticising the Ptolemaic model during the Golden Age

Al-Sijzi (pictured) argued that the Earth rotated on its axis during the 11th Century



Jia Xian/Pascal's Triangle

古法七乘方圖



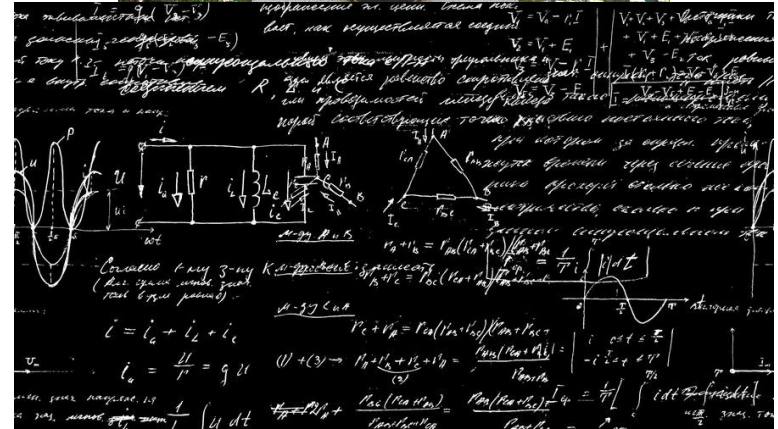
Jia Xian discovered this famous triangle almost 600 years before Pascal (who introduced it independently)

Documents show many different people have derived the triangle and this is evidenced by the fact it is known by many different names across the world such as Khayyam triangle in Iran, Yang Hui's triangle in China and Tartaglia's triangle in Italy

Zero

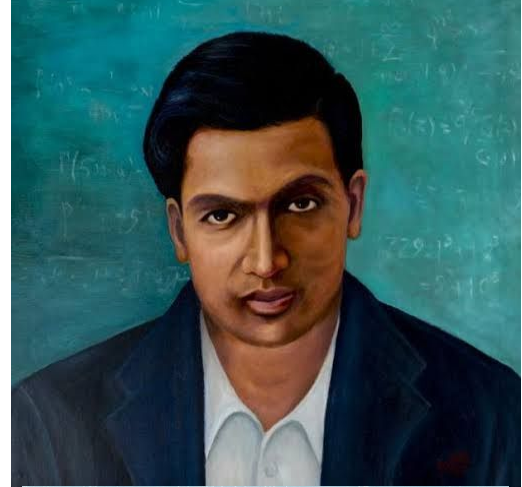
Persian scholar Muḥammad ibn Mūsā al-Khwārizmī was the first Islamic scholar to use the number zero in his mathematical work

It took another few centuries for Europeans to truly appreciate the need for a number which represented nothing



Example: Srinivasa Ramanujan

- Prodigious Indian mathematician who was invited to Cambridge and developed a working relationship with G. H. Hardy
- Independently discovered classic results from 19th Century mathematics as well as introducing new ideas such as “Ramanujan summation” which assigns a value to divergent infinite series including the famous “ $1+2+3+4\dots=-1/12$ ” result



Plan for these lectures: looking at history

Theme 1

Credit being given to men for work done by families (wives, sisters, cousins, ...)

Example:

- Mileva Marić-Einstein
- Caroline Herschel

Homework

Find an amazing scientist who is not a rich white man and tell us what cool things they've discovered

Theme 2

Credit being solely given to European or American scientists and mathematicians instead of other equally-deserving people

Examples:

- Pascal's Triangle
- The Heliocentric Model

and many more...!

Plan for these lectures: looking at ~~history~~ today

Theme 1

Authorship only

PI's

Credit being given to ~~men~~ for work done by ~~families (wives, sisters, cousins, ...)~~ *students*

Theme 2

CERN membership fees being unaffordable for institutes in the global south

Example:

- [light curves](#) in astronomy
- shifts in experiments

Homework

Find an amazing scientist who is not a rich white man and tell us what cool things they've discovered

Closing remarks

- science is and was a global undertaking!
- let's make sure we view it as such

Homework for Monday

Find the stories of some other amazing scientist and share their stories

Look for more instances of eurocentrism in science or research additional potential reasoning for why the scientific revolution is said to of happened in Europe

Have a look at the course website for some further reading a short list of ideas