



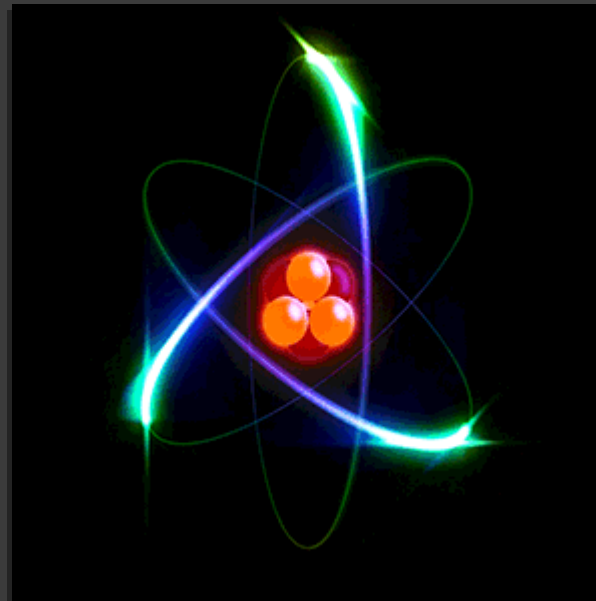
# THE HISTORY OF THE ATOM

From Democritus until now

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# WHAT IS AN ATOM?

The atom is the smallest particle of an element; it maintains the chemical properties



# History of the Atom Timeline

Democritus 460 BC  
and Dalton 1803 AD



Thomson  
1897



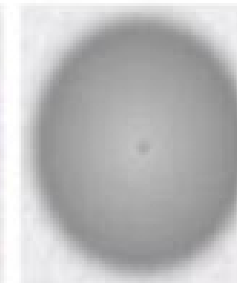
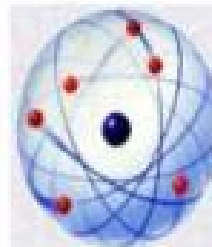
Rutherford  
1912



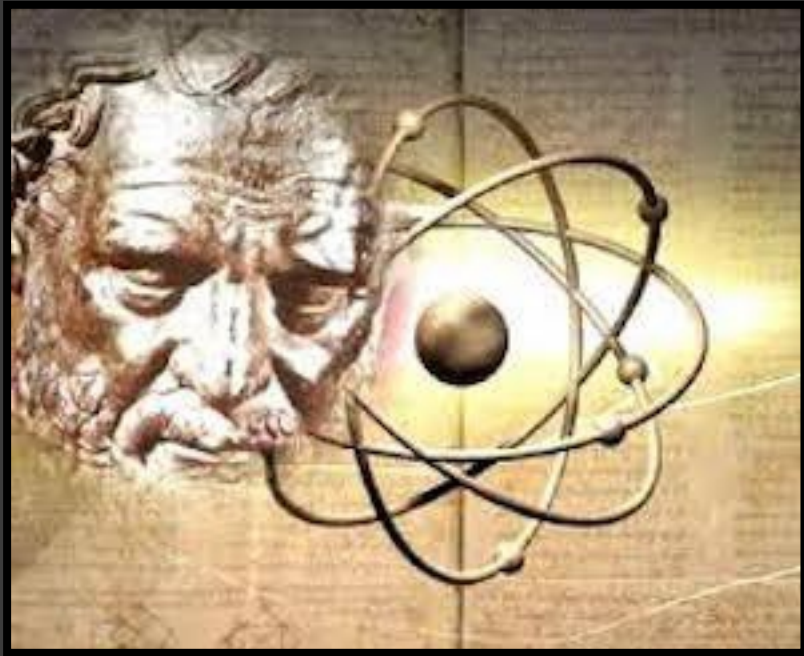
Bohr  
1913



Modern  
Quantum  
Cloud Model  
post 1930



# DEMOCRITUS (460 A.C – 370 A.C)



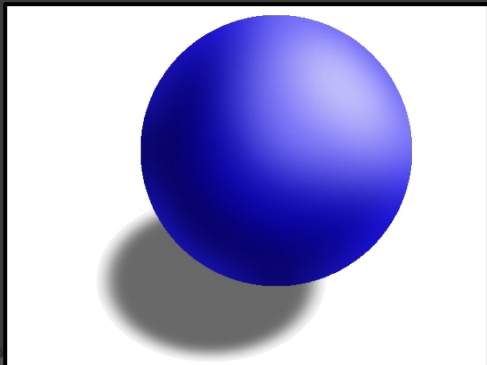
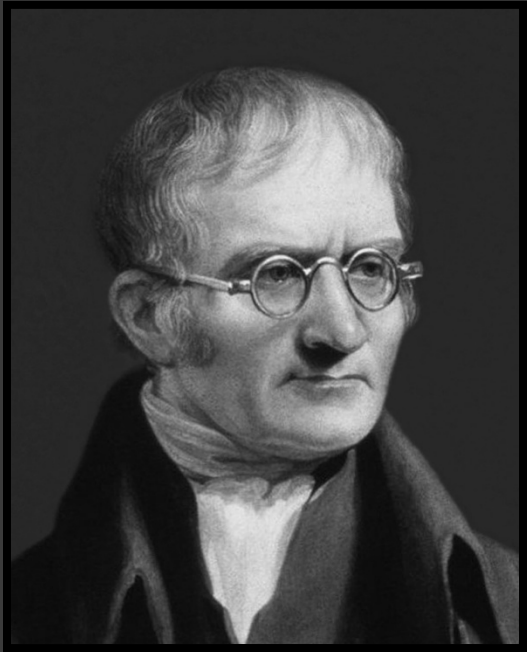
Democritus was the first philosopher of the history to speak about atoms. For Democrito the atom was the littlest part of the matter, infact the same word means indivisible. This theory was in contraposition with the one of Aristotle, more famous than Democritus, that was very criticized from the most of the other citizens.

# ARISTOTLE (380 B.C. - 320 B.C.)



Aristotle affirms, in contraposition of what Democritus said, that the atoms were divisible endlessly. He was supported from the most of the people.

# JOHN DALTON (1766 – 1844)



After almost 2000 years, Dalton, recovered the theory of the atom, applying 5 different rules:

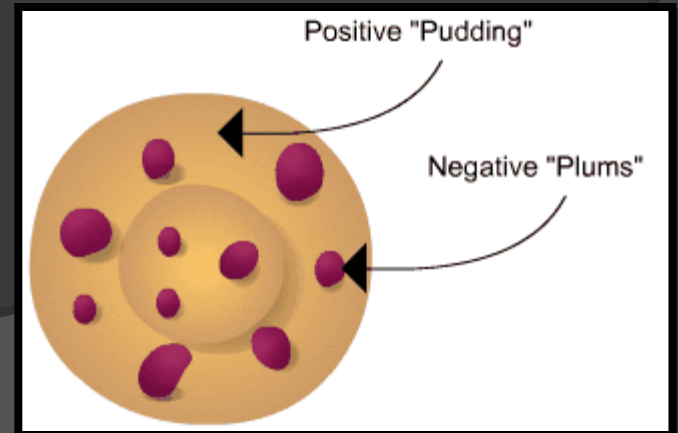
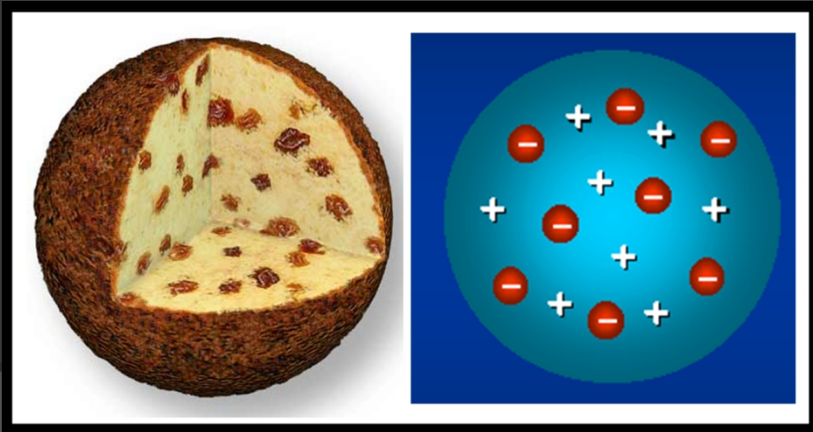
1. All the matter is composed from very little part indivisible and indistructible called atoms;
2. All the atoms of the same element are equals and they have the same mass;
3. Atoms of an element can't become atoms of another element;
4. To form a compound, atoms of an element combined themselves with atoms of other elements;
5. Atoms can't be created or destroyed, but they can be combined with other elements.



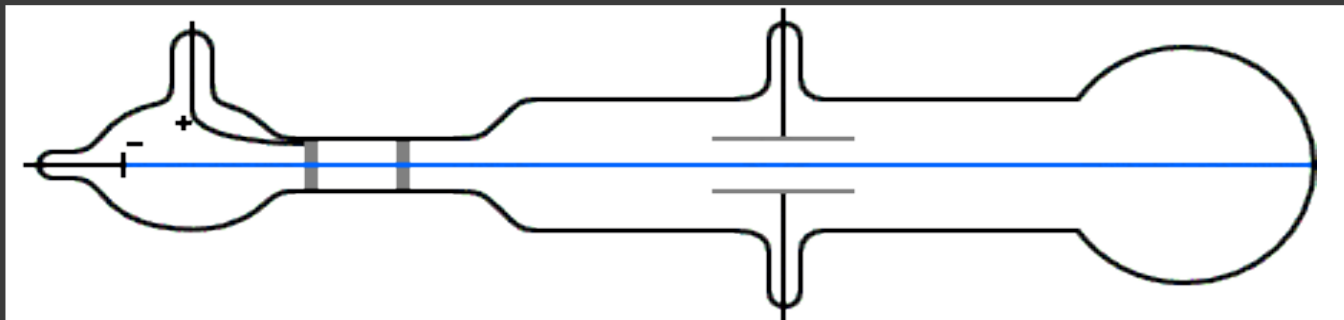
# JOHN THOMSON (1856 – 1940)



Thomson created the first model of the atom. He thought that the atom was composed from a positive mass in which were present the electrons, some corpuscles of negative charge. He represented this model like a sort of plum pudding with the electrons within.



He discovered the charge of the parts of the atom thanks to the cathode ray tube, in which were scattered the particles in straight line noticing that they take different directions when they passed through the electric field generated between the two plates, charged each other with negative and positive charge alternately.

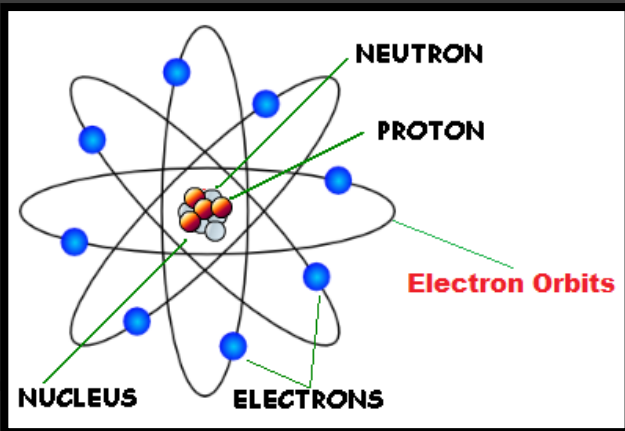




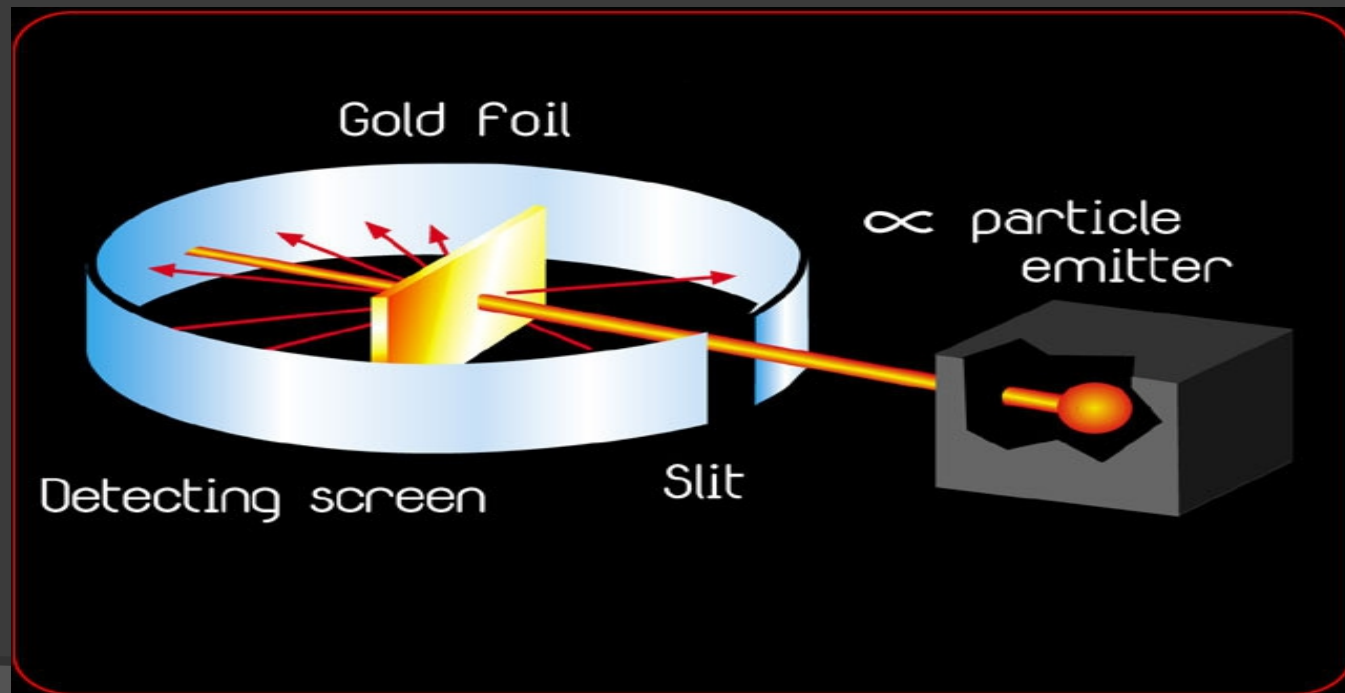
# ERNEST RUTHERFORD (1871 – 1937)



Rutherford created a new model of the atom changing the previous one of Thomson. He discovered that the electrons turn around the nucleus, made of a positive mass.



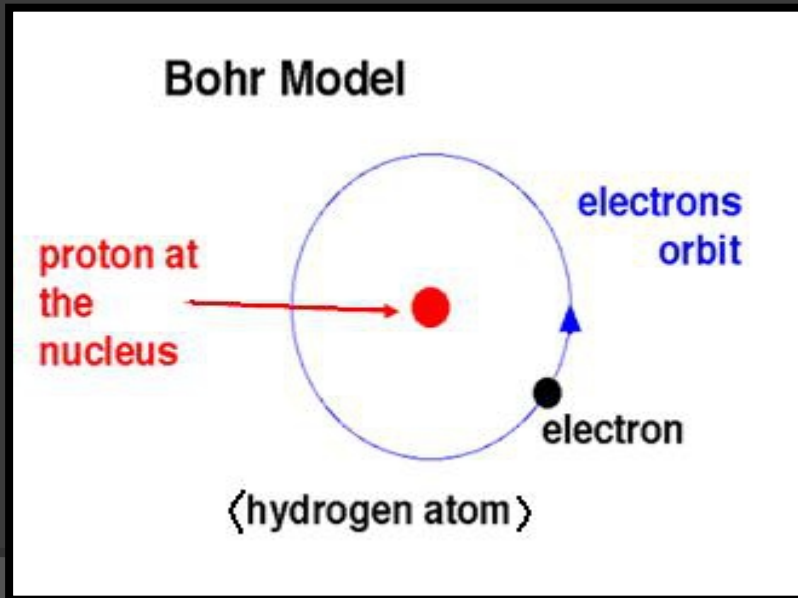
He discovered it using a gold foil, surrounded by a glass circle, and the cathode ray tube. Scattering the alpha particles towards the gold foil, he noticed that they bounce back or divert their course in the glass circle instead of going straight on like he thought. So he discovered that the nucleus was formed by the protons, and the electrons turned around this positive mass following the course of the orbitals.



# NIELS BOHR (1885 – 1962)



Bohr, taking inspiration from the model of Rutherford, discovered that the electron turn around the nucleus in dependence of the quantic number and just in a specific orbital. He discovered that because the model of Rutherford was wrong in part.



In fact he noticed that if he would applied the model of Rutherford to an atom heavier than the hydrogen one, the electrones could be able to overload themselves falling into the nucleus.

# WERNER HEISENBERG (1901 – 1976)



Heisenberg realized that it's impossible to know at the same time momentum and velocity of the atom. This is called uncertainty principle.

He discovered in fact that the electrons moves themselves with a wave motion along the orbitals instead of turning around them, so we can't say that the electron is in a particular place, but we have to say that there's the probability to find it there.

$$\Delta x \cdot \Delta p \geq \frac{h}{2\pi}$$

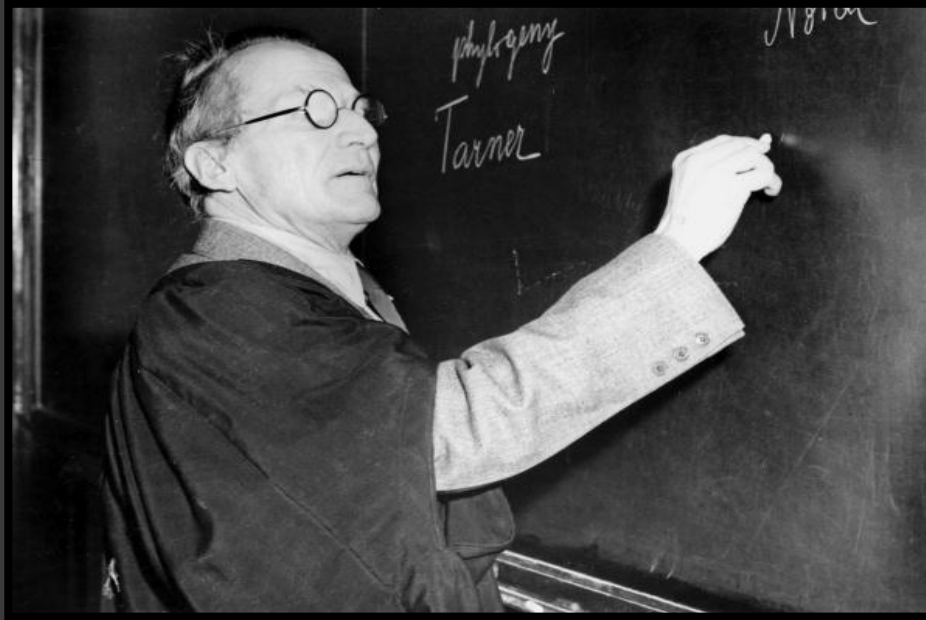
$\Delta x$  = indeterminazione  
posizione della  
particella

$\Delta p$  = indeterminazione  
quantità di moto  
della particella

$h$  = costante di Planck

$\pi$  = Pi Greco

# ERWIN SCHRÖDINGER (1887-1961)

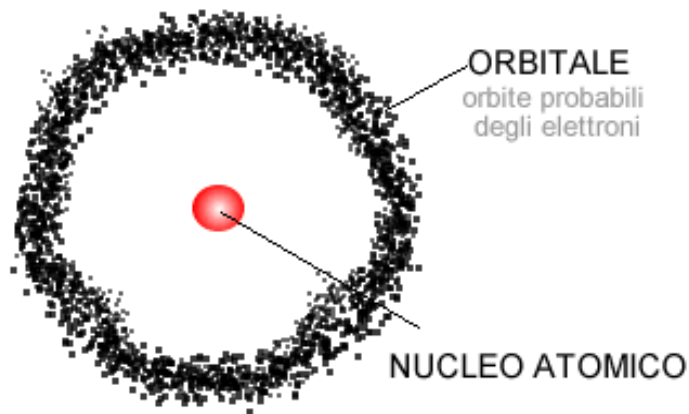


Schrodinger showed that the electrons are waves and not particles, allowing to the uncertainty principle. Infact he stated that if you do an experiment to know the position of a particle you should find something, but if not, it means that it is a wave that transmit the information of the probability to find the particle there.

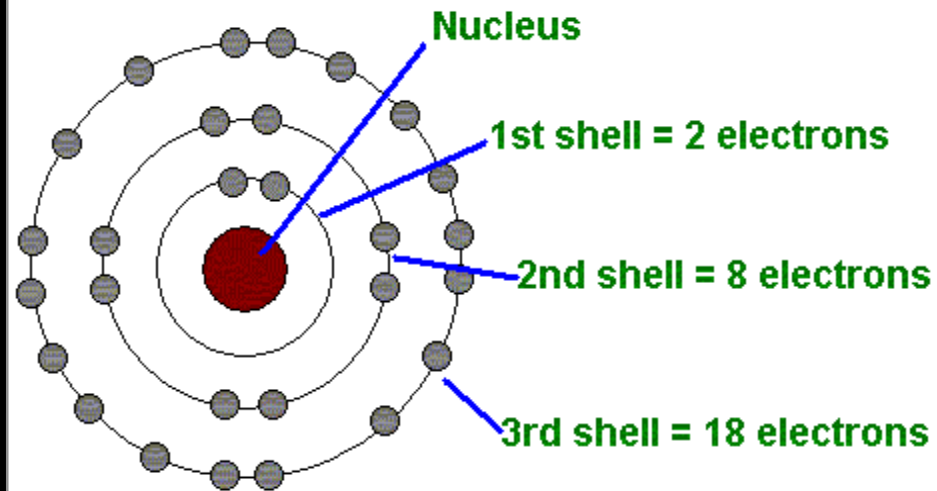
He also said that these waves don't move, but they are stationary, and the orbitals where they are can't say us where the particle is but how much energy has that wave.

This is called energy level, and it needs to know where is the best chance to find the particle there.

ATOMO DI SCHRODINGER



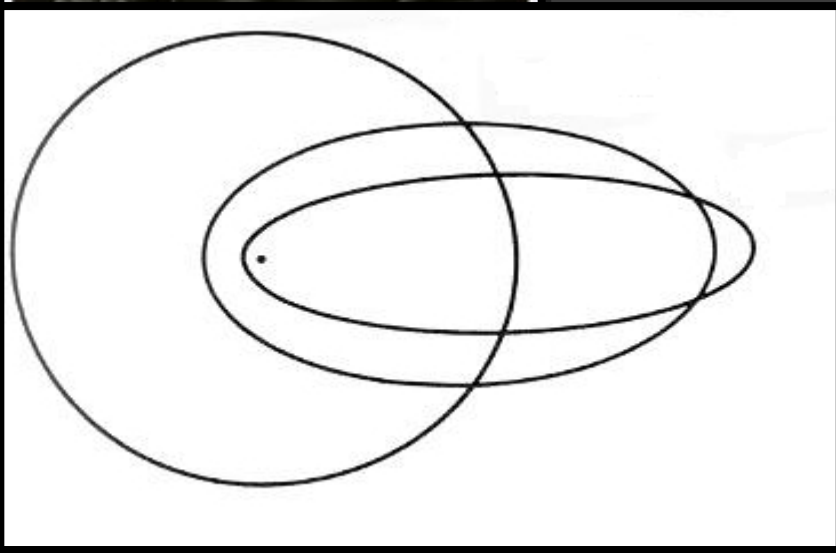
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# ARNOLD SOMMERFELD (1868-1951)



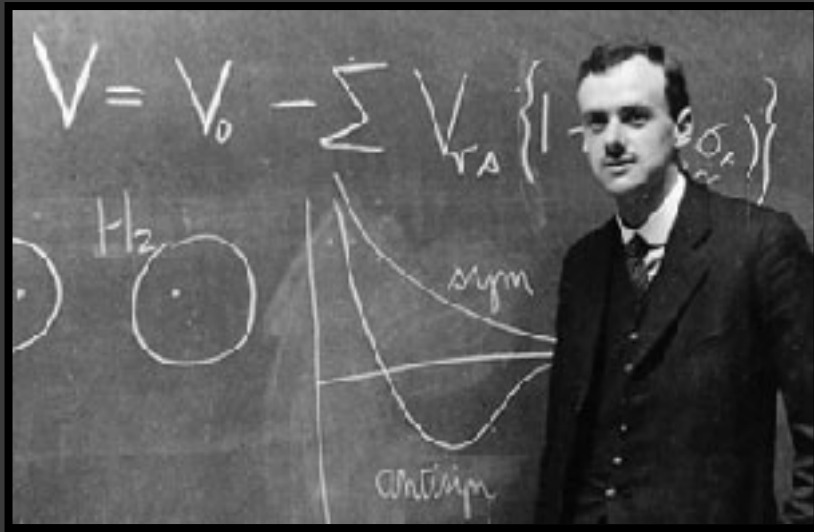
Arnold Sommerfeld tried to improve the atomic model of Bohr. In this model we supposed that the electrons were traveling in elliptical orbits around the nucleus.



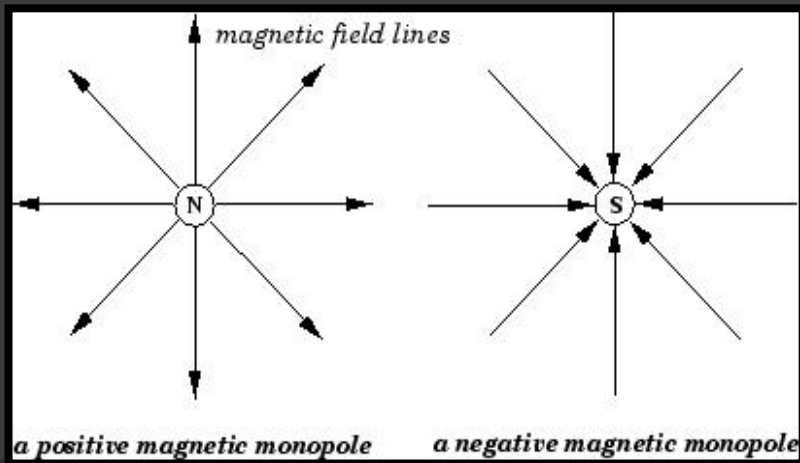
This theory contrasts the original Bohr model which supposed circular orbits.



# PAUL DIRAC (1902-1984)



Paul Dirac made valuable contributions to the development of quantum mechanics and electrodynamics. He also introduced the Dirac delta function, and supposed the presence of another particle, renamed “magnetic monopole”, equipped with an isolated magnetic charge.

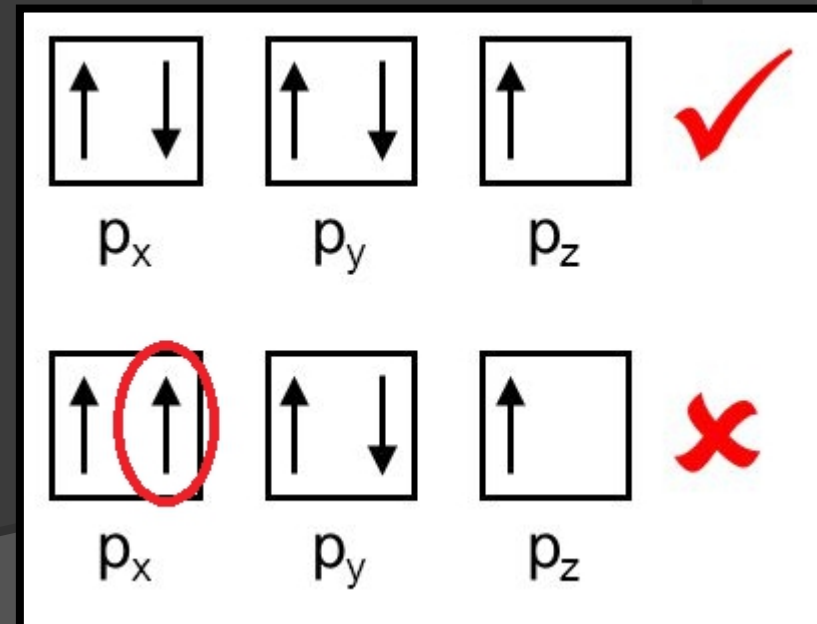


# WOLFGANG PAULI (1900 – 1958)

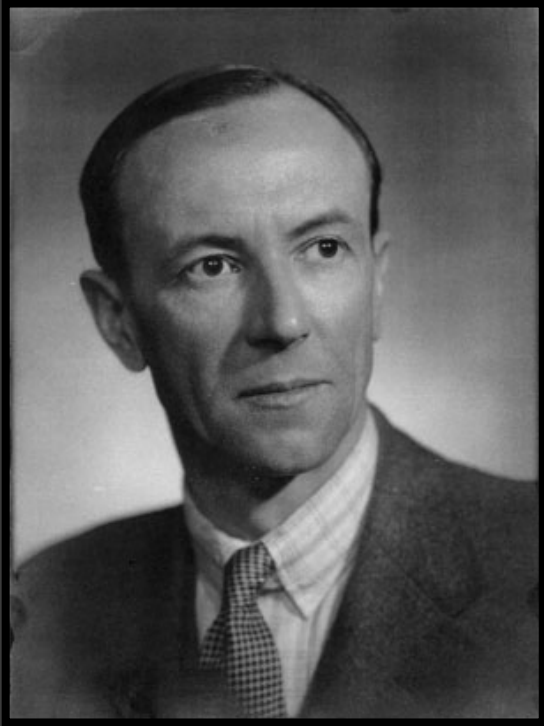


Pauli was one of the founders of quantum mechanics. He formulated the exclusion principle.

According to Pauli, can't be exist two electrons which have the same four quantum numbers.



# JAMES CHADWICK (1891-1974)



James Chadwick was an English physicist. In 1932 he discovered the neutron, a neutral particle of a nucleus.

He bombarding thin beryllium foil with alpha particles emitted by polonium, he discovered that from the beryllium were emitted secondary radiation that not resented neither an electric field nor a magnetic field.

