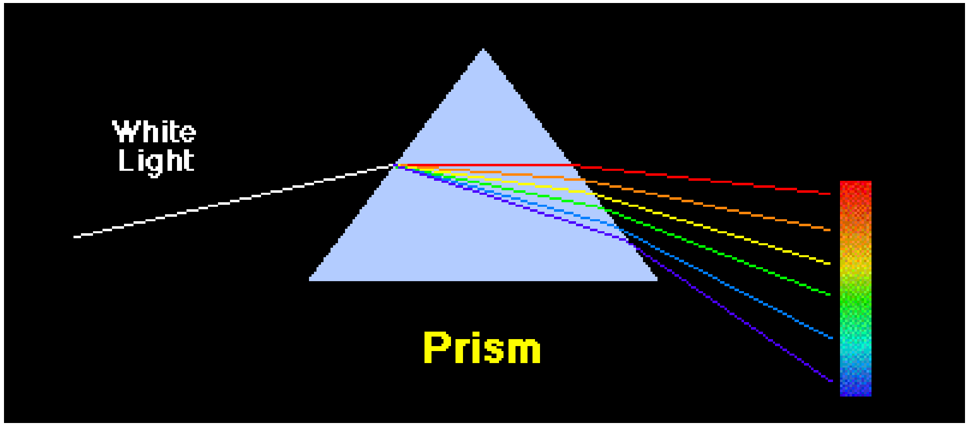
Az anyag atomi-molekuláris szerkezete

Színképek

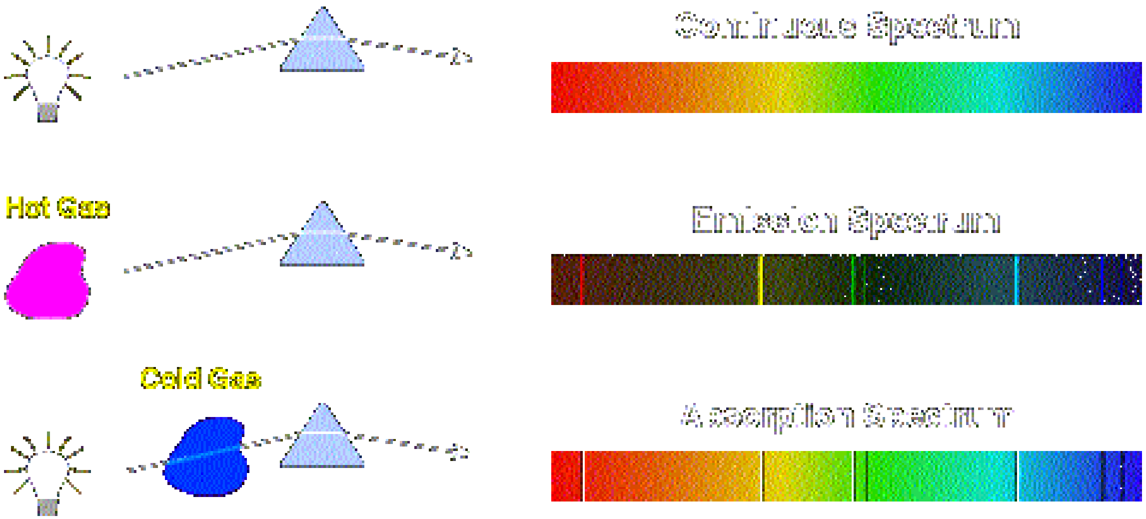
A spektroszkópia alapja: a fényt komponenseire bontjuk



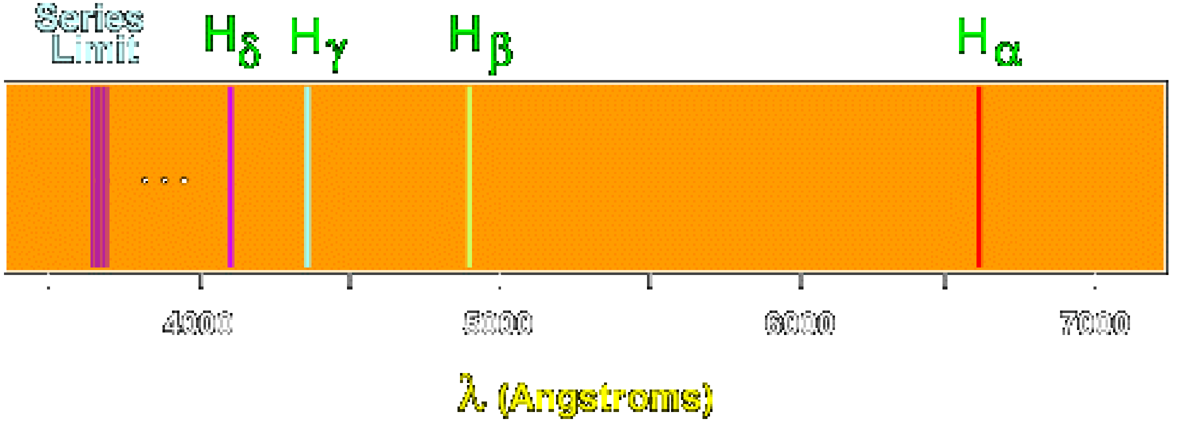
Folytonos spektrum

Vonalas emissziós sp.

Vonalas abszorpciós sp.



Balmer:
az atomos hidrogén spektruma a látható fény tartományában

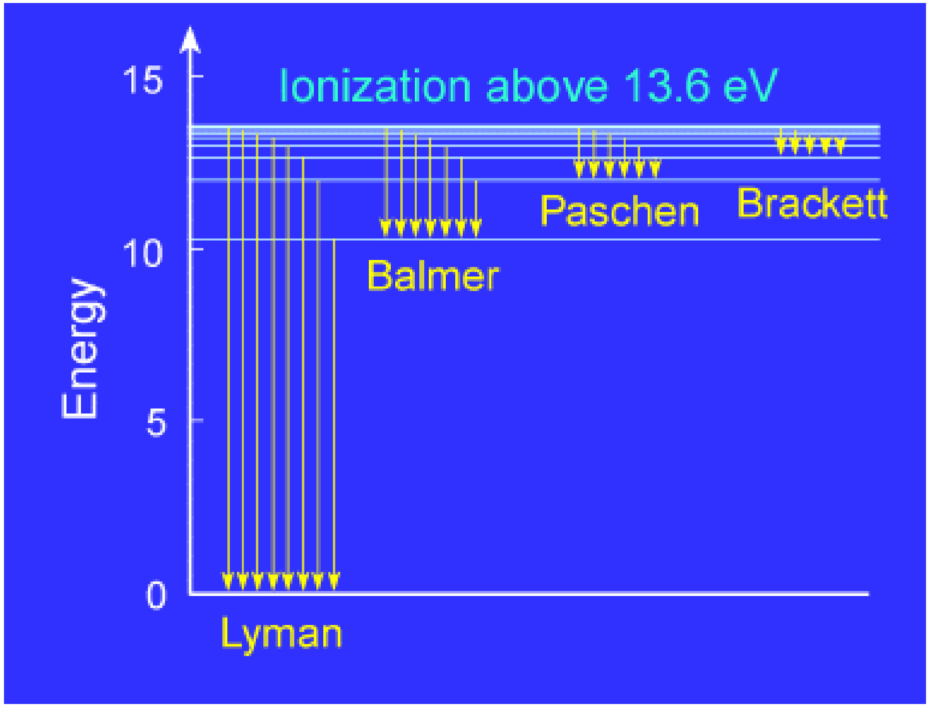


Négy vonalat észlelt: 410 nm, 434 nm, 486 nm, and 656 nm.

Ezekre egyszerű képlet adódott:

$$1/\lambda = \text{const.}\ (1/2^2 - 1/n^2)$$

ahol n = 3,4,5,6



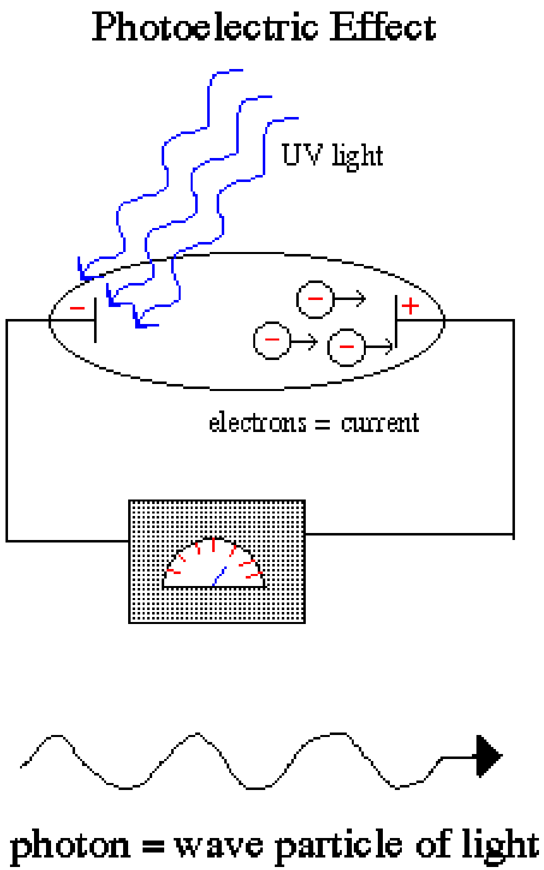
Ionization above 13.6 eV
15
10
5
0
Energy
Lyman
Balmer
Paschen
Brackett

A fotoelektromos effektus

(2005: Einstein-év)

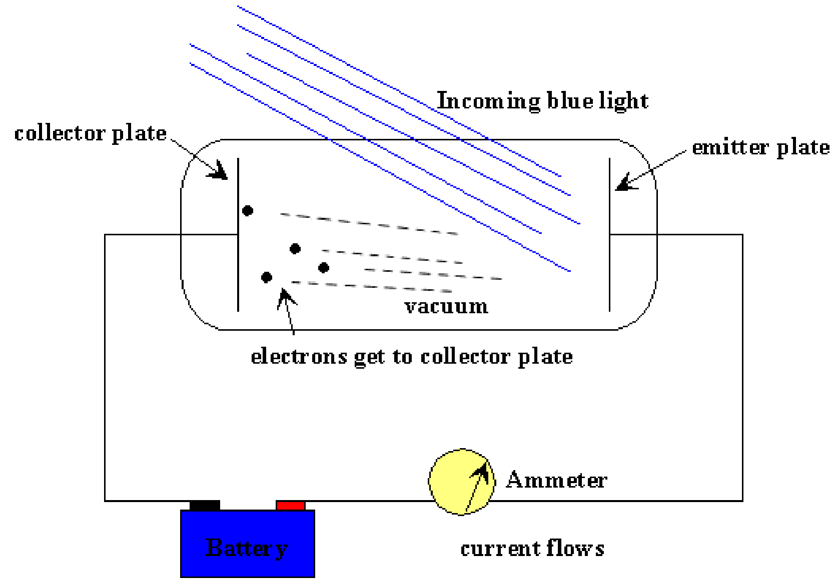
A foton energiája <u>kvantált</u>

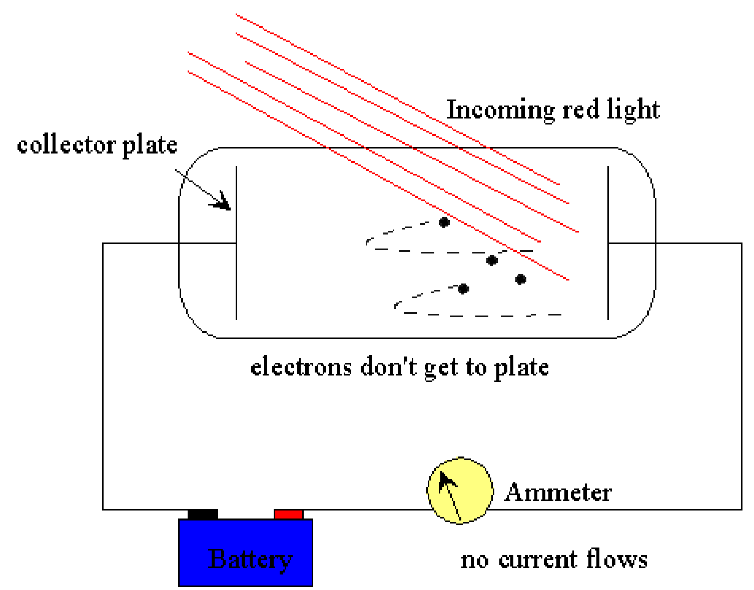
$E = h\nu$



Az eredeti kísérlet picit más volt, a kollektoron taszító, negatív feszültség

In 1902, Lenard studied how the energy of the emitted photoelectrons varied with the intensity of the light. ... To measure the energy of the ejected electrons, Lenard charged the collector plate negatively, to repel the electrons coming towards it. Thus, only electrons ejected with enough kinetic energy to get up this potential hill would contribute to the current. Lenard discovered that there was a well defined minimum voltage that stopped any electrons getting through, we'll call it V_{stop}. To his surprise, he found that V_{stop} did not depend at all on the intensity of the light! Doubling the light intensity doubled the *number* of electrons emitted, but did not affect the *energies* of the emitted electrons.





A hullámtermészet lényege: **Interferencia-diffrakció**

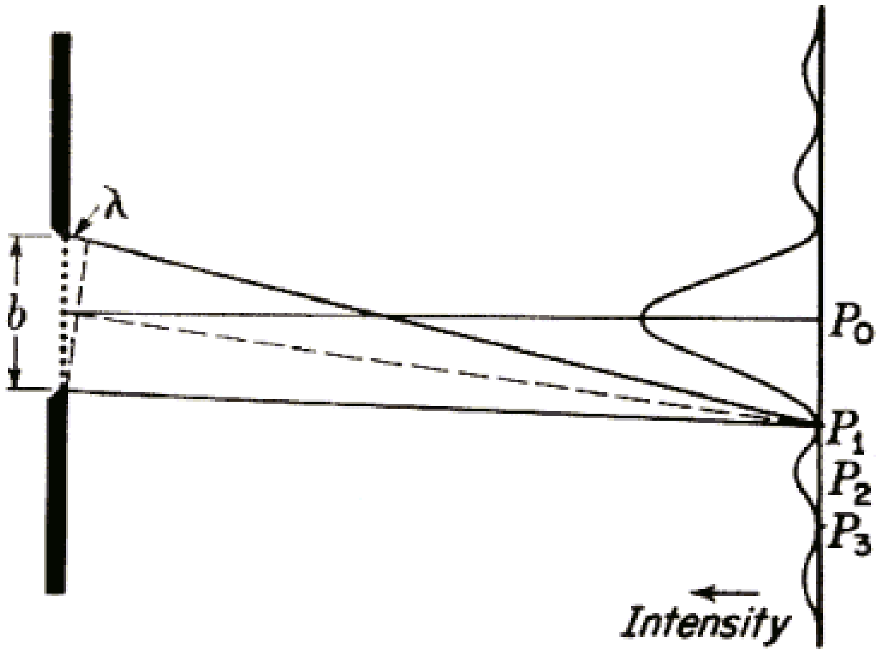
http://www.micrographia.com/tutoria/micbasic/micbpt06/micb0600.htm

EGYETLEN rés is már diffrakciót ad (Fraunhofer)

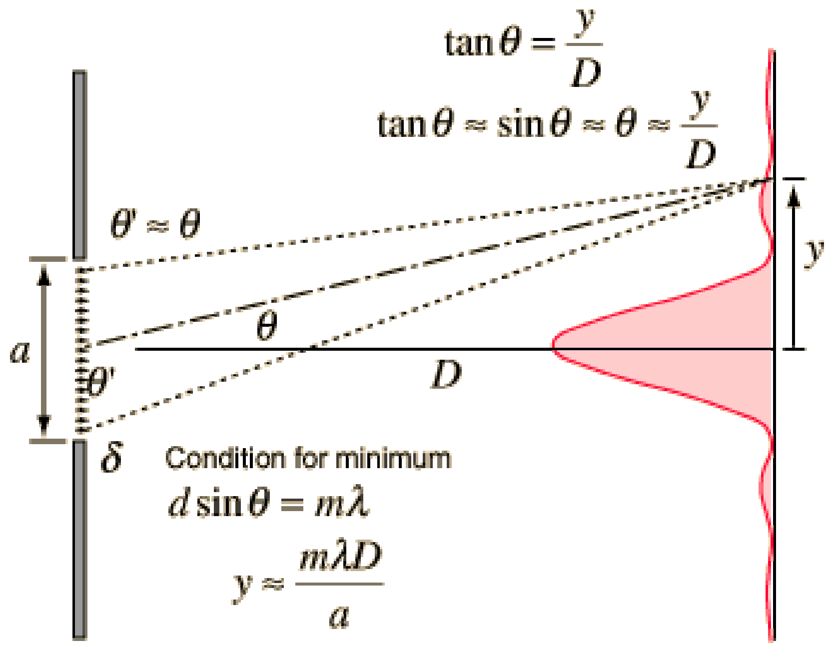
Kiemelés tőlem. Consider a subject under a brightfield microscope which has a pattern of detail in which very small opaque objects are separated from one another by a distance equal to their own diameter. The diagram below represents the **diffraction which occurs at a single narrow slit**, and is used here to illustrate what happens when light passes through the space separating the opaque objects of the above example.

*

Given the approximation that the wavefront of light arriving at this slit from a very distant point source is planar, Huyghens' principle states that along the imaginary line b which represents the wavefront momentarily present between the edges of the slit, each point on b could itself be considered a secondary source of wavelets which radiate from that point. This provides a basis for determining the distribution of the light energy passing through the slit, which, due to interference between the rays, is neither even nor random.

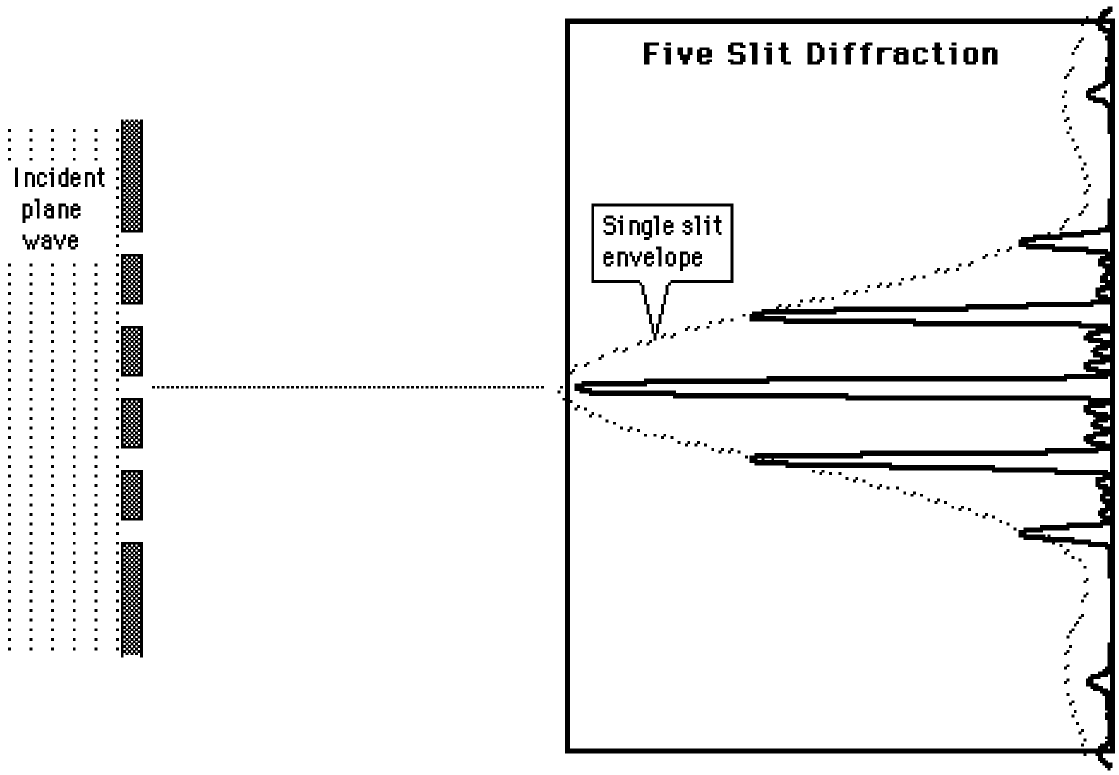


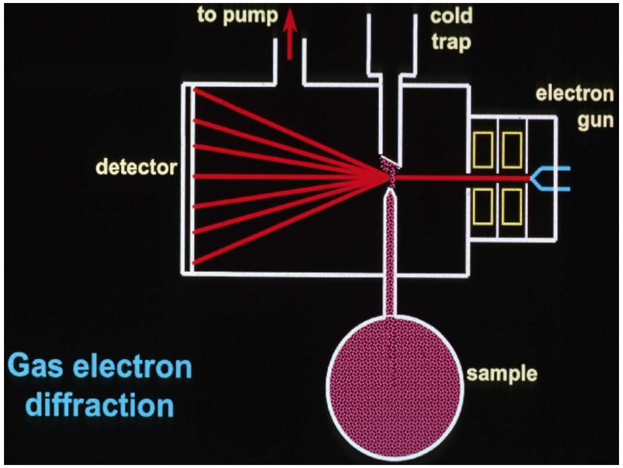
Mégegyszer a Fraunhofer-diffrakció:



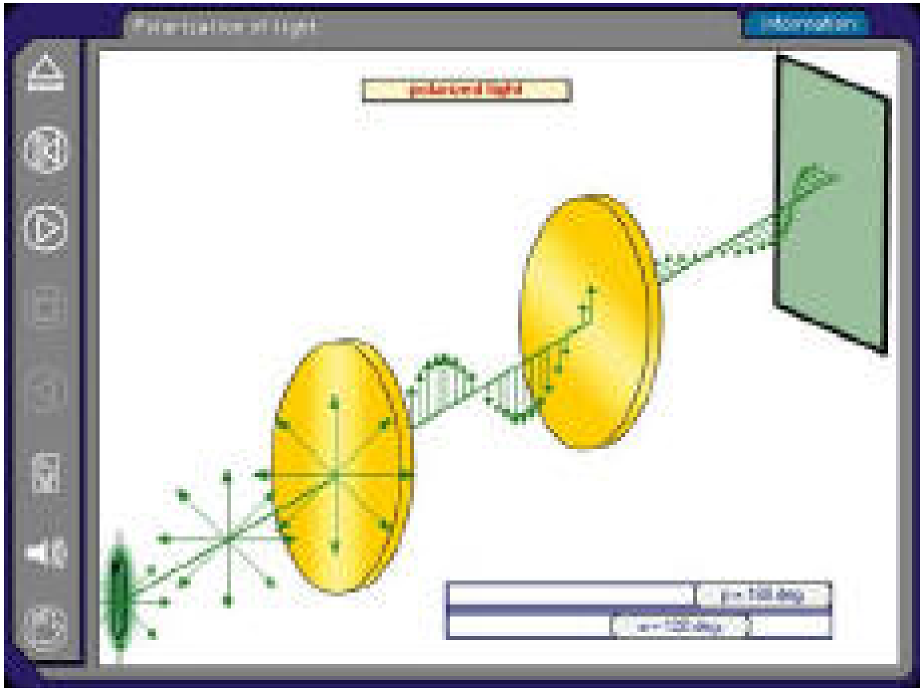
http://hyperphysics.phy-astr.gsu.edu/hbase/phyopt/mulslid.html

Több rés: a Fraunhofer-kép és az interferencia szuperpoziciája



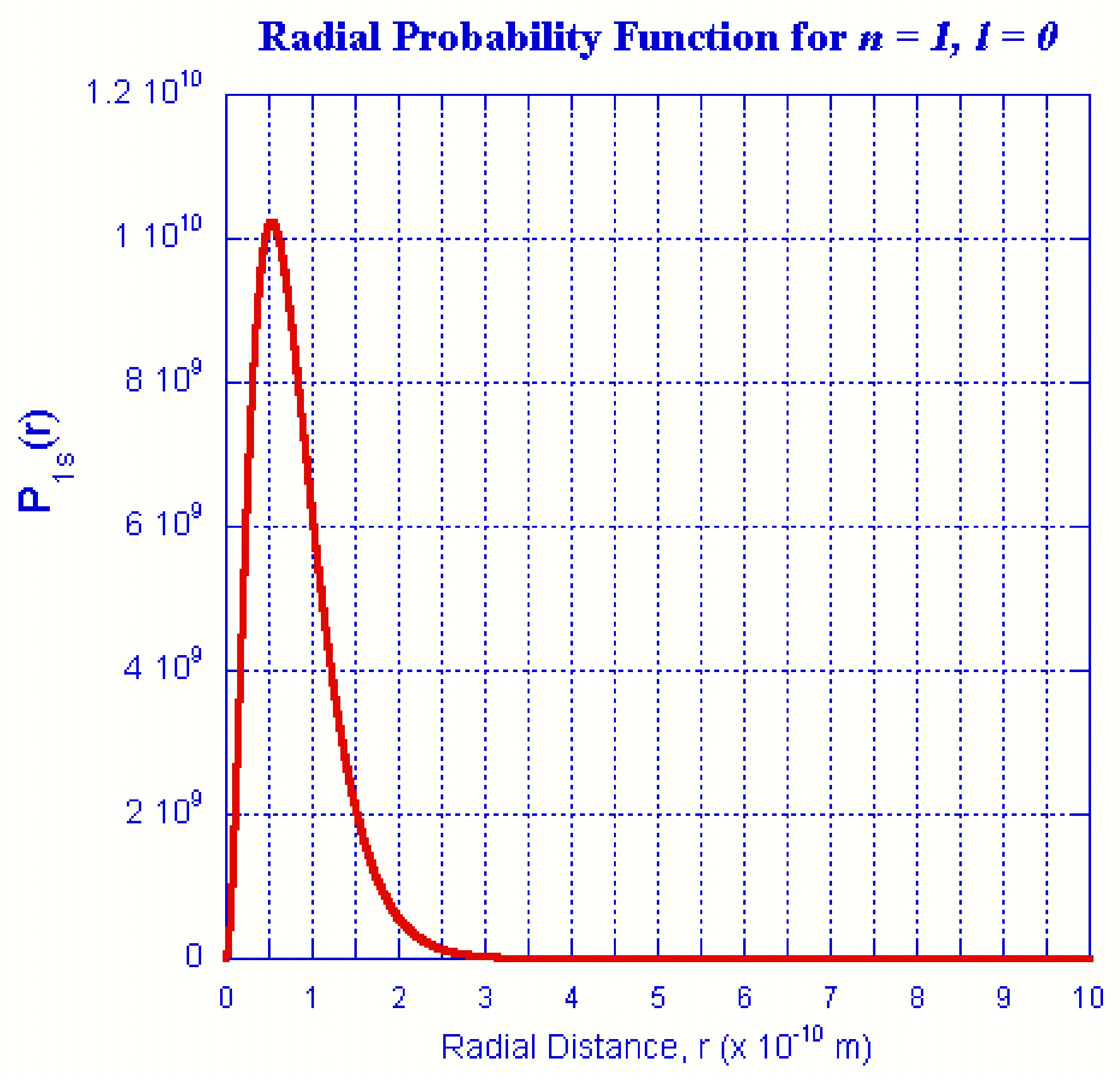

to pump
cold
trap
electron
gun
detector
sample
Gas electron
diffraction

A polarizált fény: rezgés egy síkban

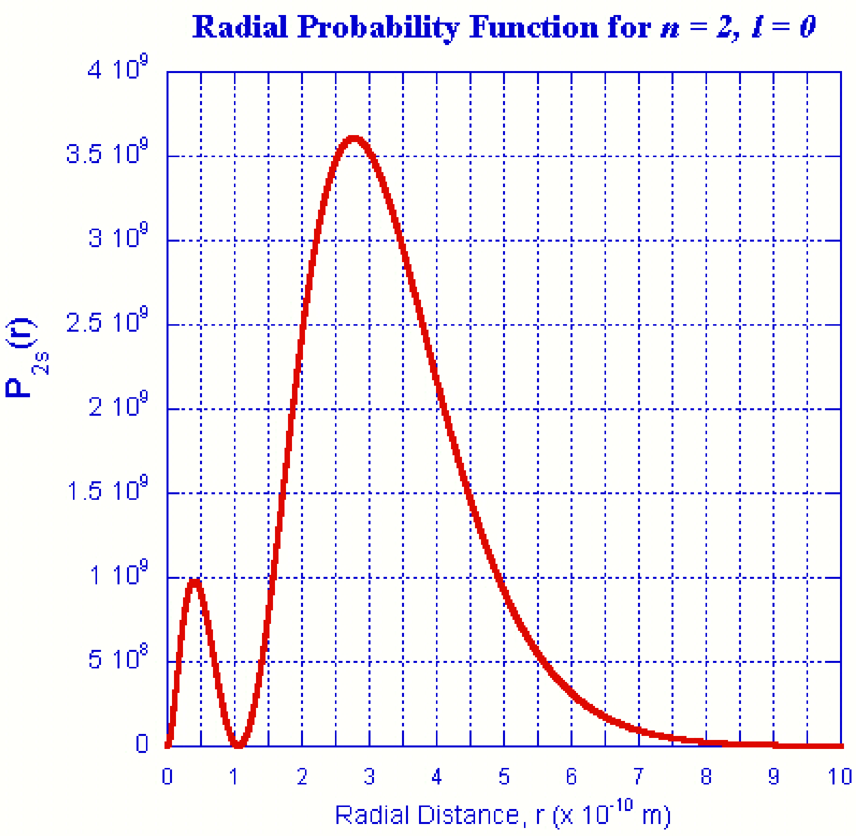


A H-atom

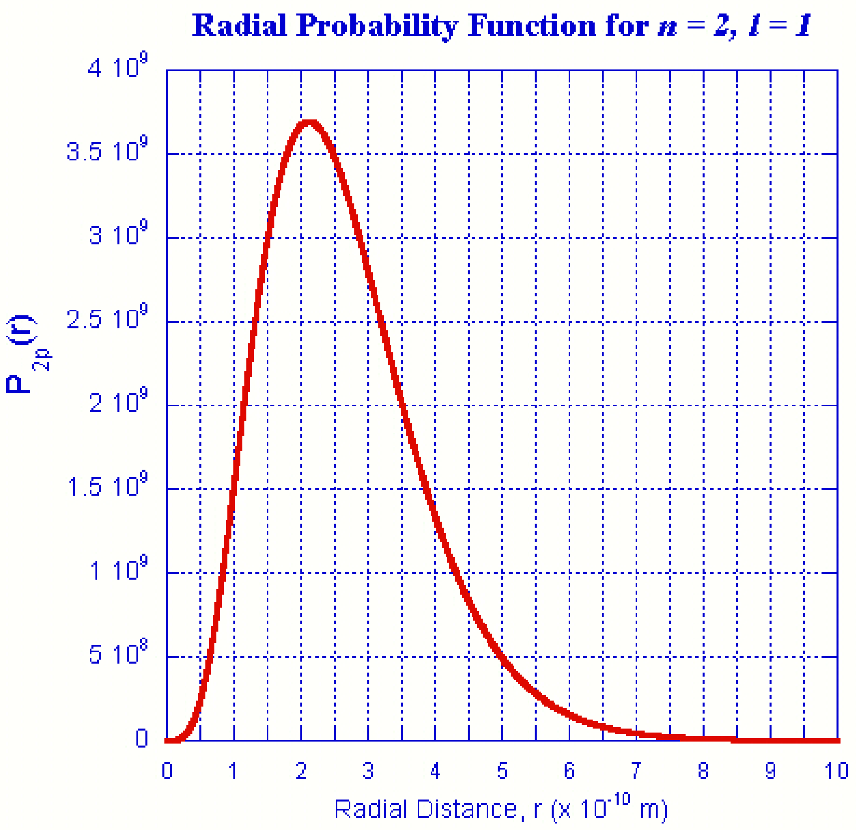
http://physics.mtsu.edu/~phys2020/Lectures/L6-L11/L9/Radial_Prob/radial_prob.html



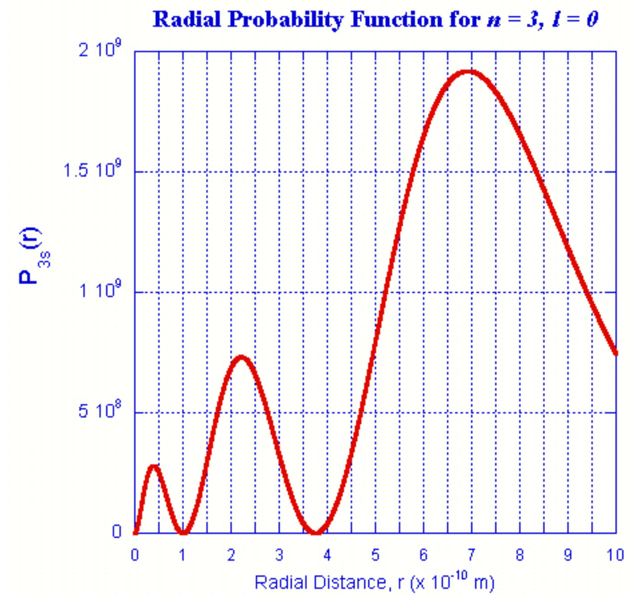
2s

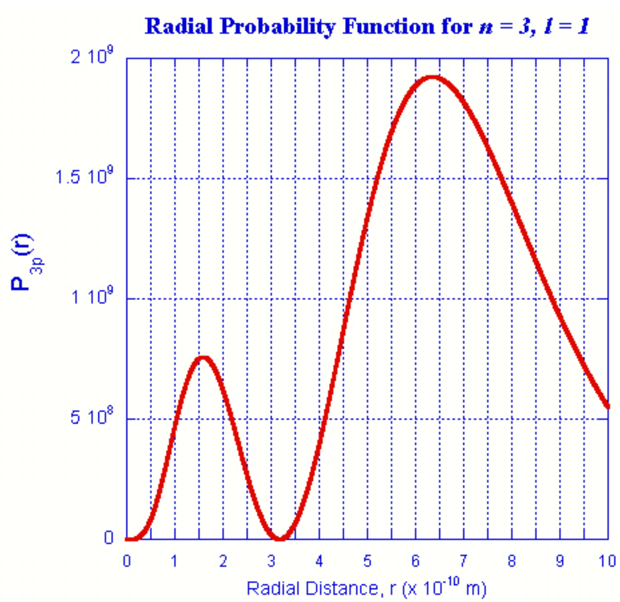

Radial Probability Function for n = 2, l = 0
P2s(r)
4 10^9
3.5 10^9
3 10^9
2.5 10^9
2 10^9
1.5 10^9
1 10^9
5 10^8
0
0 1 2 3 4 5 6 7 8 9 10
Radial Distance, r (x 10^-10 m)

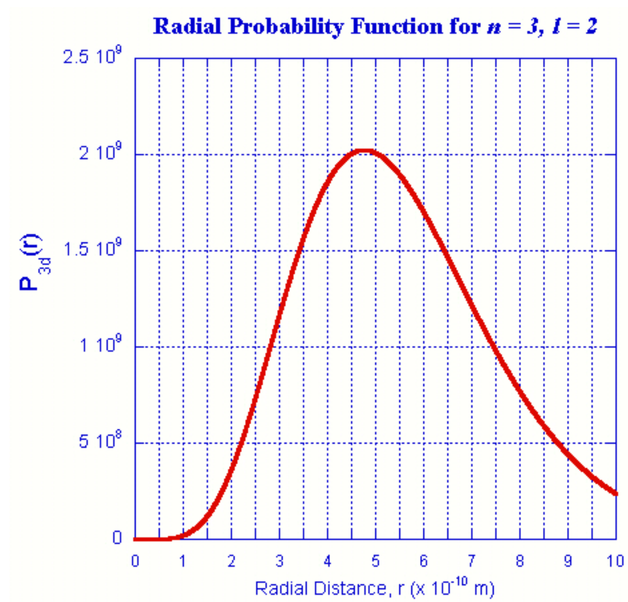
2p


Radial Probability Function for n = 2, l = 1
P2p(r)
4 10^9
3.5 10^9
3 10^9
2.5 10^9
2 10^9
1.5 10^9
1 10^9
5 10^8
0
0 1 2 3 4 5 6 7 8 9 10
Radial Distance, r (x 10^-10 m)

3s, 3p, 3d.
Figyeljük a csomófelületek számát!

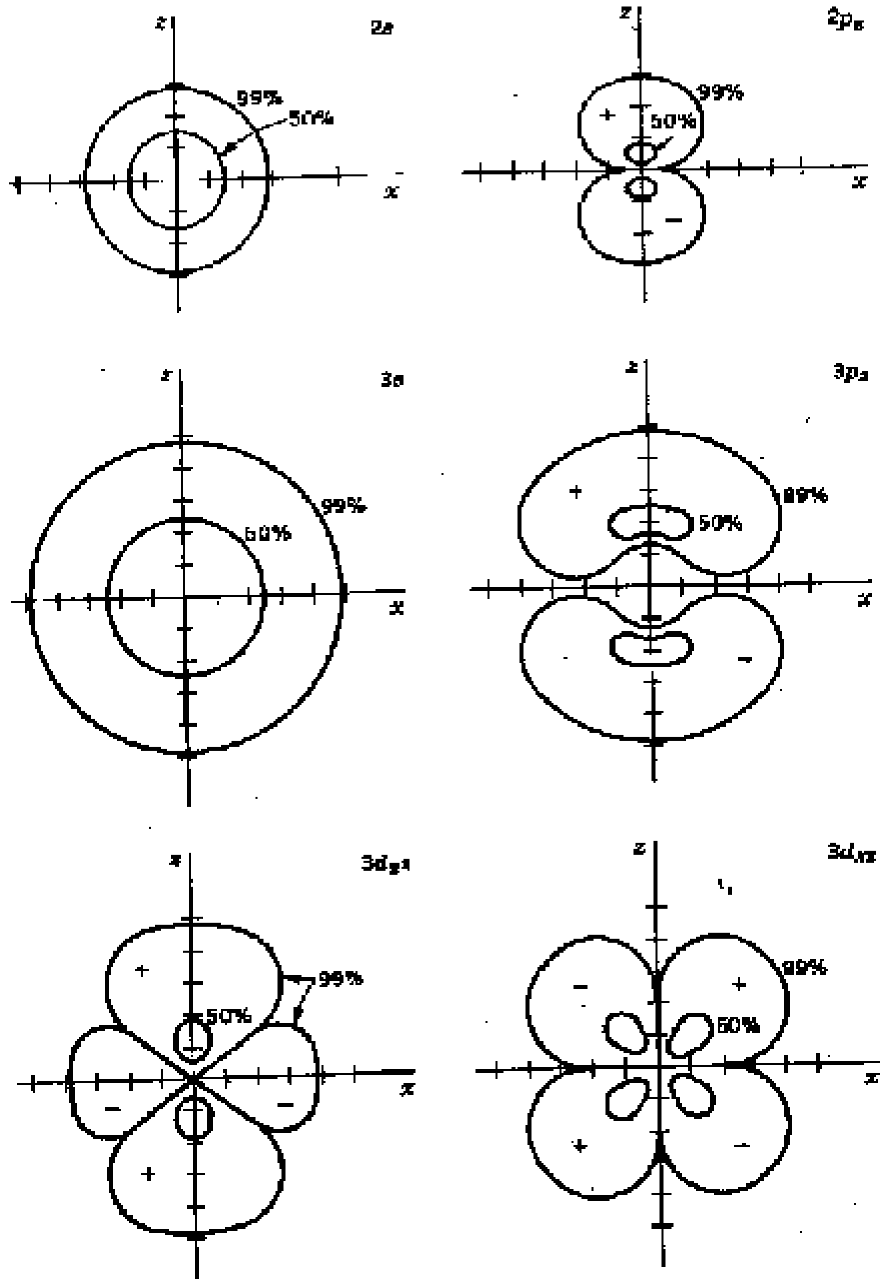




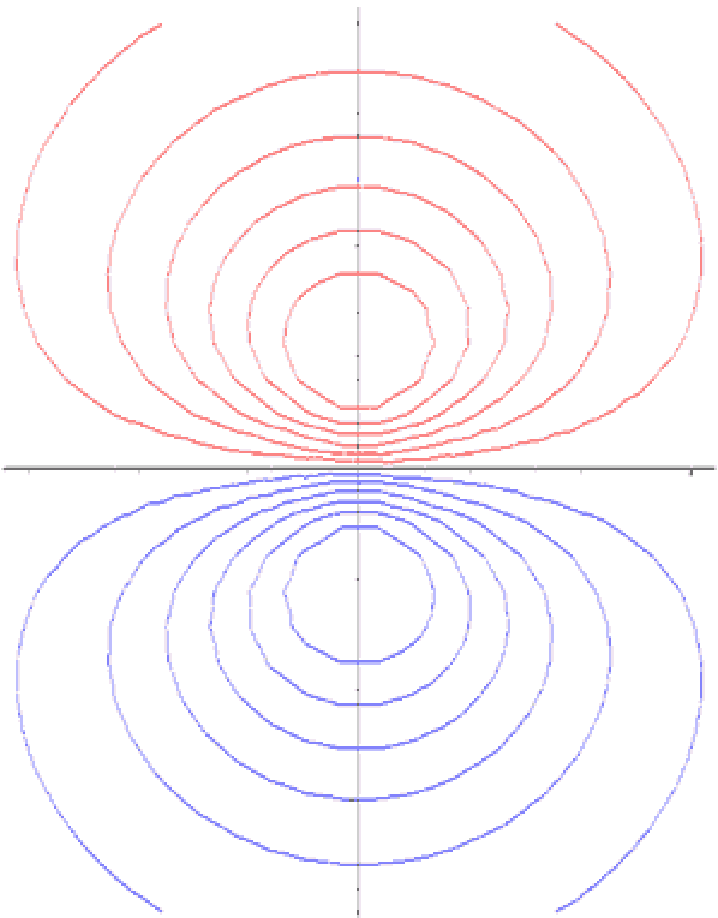


Szintvonalak

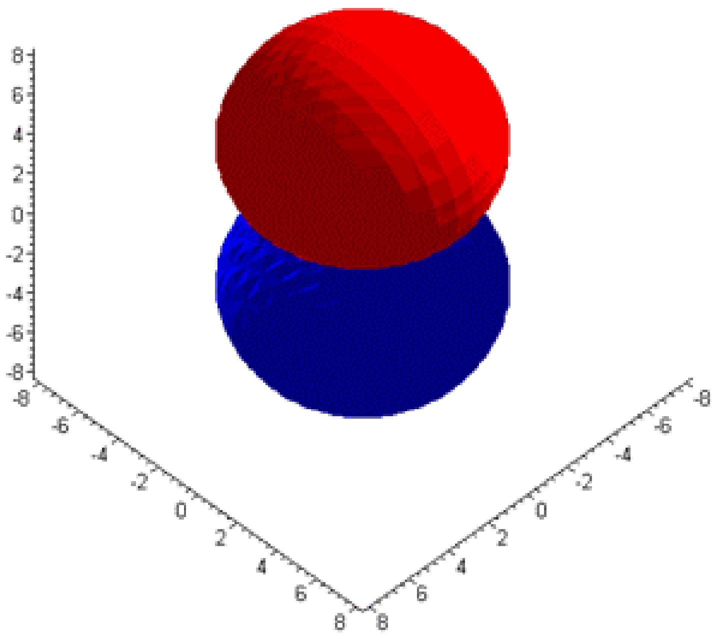
(Offenhartz, p90, scannned)



Contour plot of the $2p_z$ wave function of the hydrogen atom.
The xz-plane is taken for the cross section.

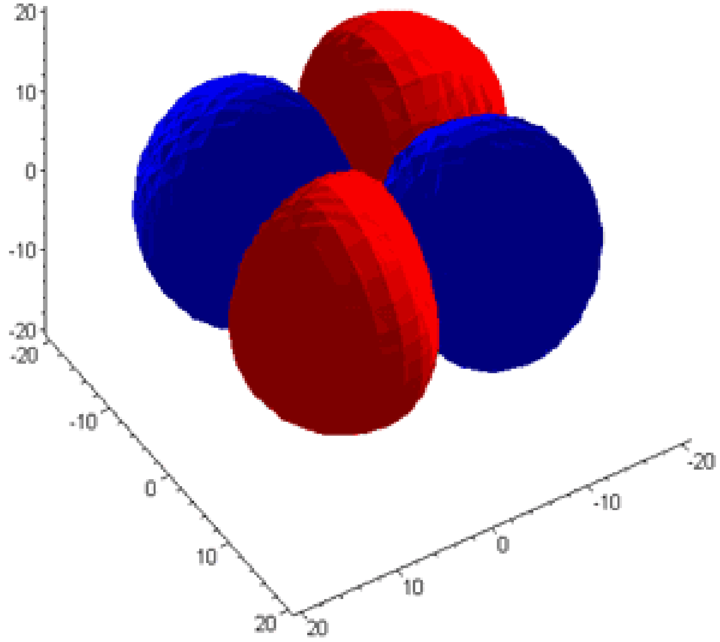


Isosurface of the $2p_z$ wave function of the hydrogen atom.

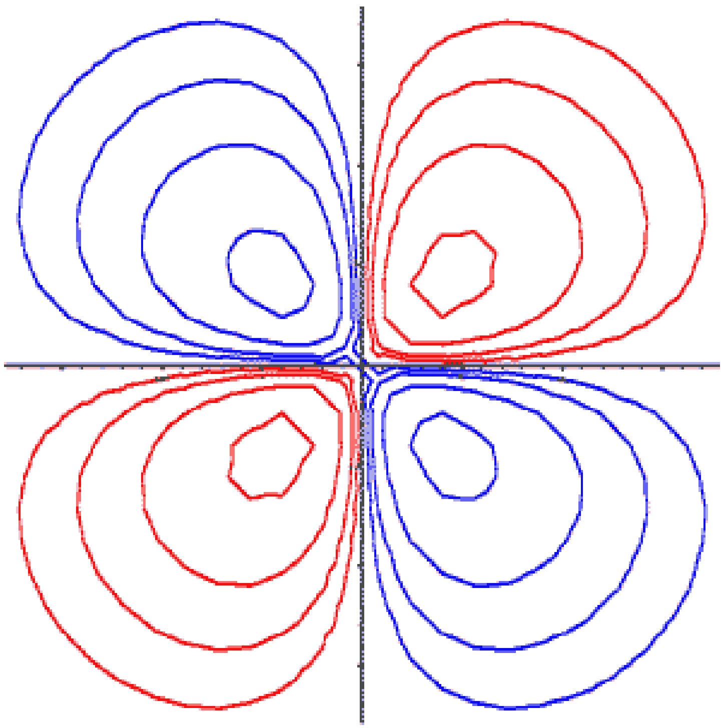


http://www.catalysis.nl/~chembond/notes/Hatom/Hatom3.html

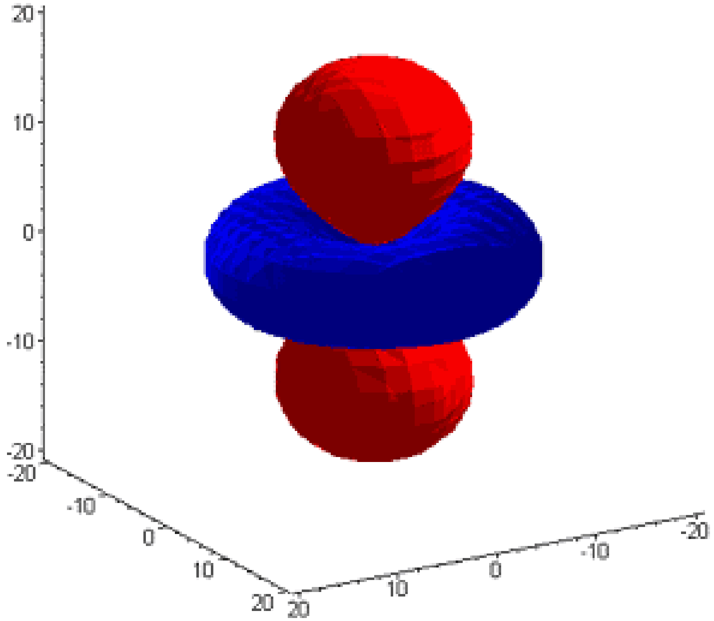
Isosurface of the $3d_{xy}$ wave function of the hydrogen atom.



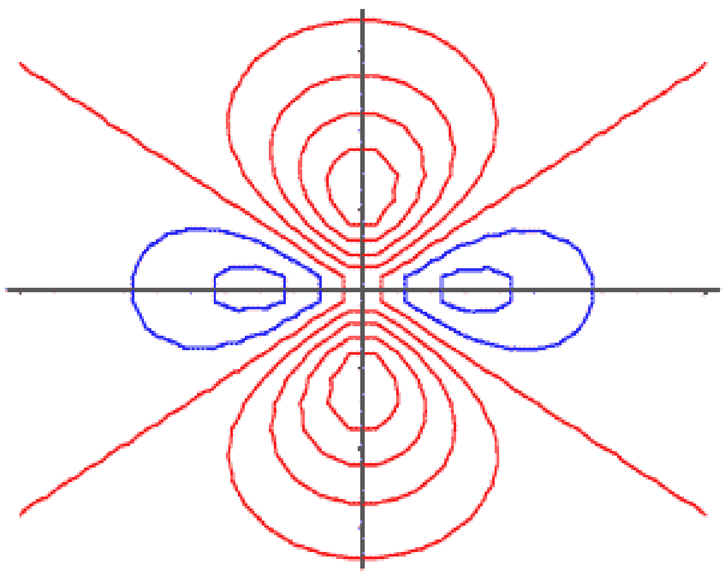
Contour plot The xy-plane is taken for the cross section.



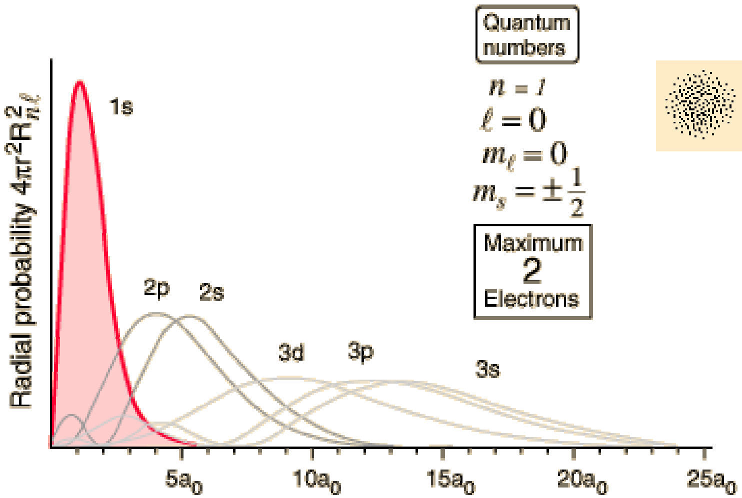
Isosurface of the $3d_{z^2}$ wave function of the hydrogen atom.

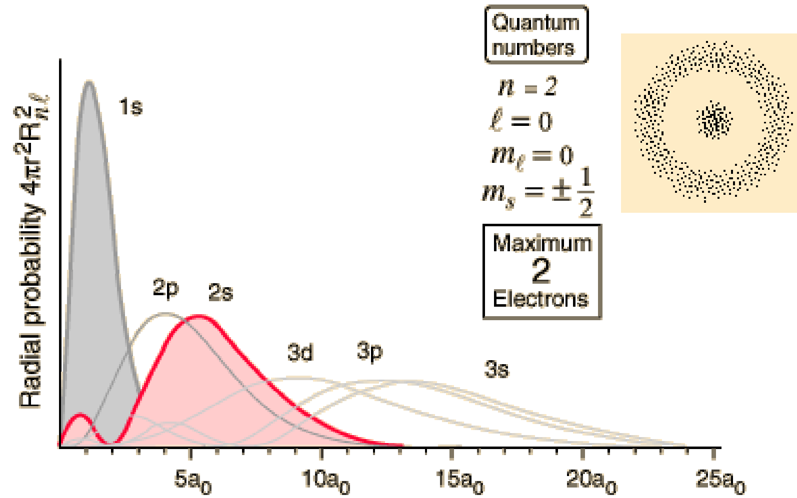


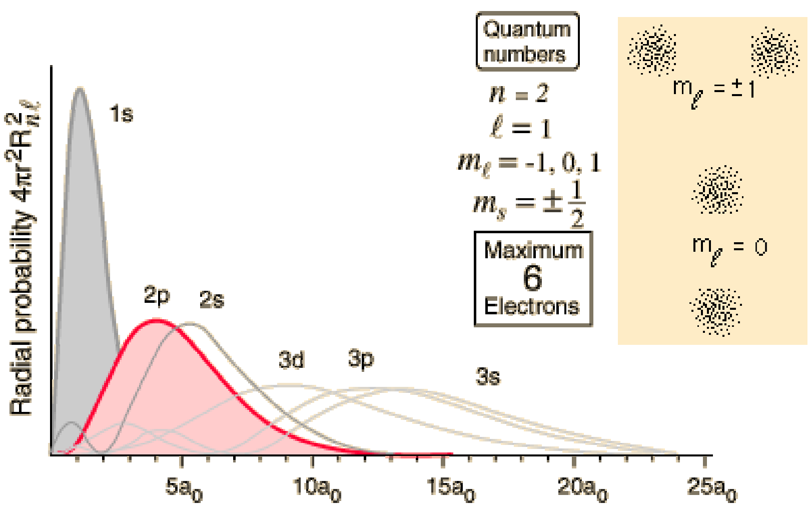
Contour plot of the $3d_{z^2}$ wave function of the hydrogen atom. The xz-plane is taken for the cross section.

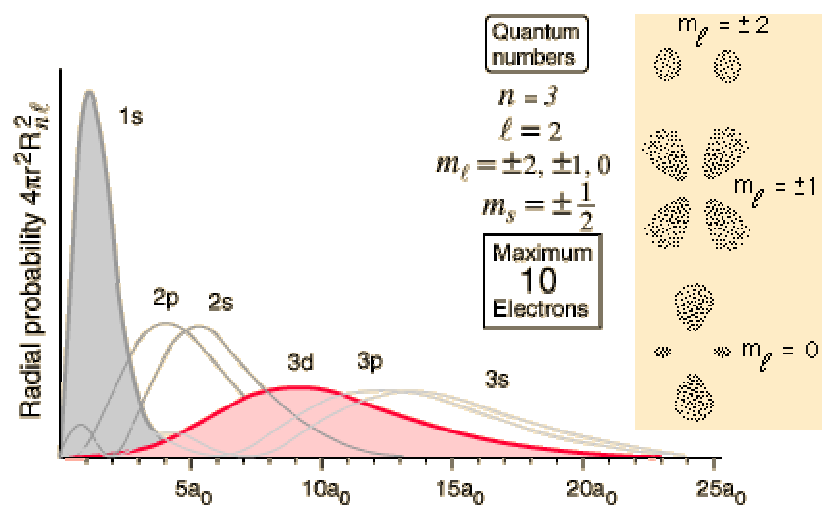


Mégegyszer együtt: radiális eloszlás és el. sűrűség





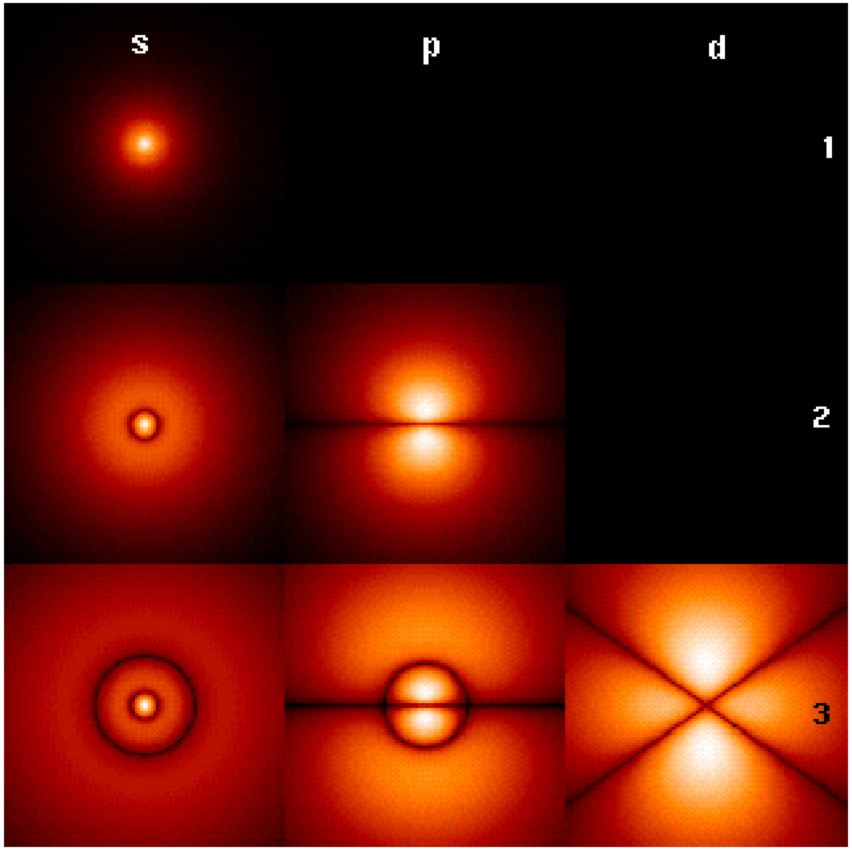




A H-atom pályái

Ábrázolva valójában Ψ négyzete, vagyis az elektronsűrűség)

http://en.wikipedia.org/wiki/Hydrogen_atom



A periódusos rendszer

TABELLE II

Reihen	Gruppe I. — R^2O	Gruppe II. — RO	Gruppe III. — R^2O^3	Gruppe IV. RH^4 RO^2	Gruppe V. RH^3 R^2O^5	Gruppe VI. RH^2 RO^3	Gruppe VII. RH R^2O^7	Gruppe VIII. — RO^4
1	H = 1							
2	Li = 7	Be = 9,4	B = 11	C = 12	N = 14	O = 16	F = 19	
3	Na = 23	Mg = 24	Al = 27,3	Si = 28	P = 31	S = 32	Cl = 35,5	
4	K = 39	Ca = 40	— = 44	Ti = 48	V = 51	Cr = 52	Mn = 55	Fe = 56, Co = 59, Ni = 59, Cu = 63.
5	(Cu = 63)	Zn = 65	— = 68	— = 72	As = 75	Se = 78	Br = 80	
6	Rb = 85	Sr = 87	?Yt = 88	Zr = 90	Nb = 94	Mo = 96	— = 100	Ru = 104, Rh = 104, Pd = 106, Ag = 108.
7	(Ag = 108)	Cd = 112	In = 113	Sn = 118	Sb = 122	Te = 125	J = 127	
8	Cs = 133	Ba = 137	?Di = 138	?Ce = 140	—	—	—	— — — —
9	(—)	—	—	—	—	—	—	
10	—	—	?Er = 178	?La = 180	Ta = 182	W = 184	—	Os = 195, Ir = 197, Pt = 198, Au = 199.
11	(Au = 199)	Hg = 200	Tl = 204	Pb = 207	Bi = 208	—	—	
12	—	—	—	Th = 231	—	U = 240	—	— — — —

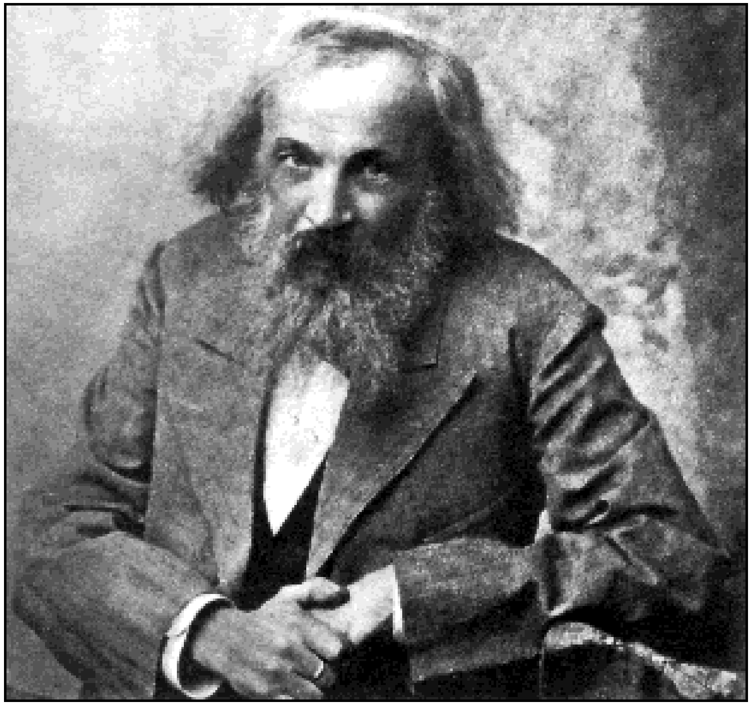
Figure 2.5 Dmitri Mendeleev's 1872 periodic table. The spaces marked with blank lines represent elements that Mendeleev deduced existed but were unknown at the time, so he left places for them in the table. The symbols at the top of the columns (e.g., R^2O and RH^4) are molecular formulas written in the style of the 19th century.

Tellur és jód helyet cserél ......

Sztori: a tellúr magyar “kapcsolata”:

Tellurium was discovered in a certain gold ore from **Transsylvania**. This ore, known as "Faczebajer weißes blättriges Golderz" (white leafy gold ore from Faczebaja) or "antimonalischer Goldkies" (antimonic gold pyrite), was according to professor Anton von Rupprecht "Spießglaskönig" (*argent molybdique*), containing native Antimony (note). The same ore was analyzed by by Franz Joseph **Müller** Freiherr von Reichenstein (1742-1825) (note), chief inspector of mines in Transsylvania, he concluded in 1782 that the ore did not contain Antimony, but that it was Bismuth sulphide (note). A year later he reported that this was erroneous and that the ore contained mainly gold and an unknown metal very similar to Antimony (note). However, Müller was not able to identify this metal. He gave it the name aurum paradoxium or metallum problematicum because it did not show the properties predicted for the Antimony he was expecting.

Mengyelejev

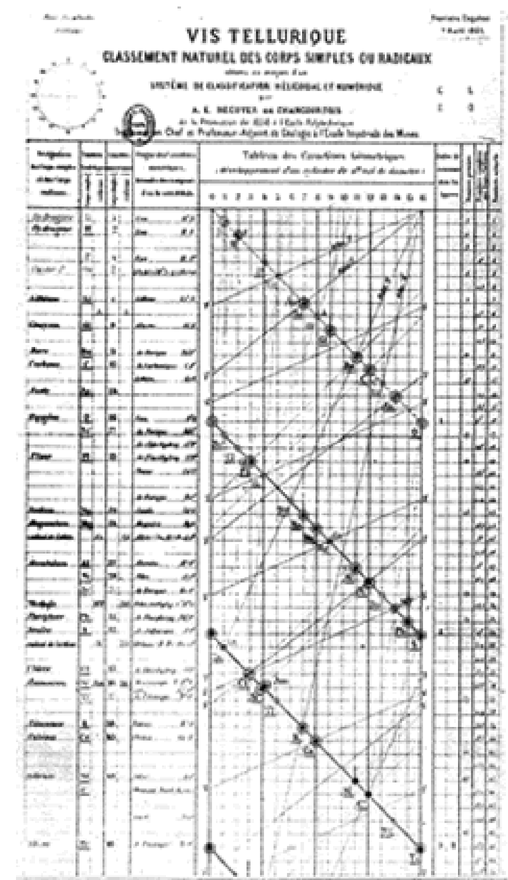


Elemek egy hengeren

185 éve született Alexandre Émile Béguyer de Chancourtois

.... 1820. január 20-án született Párizsban. A francia geológus,

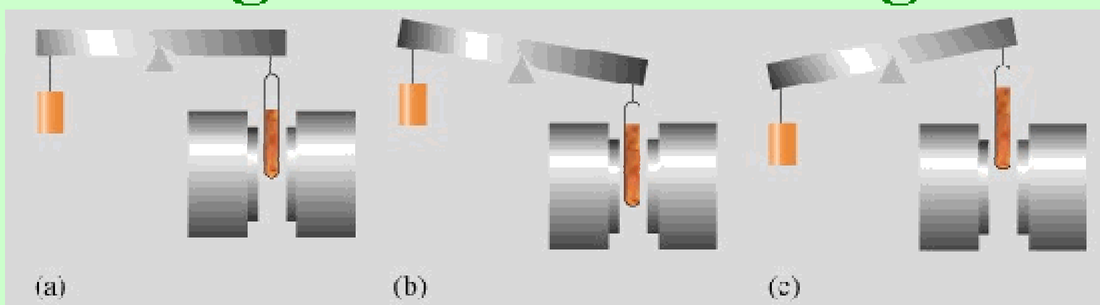
Két évvel az első nemzetközi vegyészkonferencia után **1862**-ben Chancourtois az atomsúlyok szerint sorba rendezett elemek neveit egy **henger palástjára** írta fel spirális alakban.



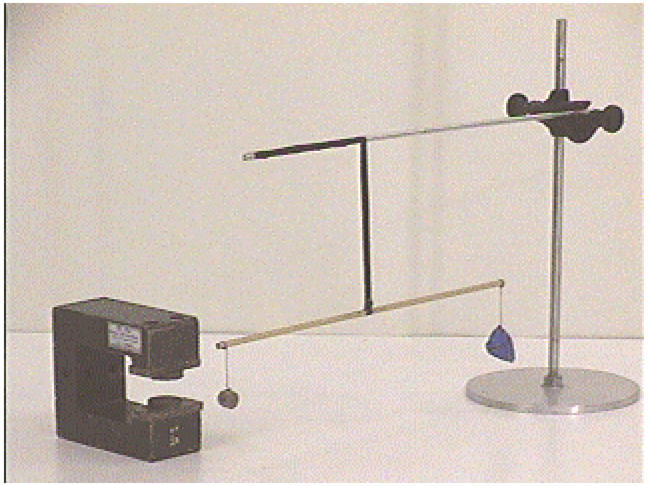
Mágneses tulajdonságok

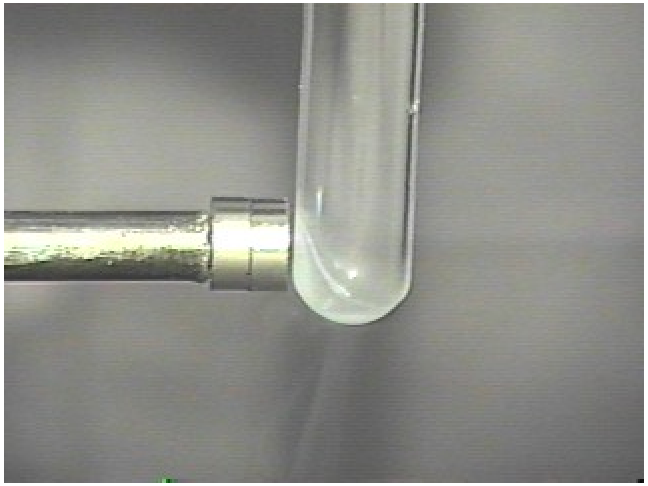
alapja az elektronspin

Paramagnetism and Diamagnetism



- A species with unpaired electrons is paramagnetic and is pulled into a magnetic field; one without unpaired electrons is diamagnetic and is pushed out of a magnetic field.
- Paramagnetism and diamagnetism can be distinguished experimentally by an apparatus like that above.
  - (a) no magnetic field
  - (b) paramagnetic substance appears to weigh more.
  - (c) diamagnetic substance appears to weigh less.



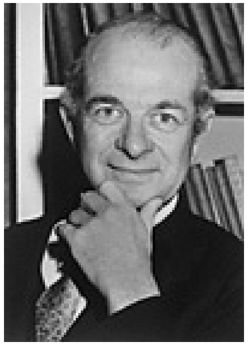


Bizmut:
diamágneses, mágneses tér taszítja

CuSO4:
paramágneses, mágneses tér behúzza

Meglepetés: egy egyszerű kétatomos molekula is lehet paramágneses : Oxigén

Linus Carl Pauling



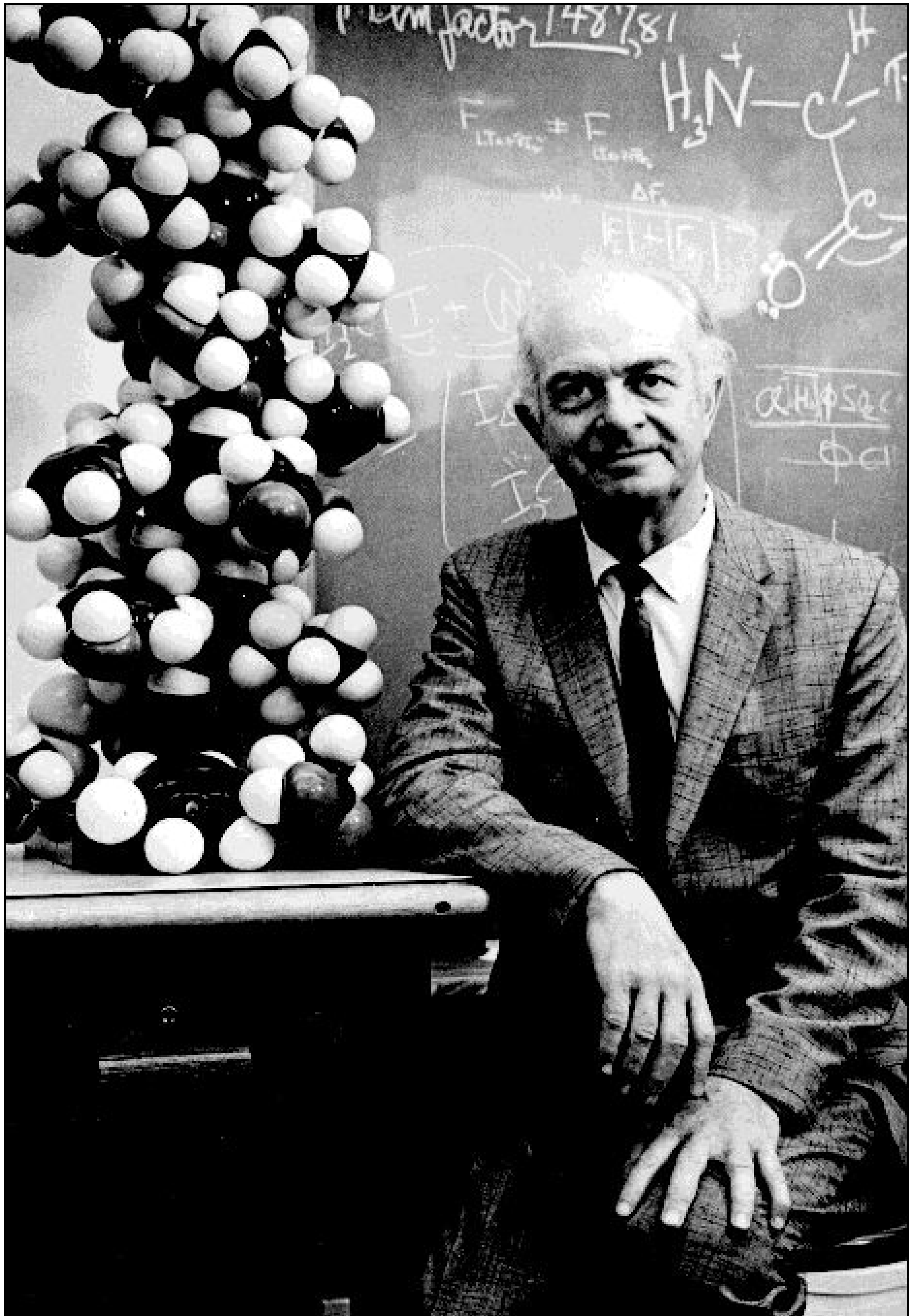
The Nobel Prize in Chemistry 1954

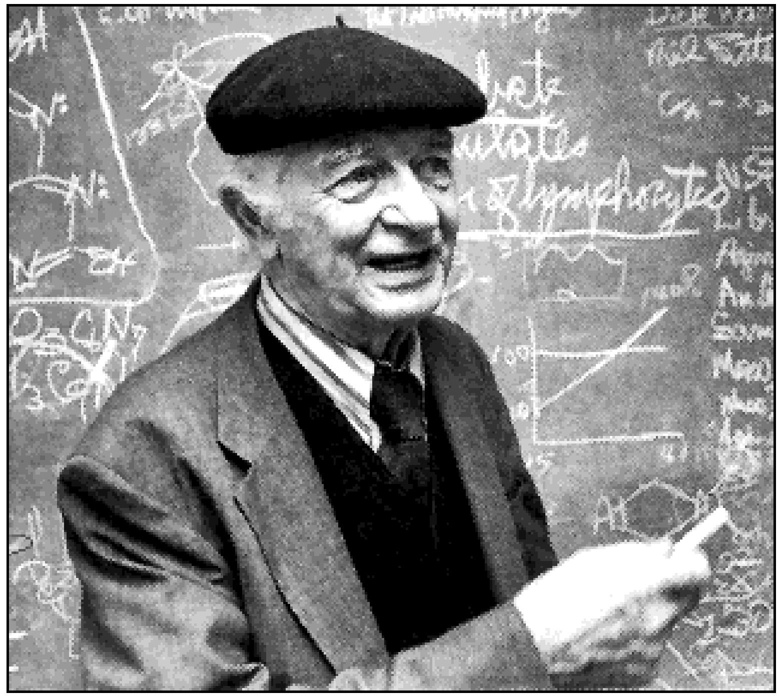
"for his research into the nature of the chemical bond and its application to the elucidation of the structure of complex substances"

USA

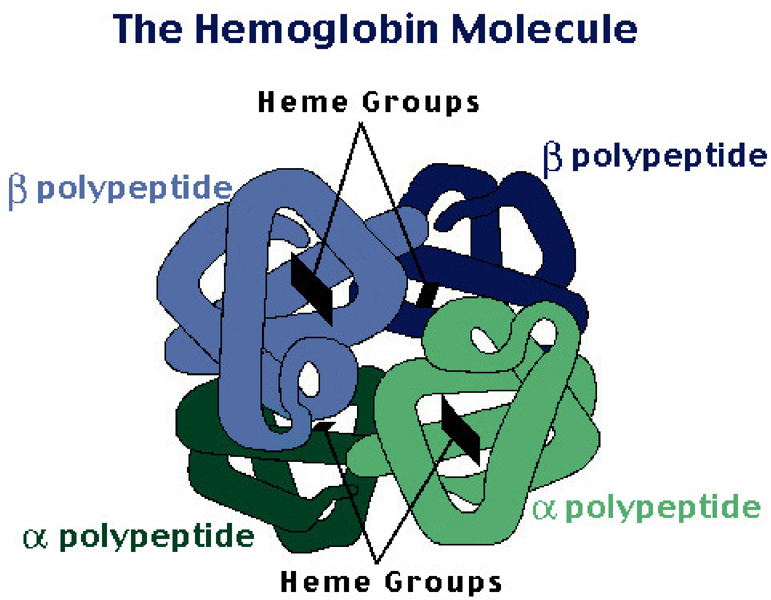
California Institute of Technology (Caltech)
Pasadena, CA, USA

b. 1901
d. 1994



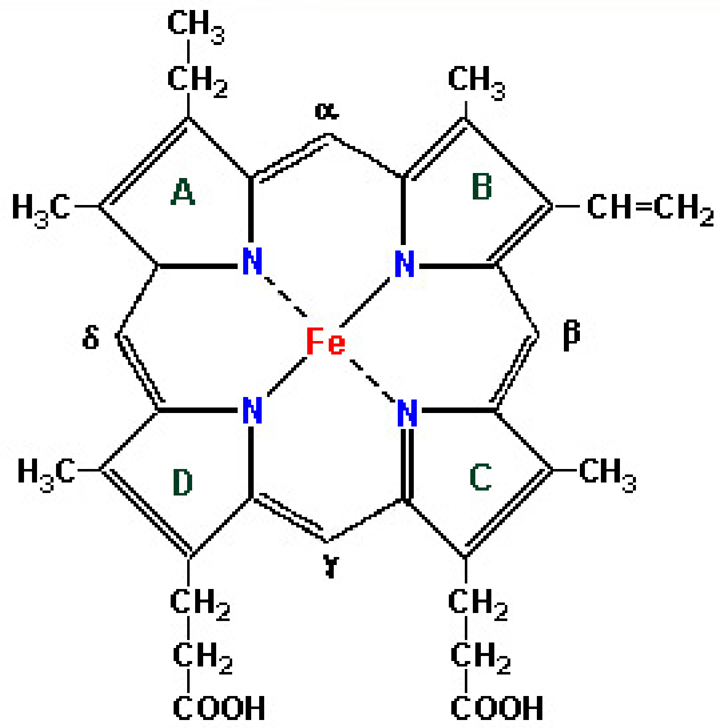


Komplexek a természetben:



Russell, P. J. 1996. *Genetics.* Harper Collins, NY.

A *heme* molekula:



Heme Molecule

vége a 2. résznek