Úvod do fyziky

1. Co je fyzika ?
2. Fyzikální poznávání
3. Měření
4. Prostor, čas, pohyb
5. Síly, pole
6. Základní fyzikální konstanty
7. Zákony zachování
8. Kmity, vlny,světlo
9. Mikrosvět

Literatura

D.Halliday, R.Resnick, J.Walker: Fyzika. Brno VUTIUM 2001
R.P.Feynman, R.B.Leighton, M.Sands : Feymanovy přednášky z fyziky 1.-3.díl. Havlíčkův Brod: FRAGMENT 2000-2002.
http://www.google.com/
http://scholar.google.com/
http://www.lightandmatter.com/
http://hyperphysics.phy-astr.gsu.edu/hbase/hph.html#mechcon

http://video.mit.edu/

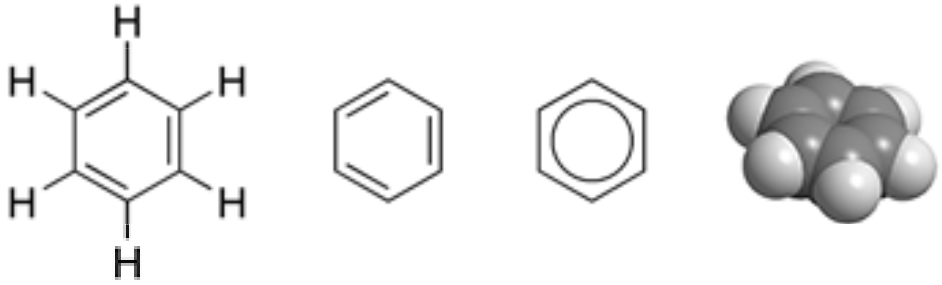
http://video.mit.edu/watch/walter-lewin-for-the-love-of-physics-8085/

http://video.mit.edu/watch/walter-lewin-video-promo-2996/

Walter Lewin: *Art* through the Eyes of a *Physicist* | MIT Video

1. Co je fyzika ?

Jak studovat fyziku
Fyzika je…
Vztah k přírodním vědám
Vztah k matematice
Vztah k obecným problémům
Fyzika a technické aplikace
Fyzika a filosofie
Fyzika - experimentální věda
- měření
- rozsah zájmu

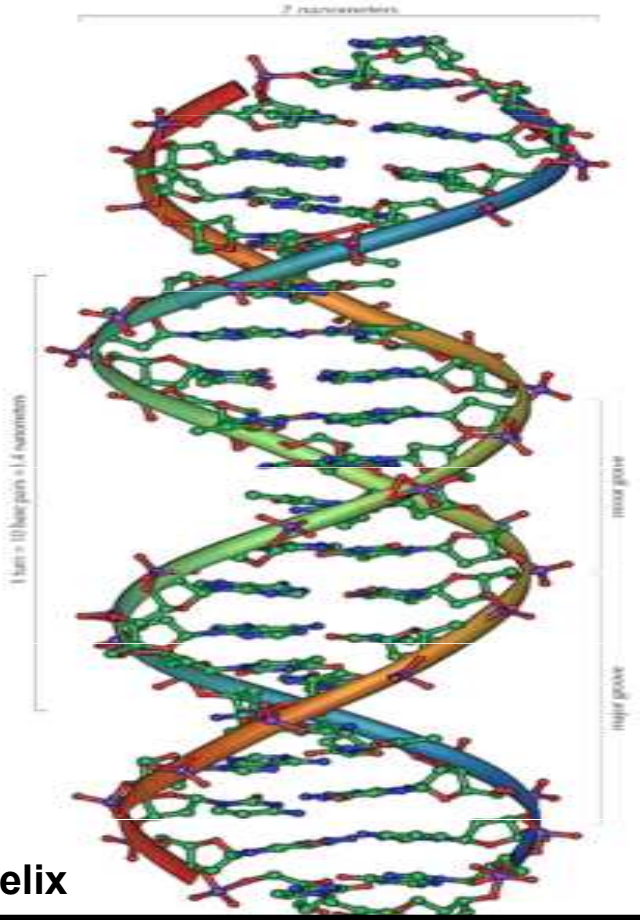


Benzen C_6H_6

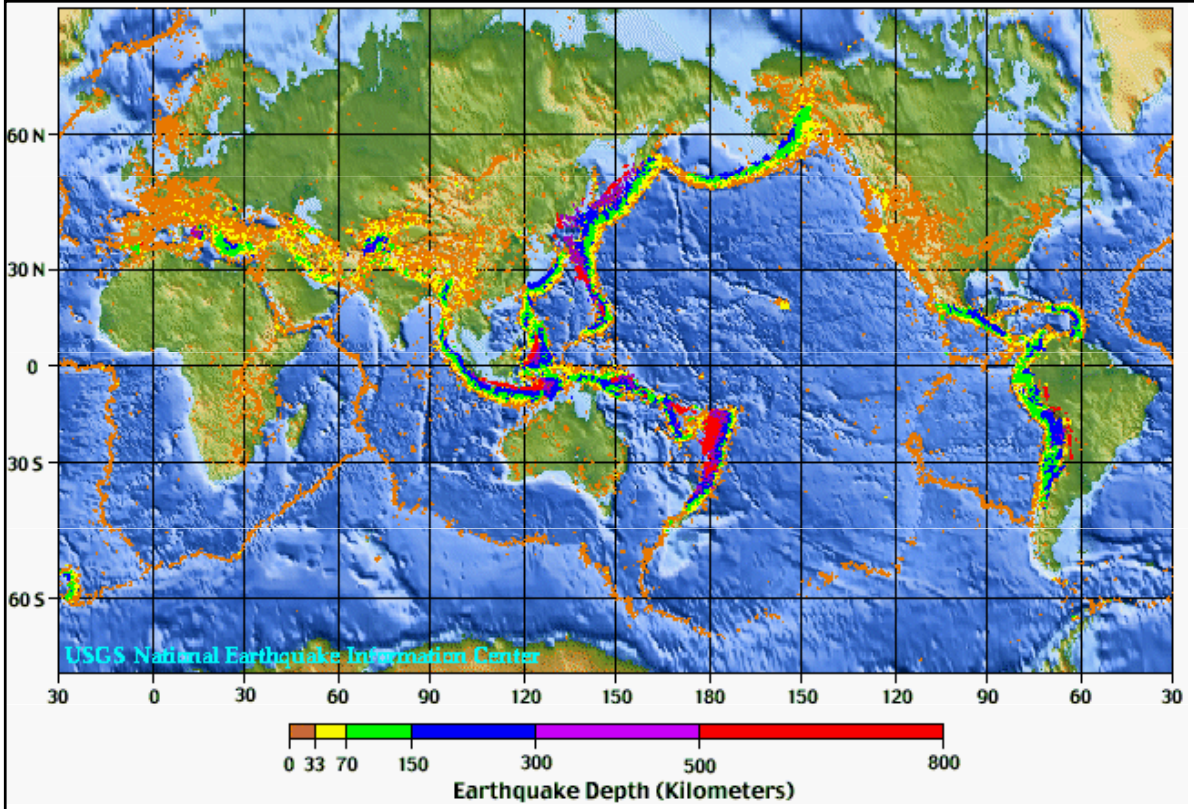
Jan Josef Loschmidt (1821 - 1895)

$n0 = (2{,}686\ 7774\ \pm 0{,}000\ 0047) \times 1025\ m^{-3}$.

Gregor Mendel (1822-1884)



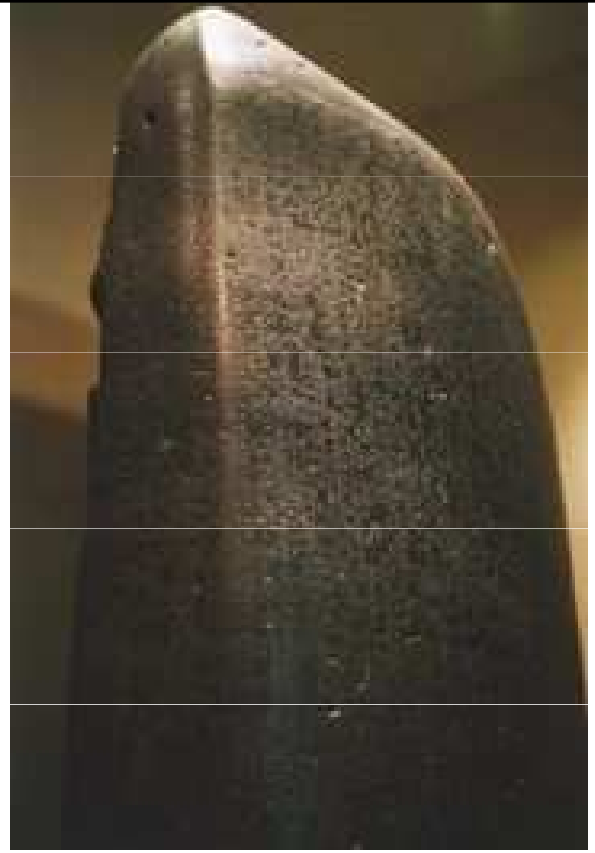
The structure of part of a DNA double helix



Distribution of earthquake **epicenters** from 1975 to 1995.

M81

This image combines data from
the Hubble Space Telescope,
the Spitzer Space Telescope,
and the Galaxy Evolution Explorer (GALEX)



Chammurapiho zákoník
1780 př.n.l.

$$\mathbf{p} = m\mathbf{v}$$

$$\mathbf{F} = \dot{\mathbf{p}}$$

$$\mathbf{F}_{12} = -\mathbf{F}_{21}$$

Newton

$$\nabla \mathbf{D} = \rho_e$$

$$\nabla \mathbf{B} = \rho_m$$

$$\nabla \times \mathbf{H} = \mathbf{j}_e + \dot{\mathbf{D}}$$

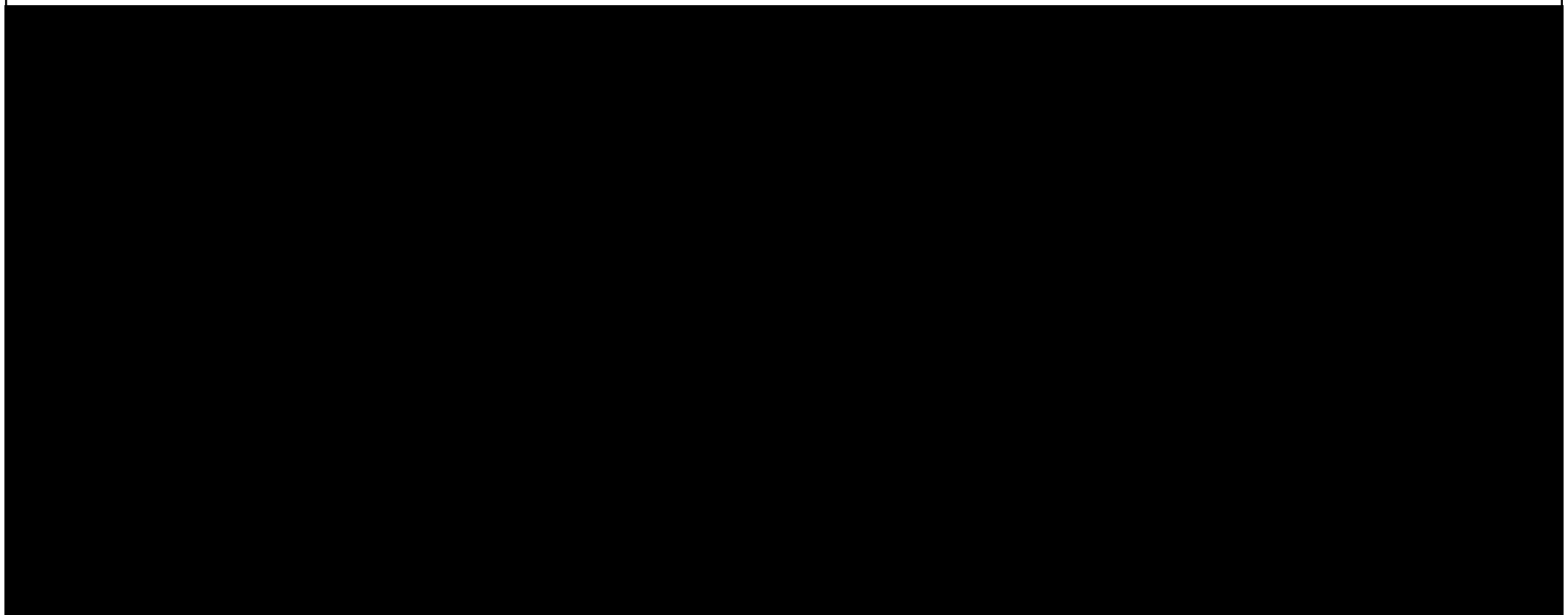
$$\nabla \times \mathbf{E} = -\mathbf{j}_m - \dot{\mathbf{B}}$$

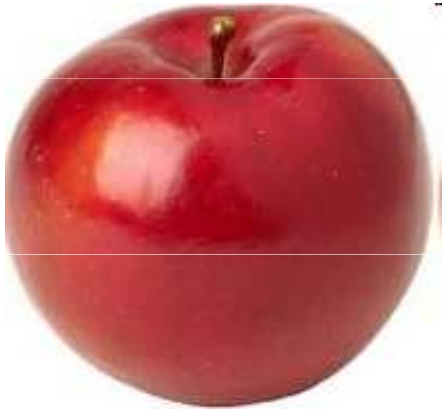
Maxwell

$$i\hbar \frac{\partial \psi}{\partial t} = \hat{H}\psi$$

$$\hat{H}\psi = E\psi$$

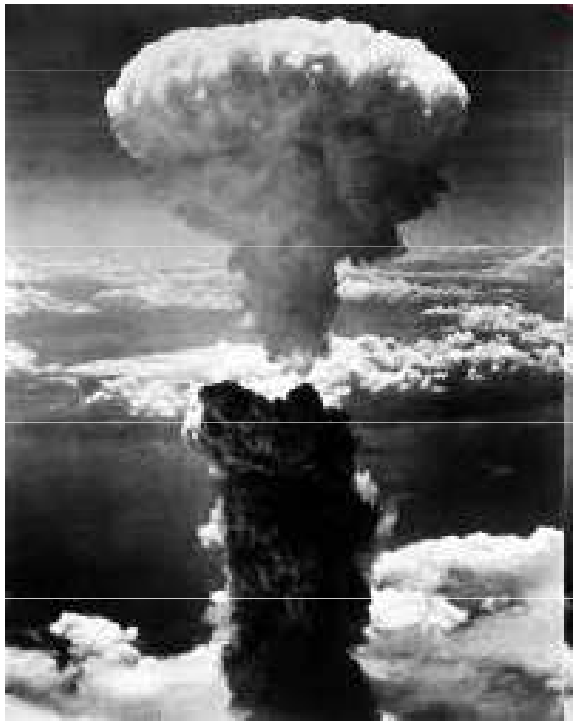
Schrödinger



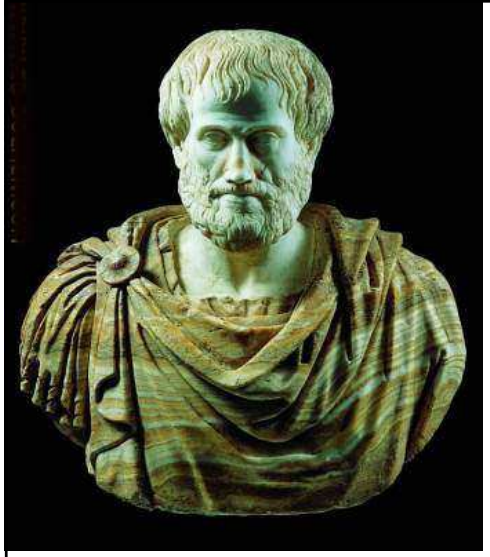


radioterapie

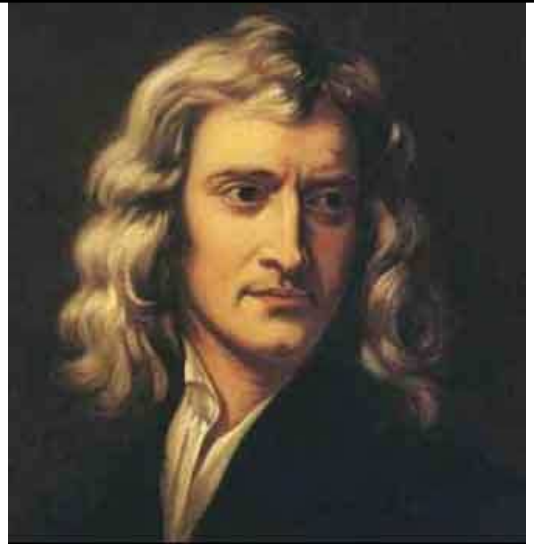
Temelín



Nagasaki

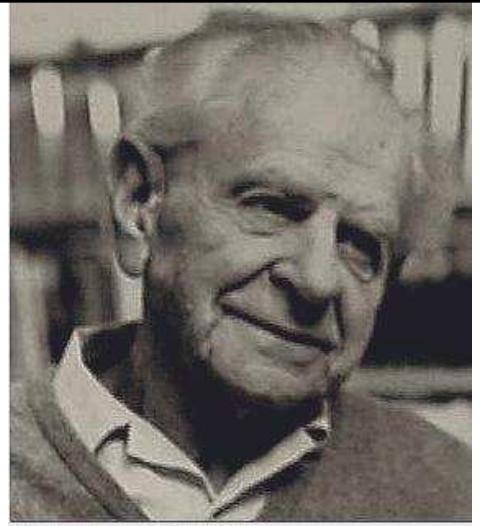


Aristóteles
384 a.C. - c. 322.A.C



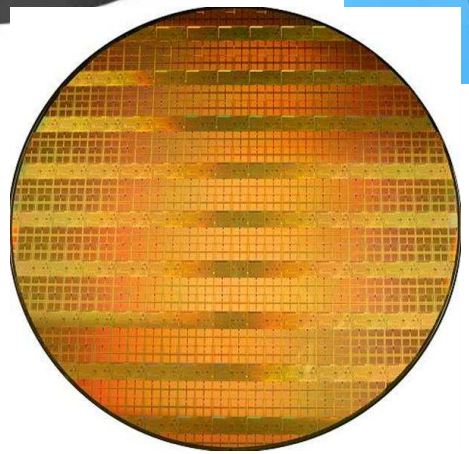
Isaac Newton
1643-1727

Werner Karl Heisenberg
(1901-1976)

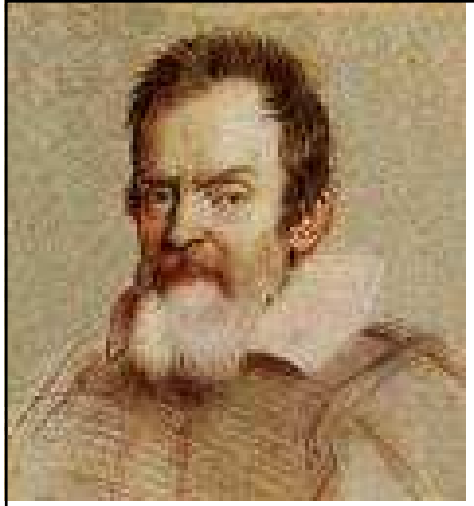


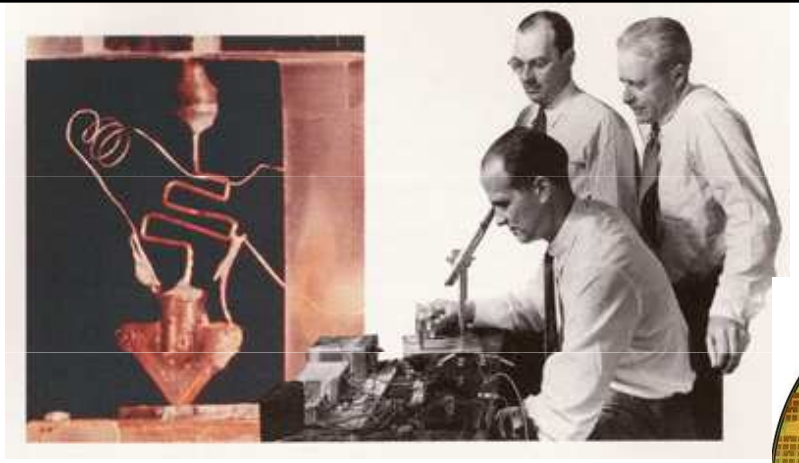
Sir Karl Popper (1902-1994)

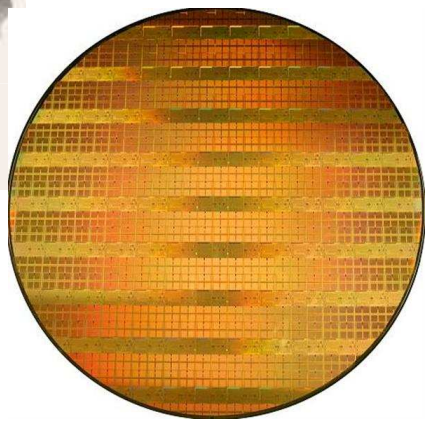
Karl Raimund Popper
1902-1994



300 mm - 45 nm







Galileo Galilei 1564-1642

$L=2.1746\pm0.0003$ m

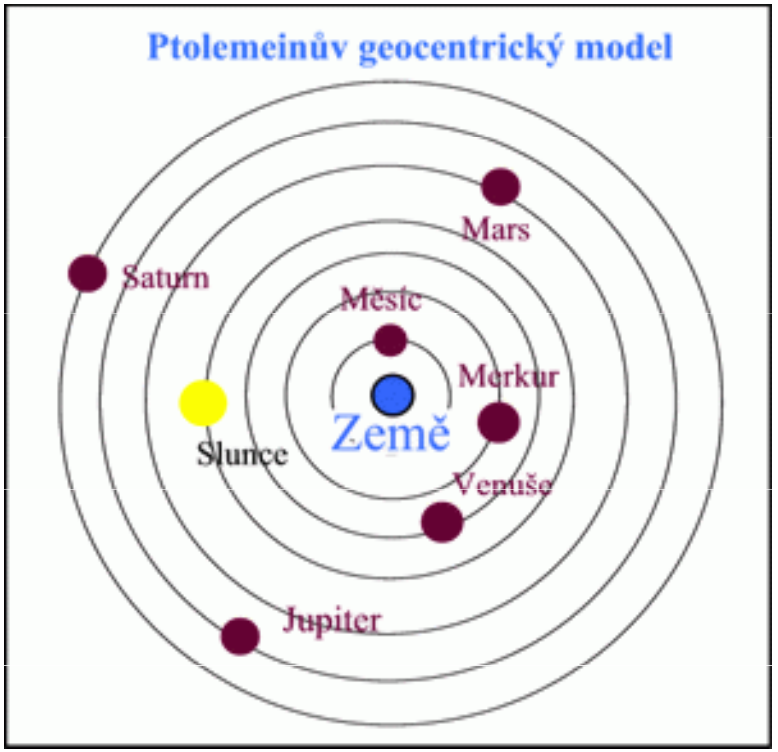
$c=299\ 792\ 458$ m/s;

$\Delta x \cdot \Delta p \gtrsim h$

m(kg)	10^{-36} (neutrino)	10^{0} (litr)	10^{50} (vesmír)
l(m)	10^{-35} (Planck, struna)	10^{0}(člověk)	10^{26} (vesmír)
t(s)	10^{-44}(Planck)	10^{0}(srdce)	10^{17}(vesmír)

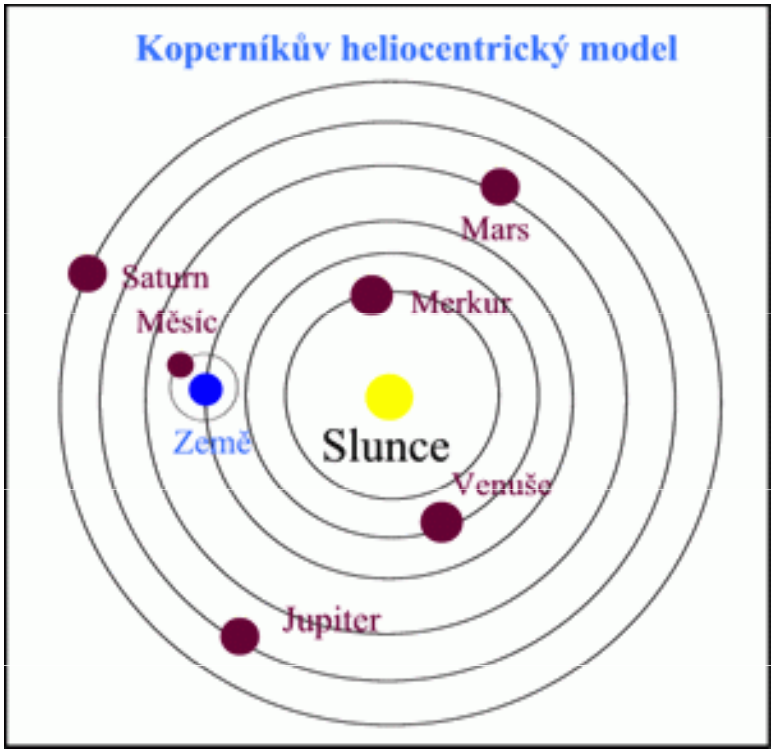
2. Fyzikální poznávání

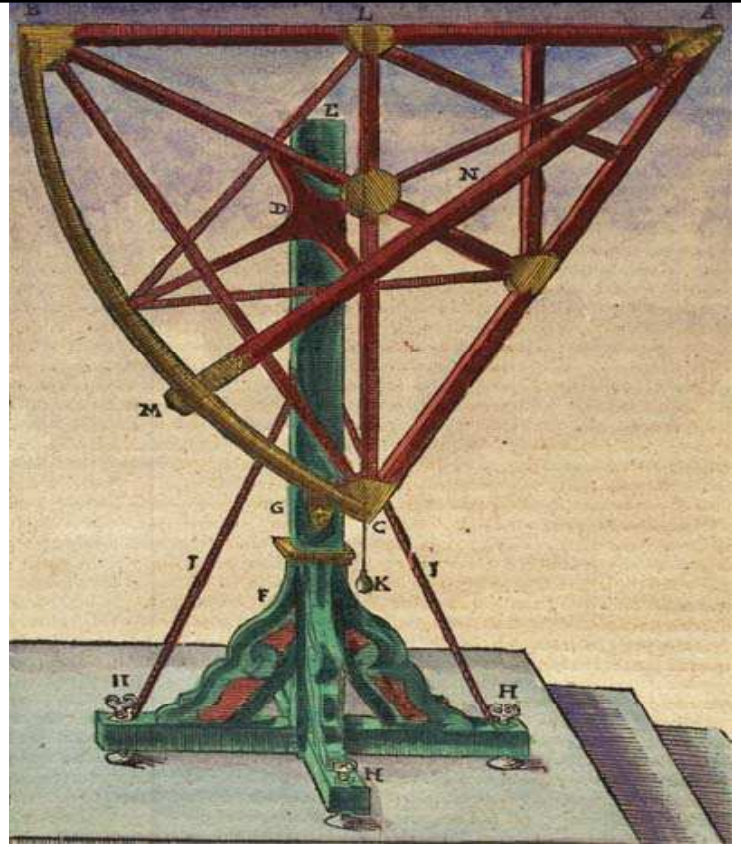
Filosofie objevu
-Koperník,Brahe, Kepler,Newton
Model, teorie, zákon
- model (světlo)
- teorie (mechanika, relativita)
- zákon (zákony zachování, empirie)
Pravidlo pravidel (symetrie)



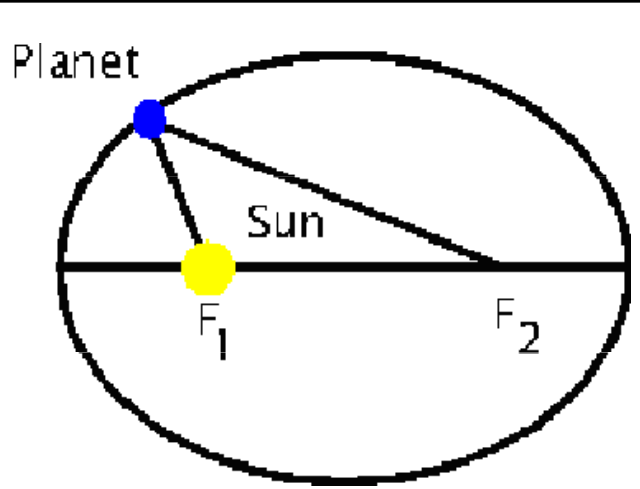
Claudius Ptolemaeus 85 - 165

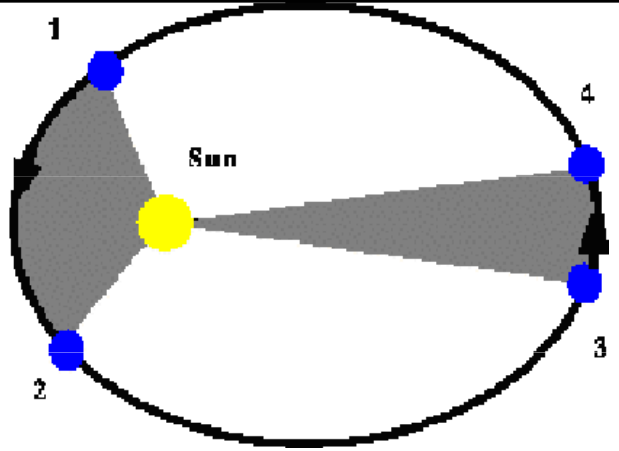
1473 - 1543


Koperníkův heliocentrický model
Mars
Saturn
Měsíc
Merkur
Země
Slunce
Venuše
Jupiter



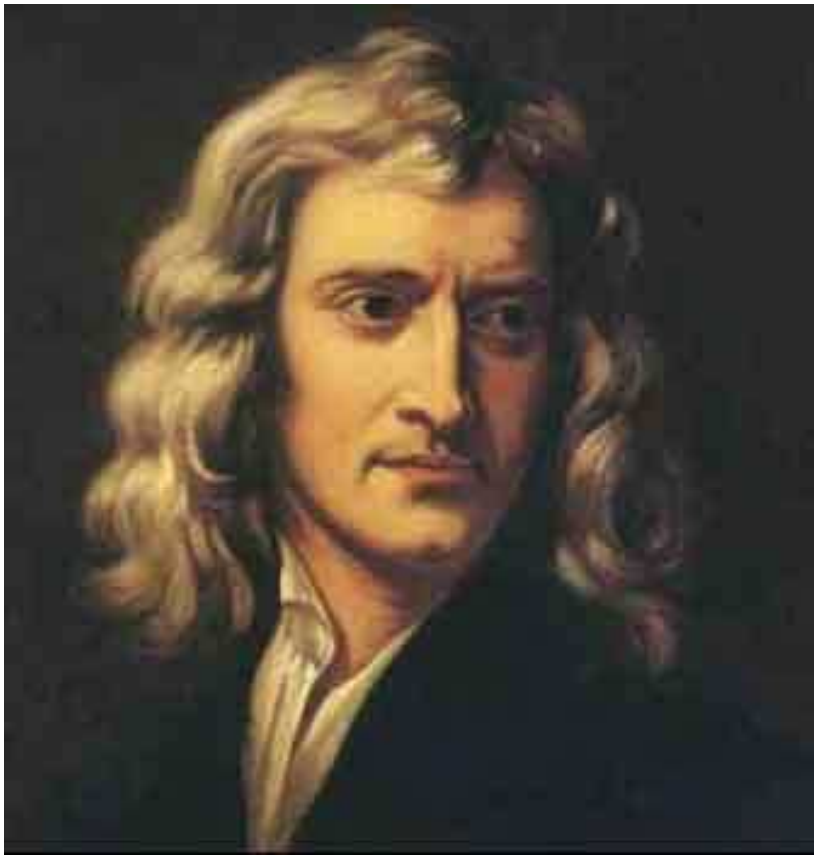
Tycho Brahe 1546 - 1601





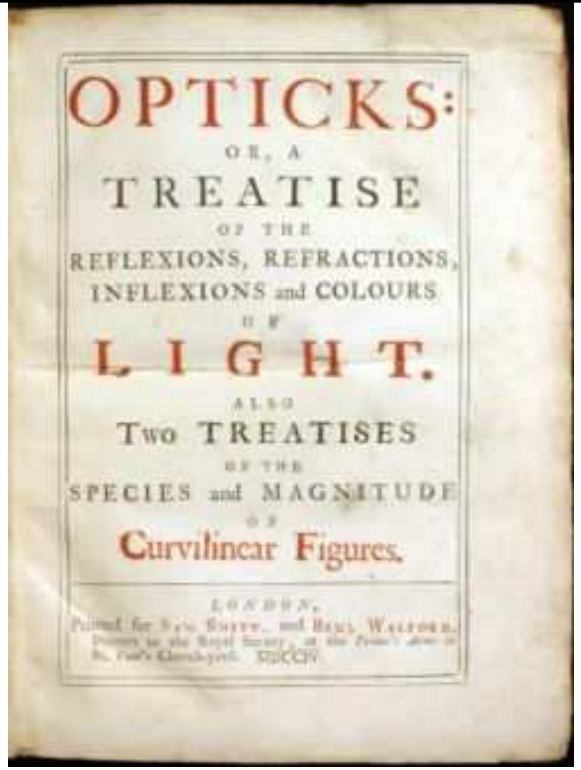
$$\frac{r^3}{T^2} = \text{konst}$$

Johannes Kepler 1571-1630



$$F = G\frac{m_1 m_2}{r^2}$$

Isaac Newton
1643-1727



OPTICKS:

OR, A

TREATISE

OF THE

REFLEXIONS, REFRACTIONS,
INFLEXIONS and COLOURS

OF

LIGHT.

ALSO

Two TREATISES

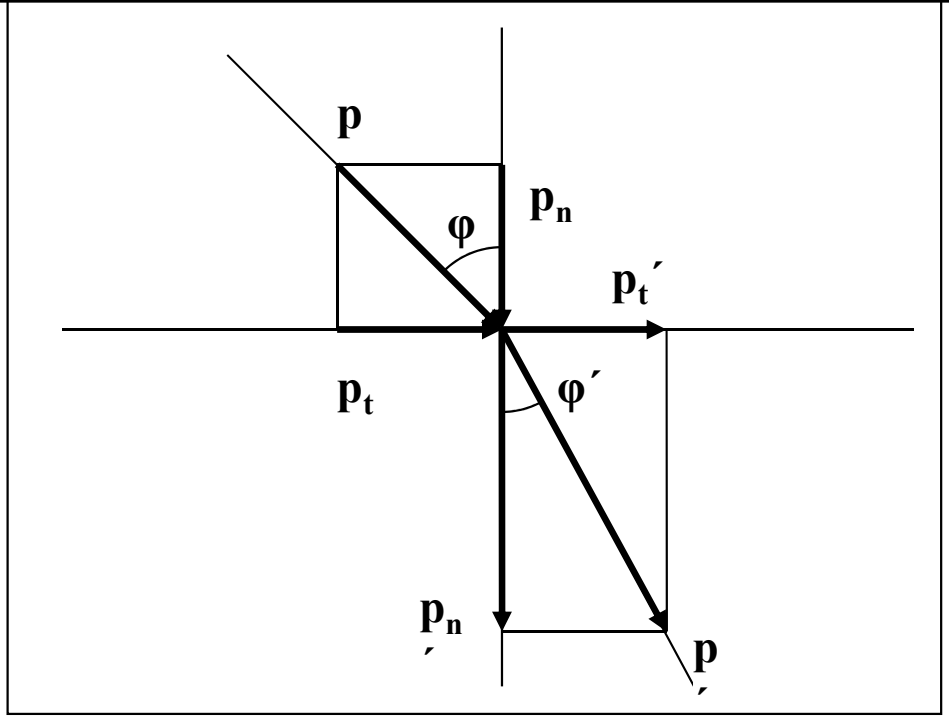
OF THE

SPECIES and MAGNITUDE

OF

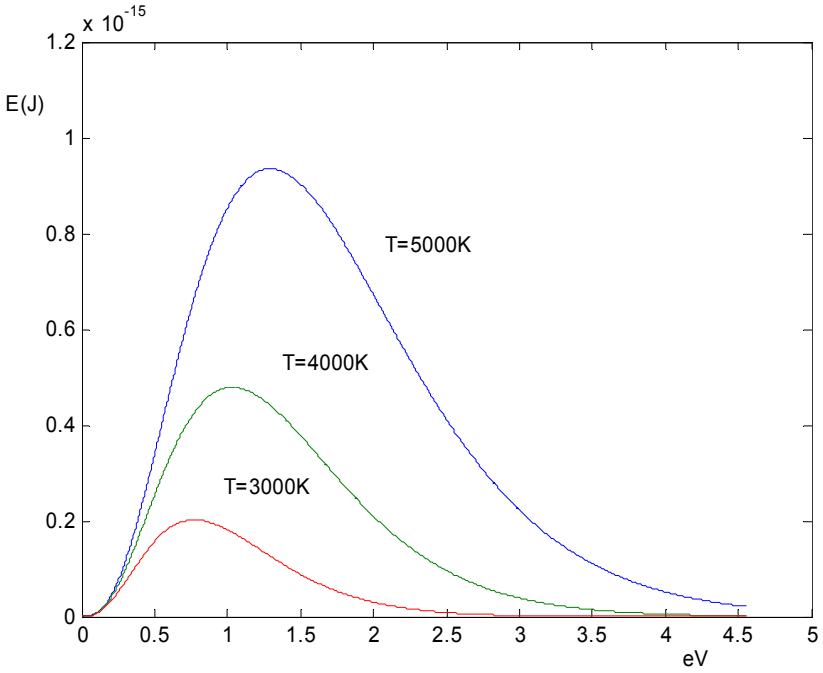
Curvilinear Figures.

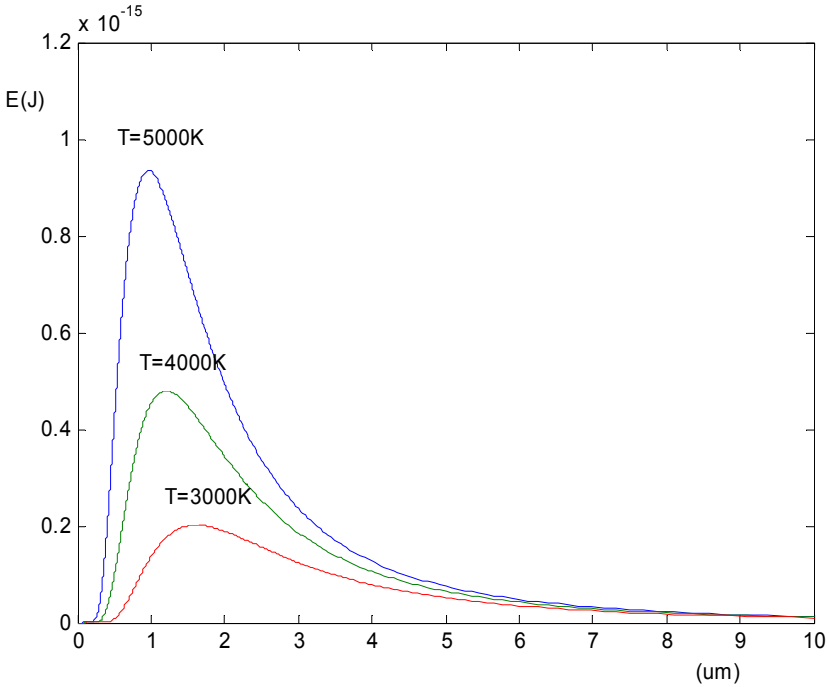
LONDON,



Max Planck
(1858-1947)

http://micro.magnet.fsu.edu/optics/

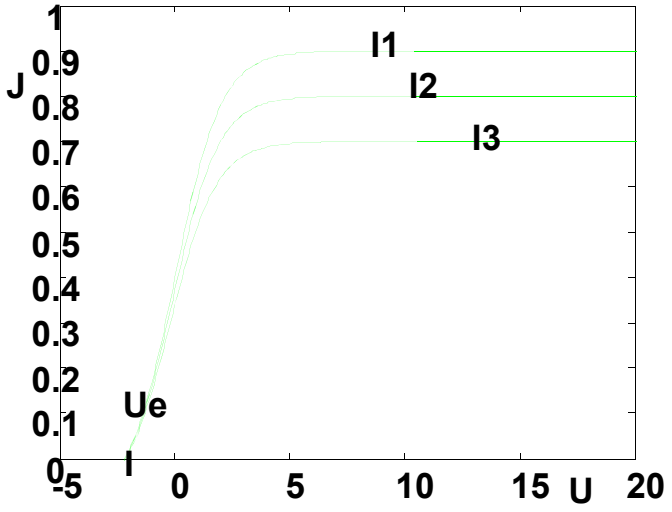

x 10^-15
E(J)
T=5000K
T=4000K
T=3000K
eV

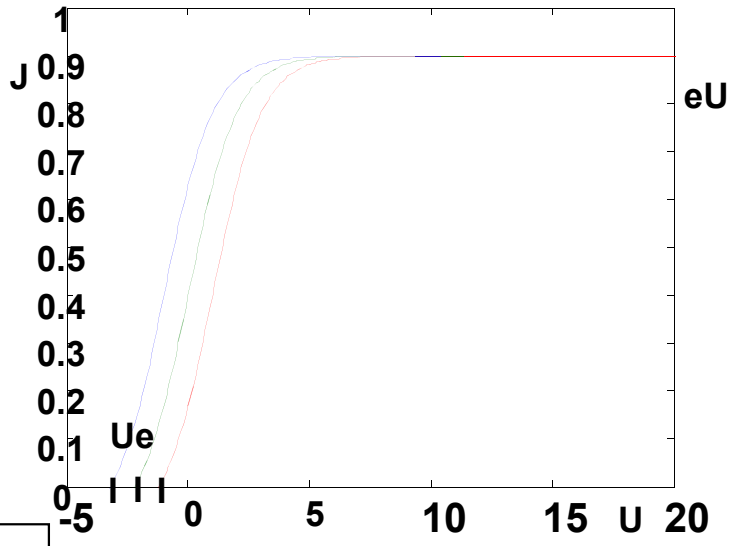

x 10^-15
E(J)
T=5000K
T=4000K
T=3000K
(um)

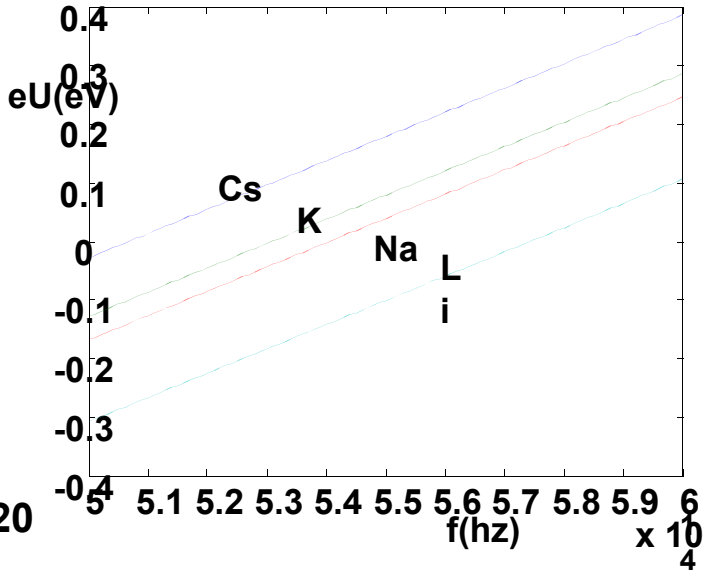
Záření absolutně černého tělesa - 1900 - Max Planck (1858-1947)

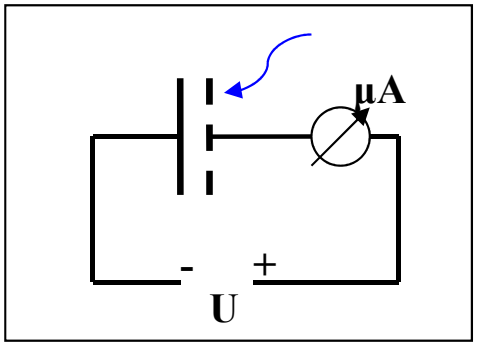
$$E(\nu) = \frac{8\pi h}{c^3} \frac{\nu^3}{e^{h\nu/kT} - 1}$$

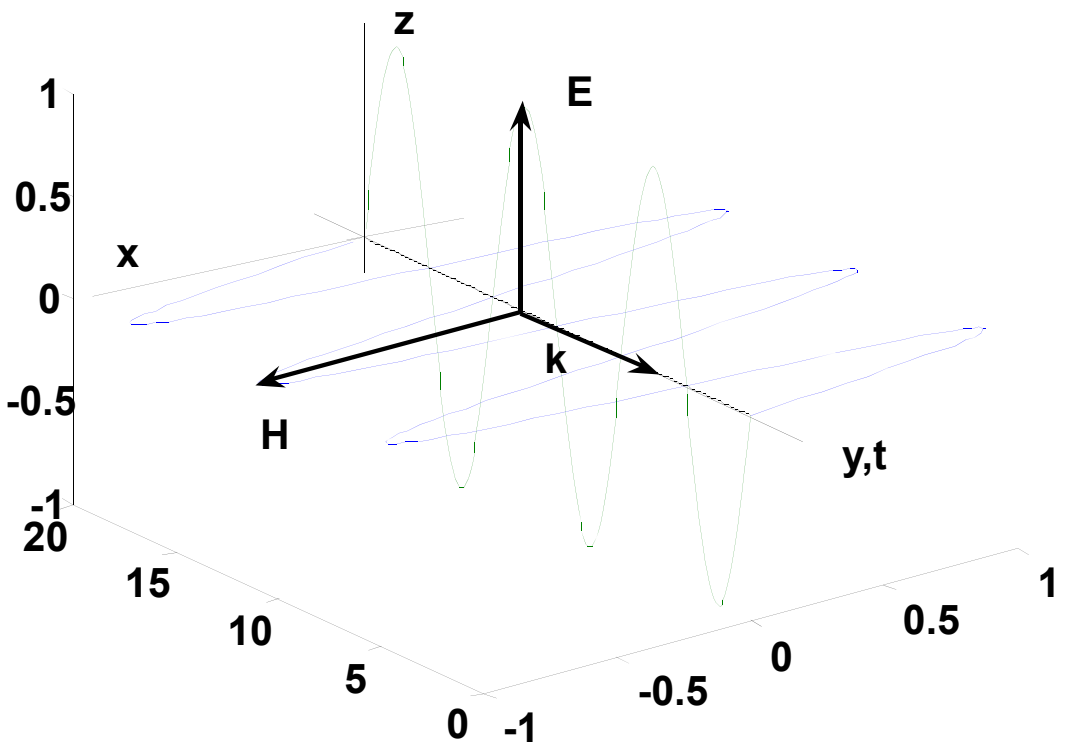
$$k = 1.381 \quad 10^{-23} \text{ JK}^{-1} \qquad h = 6.625 \quad 10^{-34} \text{ Js}$$


J
I1
I2
I3
Ue
I
U

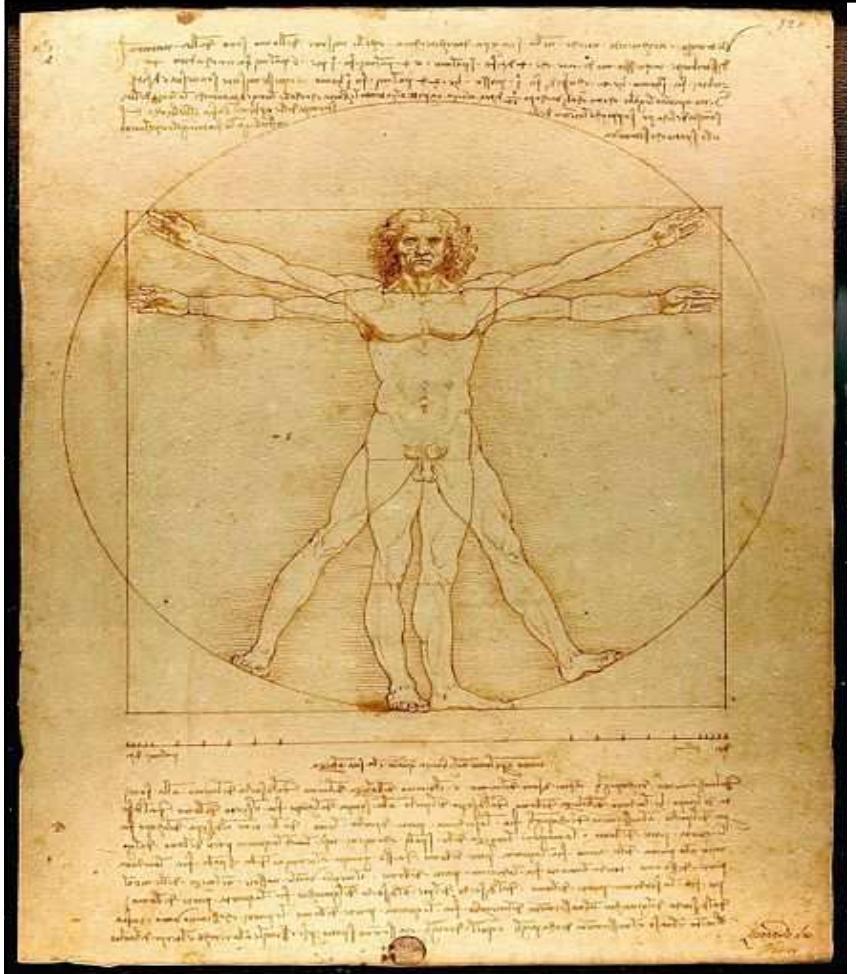

J
Ue
U

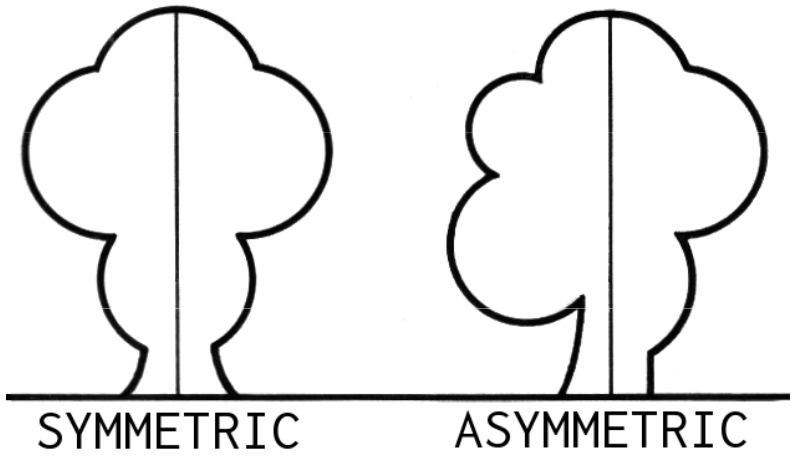

eU(eV)
Cs
K
Na
L
i
f(hz)
x 10^14


μA
-
+
U


z
E
1
0.5
x
0
-0.5
-1
k
H
y,t
20
15
10
5
0
-1
-0.5
0
0.5
1

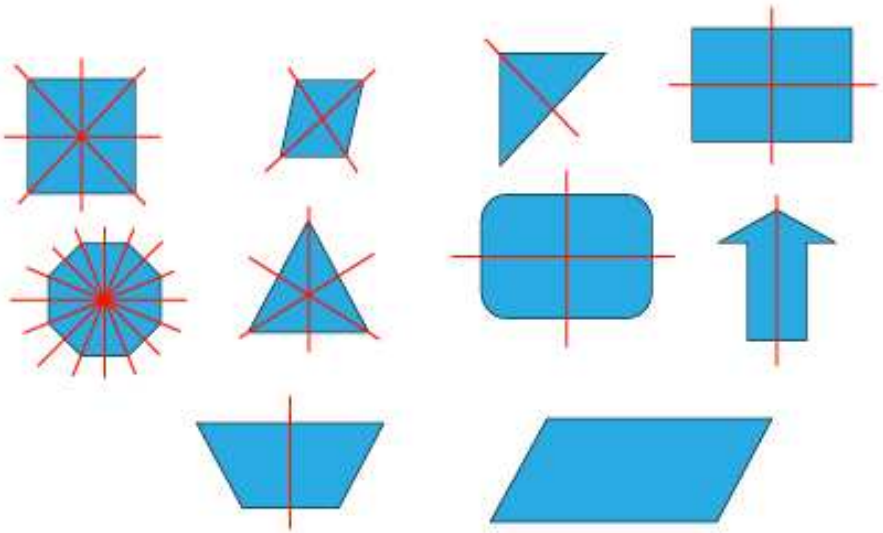
Amalie Emmy Noether 1882-1935

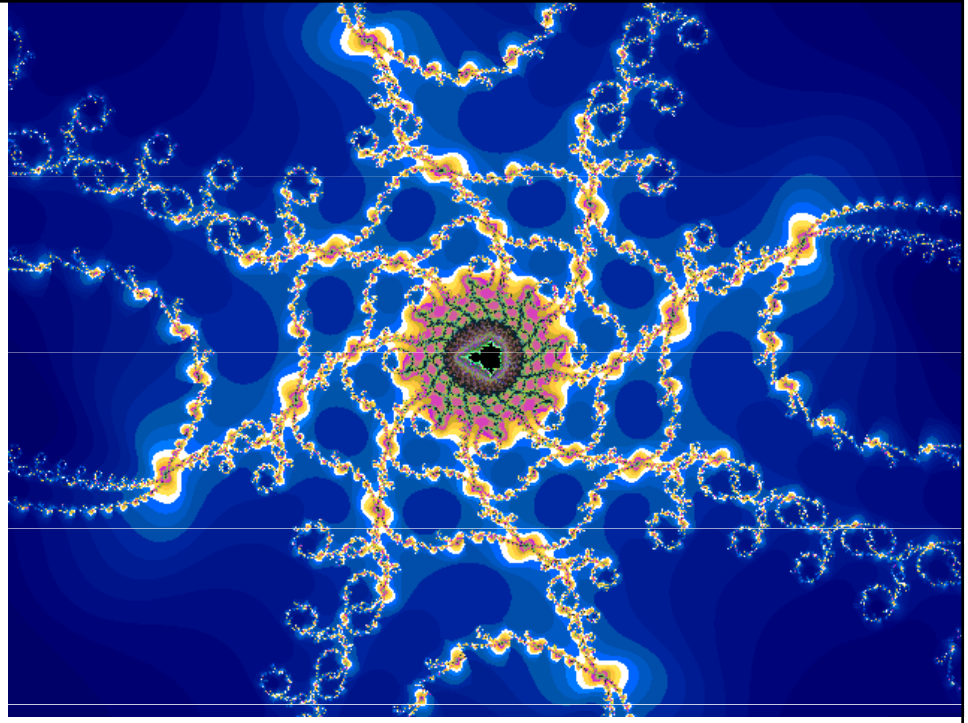




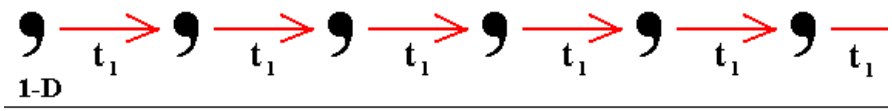
Leonardo da Vinci's *Vitruvian Man* (ca. 1487) is often used as a representation of symmetry in the human body and, by extension, the natural universe.

Jiří David

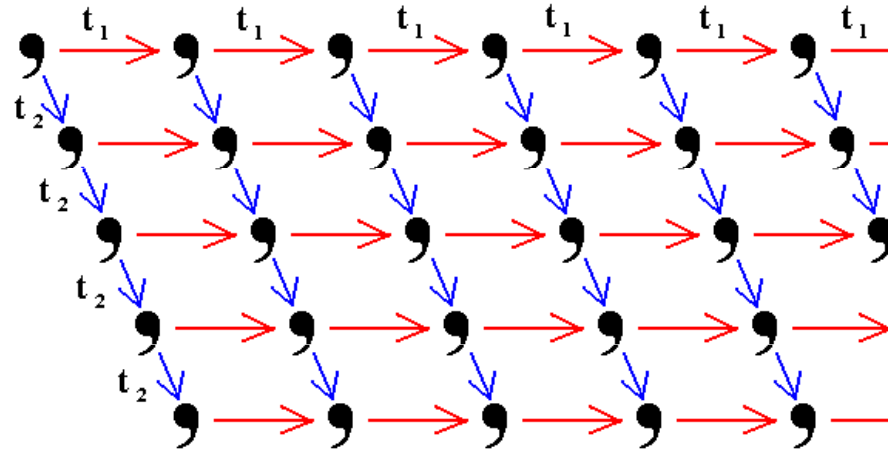




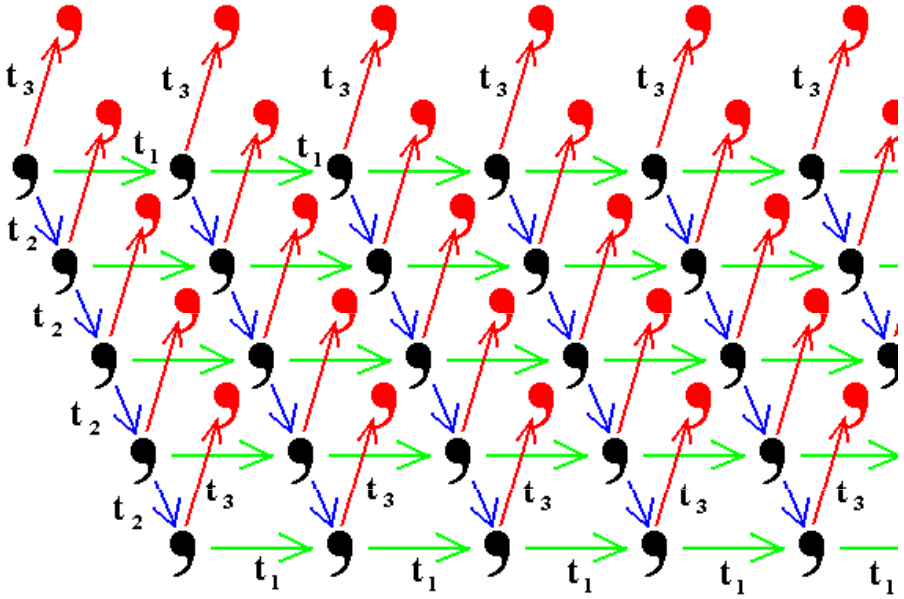
Fractal


t1
t1
t1
t1
t1
t1

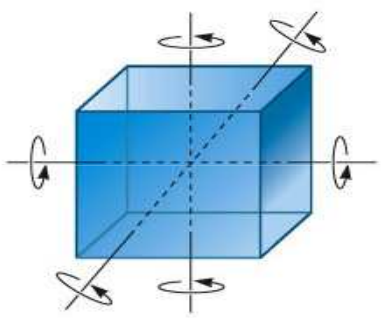
1-D


t1
t1
t1
t1
t1
t1
t2
t2
t2
t2

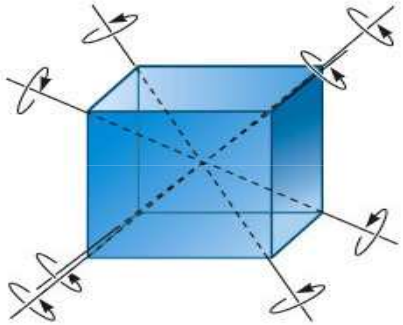
2-D


t3
t3
t3
t3
t3
t3
t1
t1
t2
t2
t2
t2
t3
t3
t3
t3
t3
t1
t1
t1
t1
t1

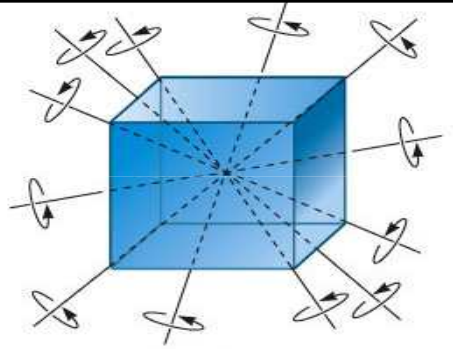
3-D



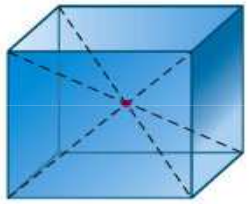
Three 4-fold axes



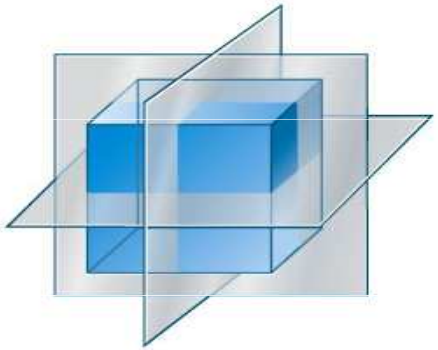
Four 3-fold axes

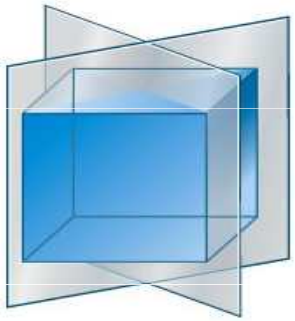


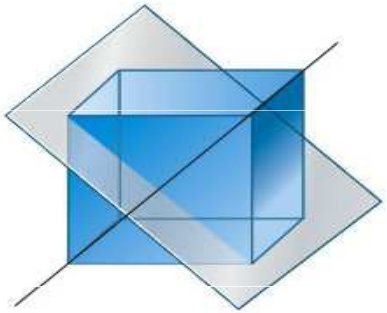
Six 2-fold axes

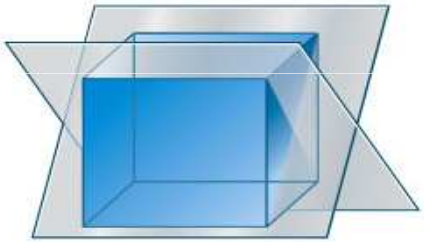


Center of inversion

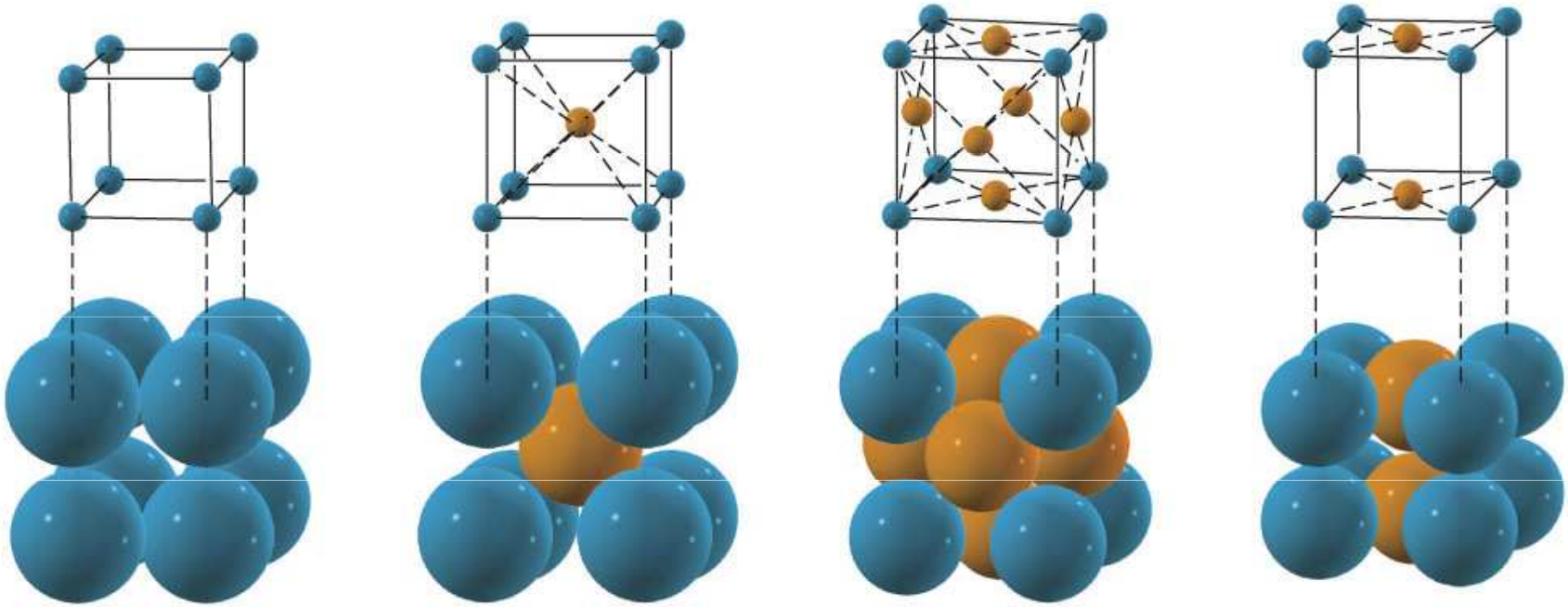








Nine mirror planes



Primitive | Body-centered | Face-centered | Side-centered

Přesné symetrie:

Symetrie přírodních zákonů vůči posunutí (translaci) v prostoru – zákon zachování hybnosti.

Symetrie přírodních zákonů vůči posunutí v čase – zákon zachování energie.

Symetrie přírodních zákonů vůči otočení (změně orientace) v prostoru – zákon zachování momentu hybnosti

Symetrie přírodních zákonů vůči záměně znaménka náboje –zákon zachování náboje

Přibližné symetrie:

Symetrie přírodních zákonů vůči zrcadlové inverzi
– zákon zachování parity (P-symetrie) x → -x , y → -y, z → -z

Symetrie přírodních zákonů vůči záměně částic za antičástice a naopak
– zákon zachování C-symetrie Q → -Q, …

Symetrie přírodních zákonů vůči časové inverzi
– zákon zachování T-symetrie t → -t.

Jejich kombinace:

Symetrie přírodních zákonů vůči současné zrcadlové inverzi a záměně částice za antičástici – zákon zachování CP symetrie

Symetrie přírodních zákonů vůči současné zrcadlové inverzi a záměně částice za antičástici a změně toku času – zákon zachování CPT symetrie

Co je důsledkem narušení symetrií:

Narušení P symetrie → svět v zrcadle odlišitelný od světa

Narušení C symetrie → antisvět odlišitelný od světa

Narušení T symetrie → směr toku času není rovnocený

Narušení CP symetrie → antisvět v zrcadle je odlišitelný od světa

3. Měření

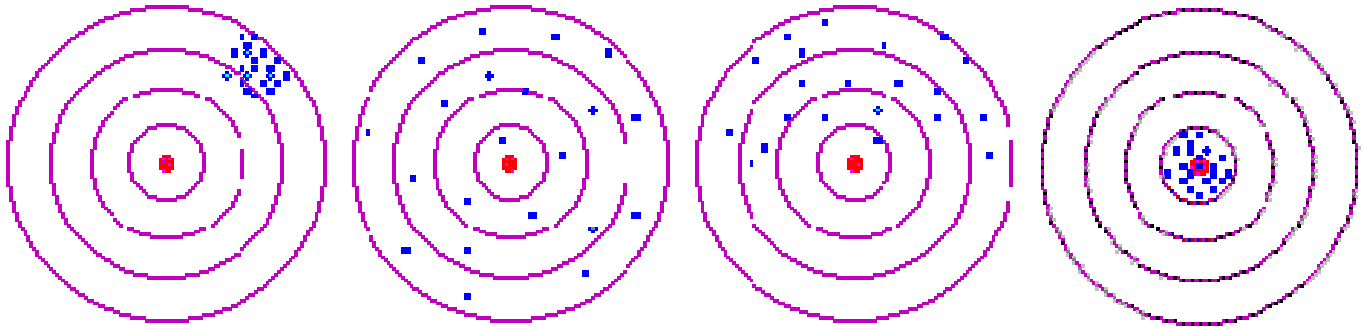
Fyzikální veličiny
Fyzikální jednotky
Soustava SI
Jiné soustavy
Měření
- chyby
- zpracování výsledků měření
- graf

Veličina	jednotka	značka	přesnost
Délka	metr	m	10^{-10}
Hmotnost	kilogram	kg	10^{-7}
Čas	sekunda	s	10^{-14}
Elektrický proud	ampér	A	10^{-5}
Teplota	kelvin	K	10^{-4}
Svítivost	kandela	cd	5.10^{-3}
Látkové množství	mol	mol	10^{-6}

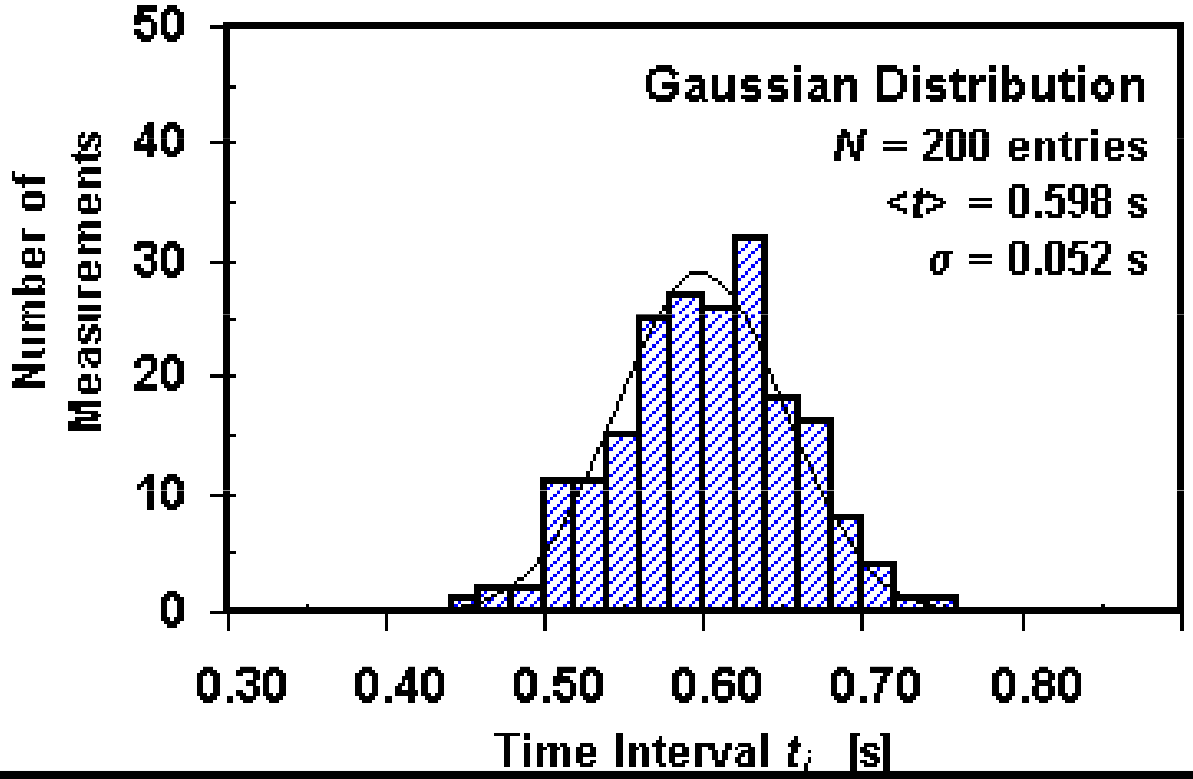
činitel	předpona	značka			
10^{24}	yotta	Y	10^{-1}	deci	d
10^{21}	zetta	Z	10^{-2}	centi	c
10^{18}	exa	E	10^{-3}	mili	m
10^{15}	peta	P	10^{-6}	mikro	µ
10^{12}	tera	T	10^{-9}	nano	n
10^{9}	giga	G	10^{-12}	piko	p
10^{6}	mega	M	10^{-15}	femto	f
10^{3}	kilo	k	10^{-18}	atto	a
10^{2}	hekto	h	10^{-21}	zepto (*dříve* banto)	z (*dříve* b)
10^{1}	deka	da	10^{-24}	yokto	y

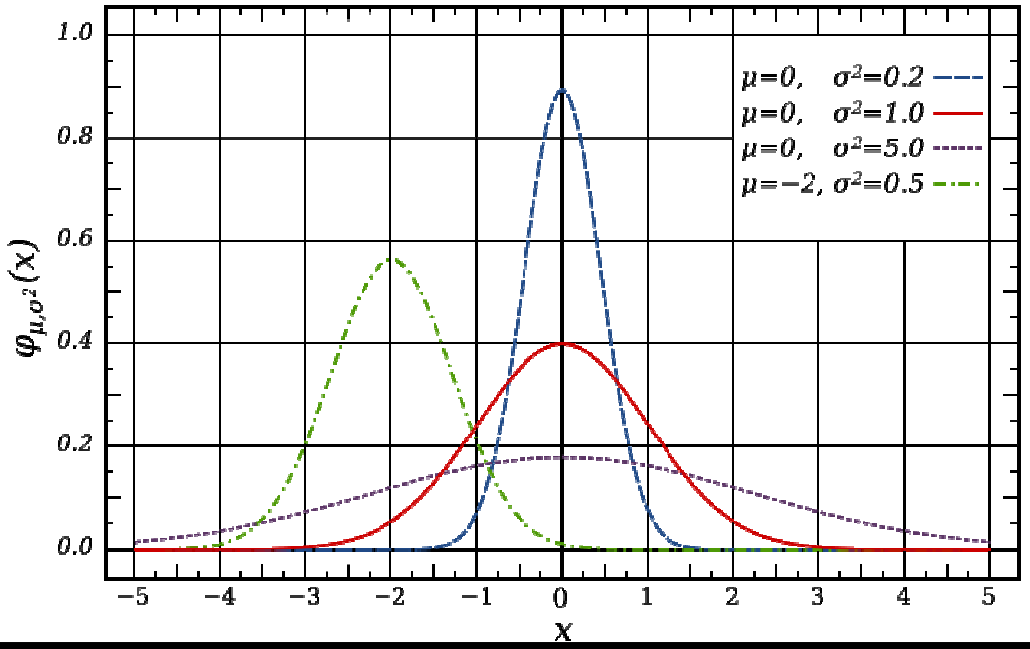
m

kg

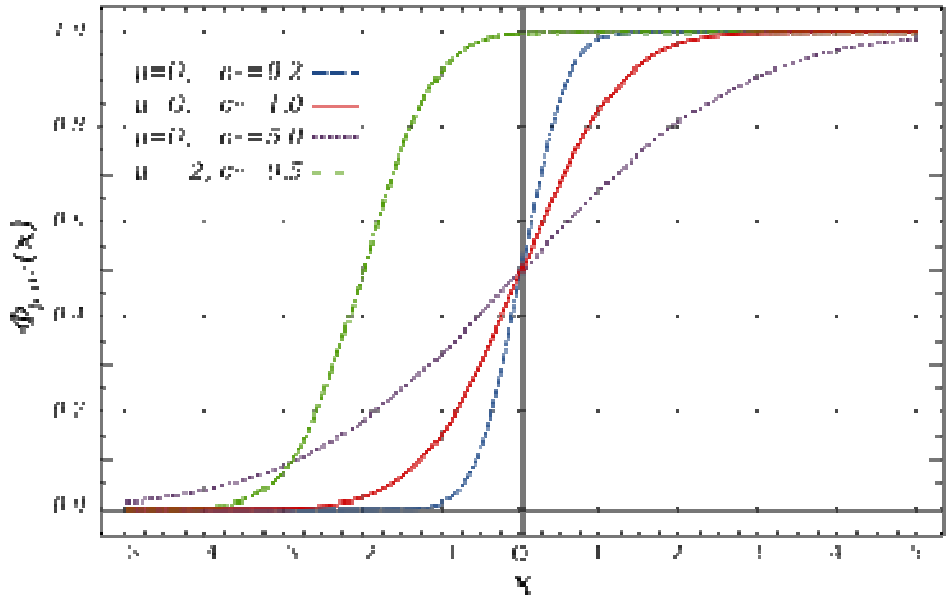


Statistical:	Small	Large	Large	Small
Systematic:	Large	Small	Large	Small

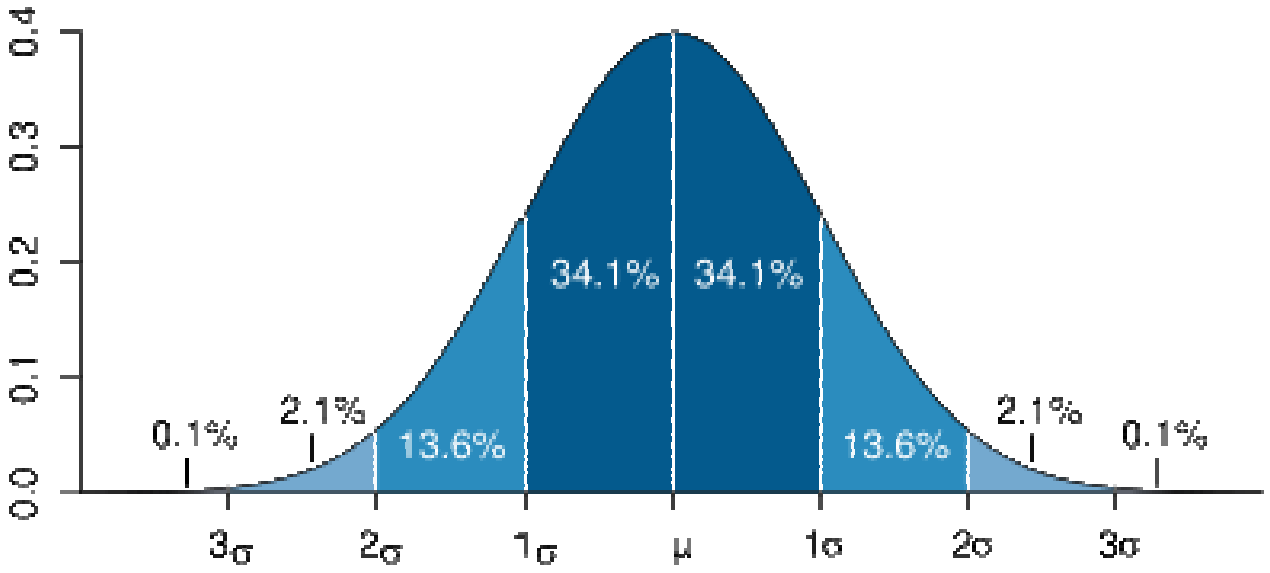

Gaussian Distribution
N = 200 entries
<t> = 0.598 s
σ = 0.052 s
Number of Measurements
50
40
30
20
10
0
0.30
0.40
0.50
0.60
0.70
0.80
Time Interval t_i [s]



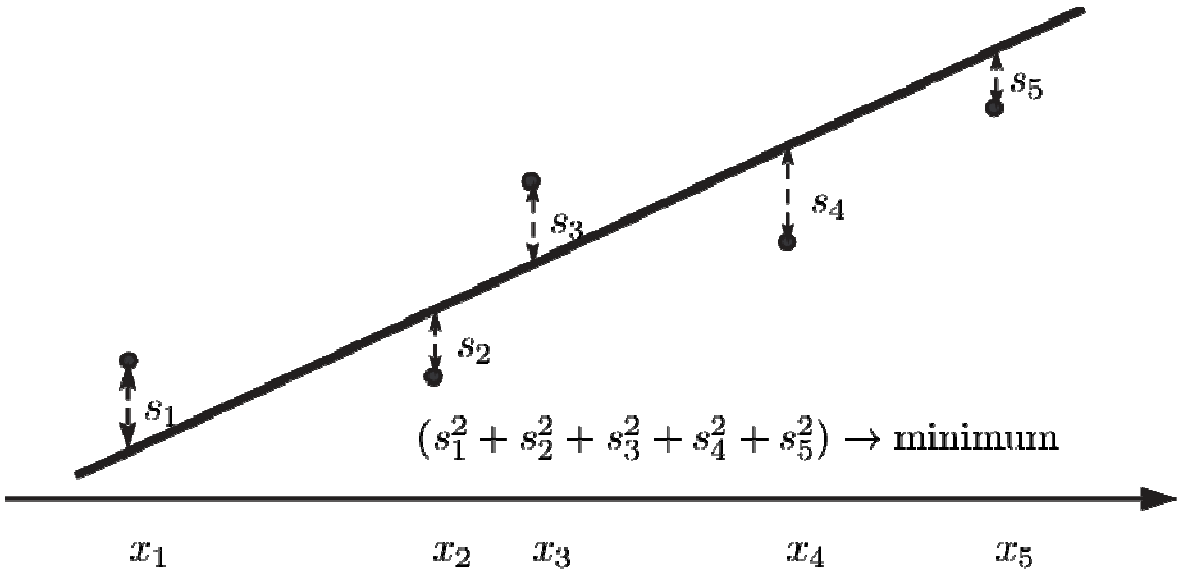
$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} \exp\left[-\frac{(x-\mu)^2}{2\sigma^2} \right]$$



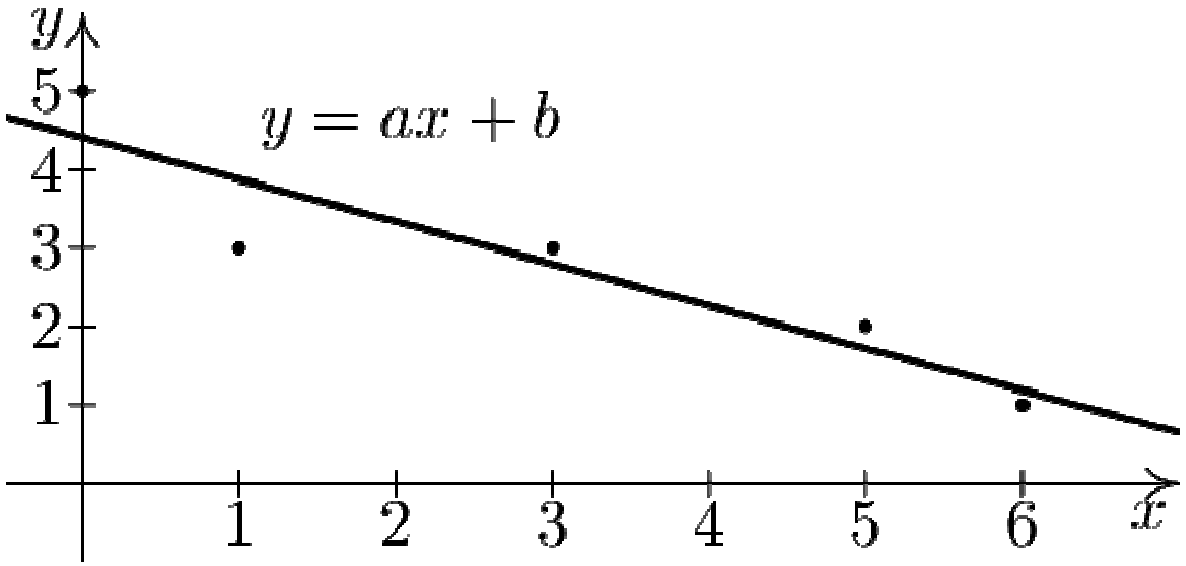
$$F(x) = \int_{-\infty}^{x} f(x')dx'$$



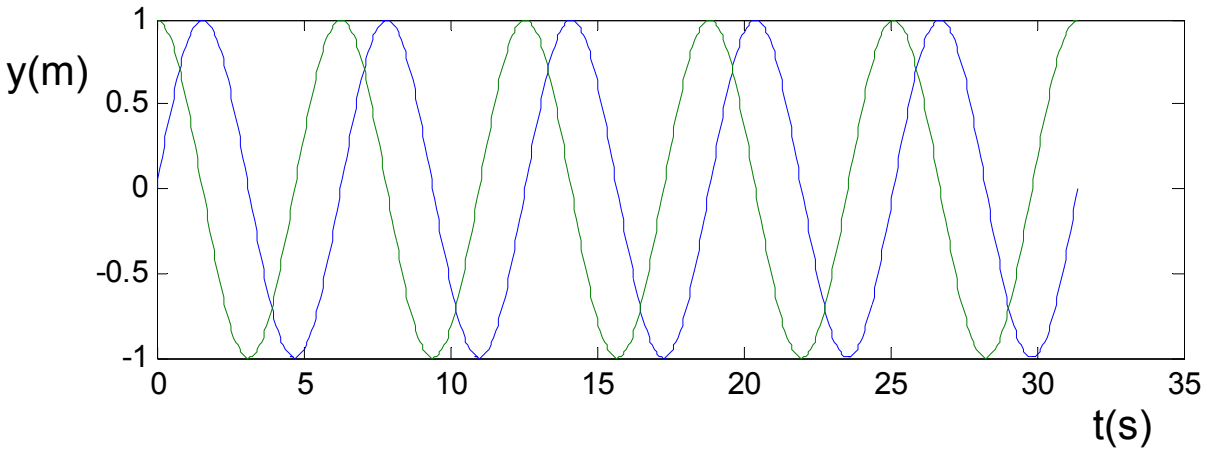
P(μ-σ, μ+σ)=0.682
P(μ-2σ, μ+2σ)=0.954
P(μ-3σ, μ+3σ)=0.997



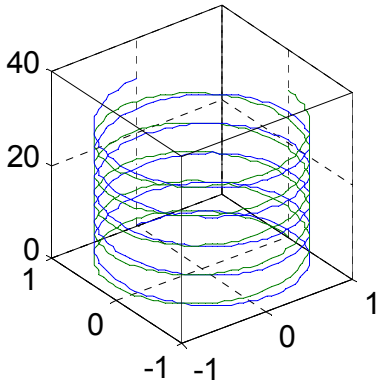
http://www.topclanky.cz/Metoda-nejmensich-ctvercu-24390



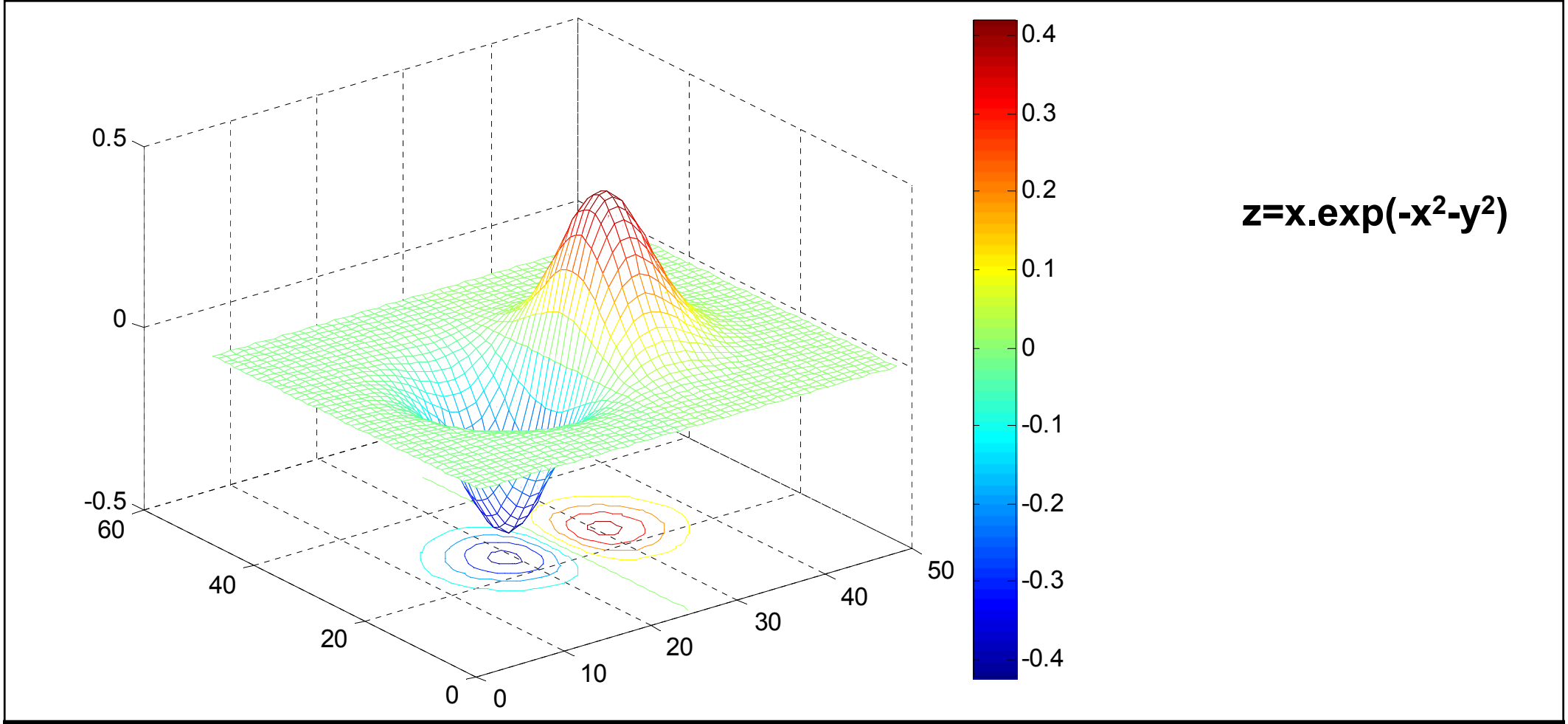
http://user.mendelu.cz/marik/prez/mnc-cz.pdf



y=sin(t)
y=cos(t)

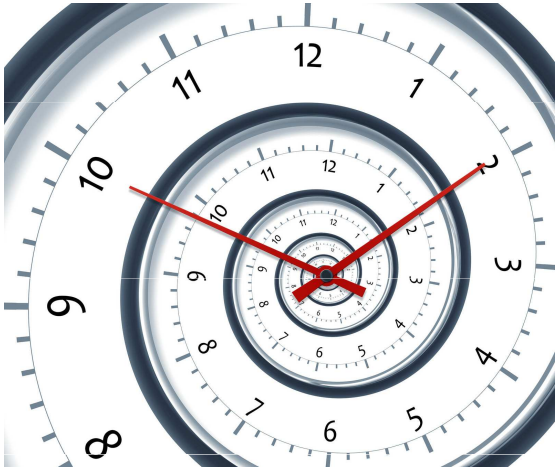


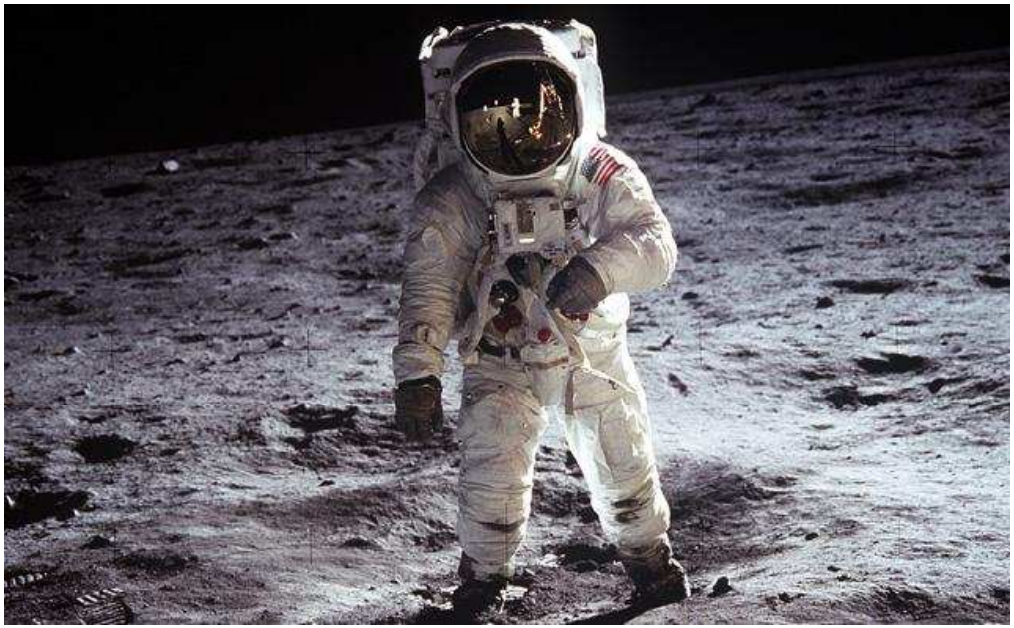
x=sin(t)
y=cos(t)
z=t
x=cos(t)
y=sin(t)
z=t


0.5
0
-0.5
60
40
20
0
0
10
20
30
40
50
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
z=x.exp(-x²-y²)

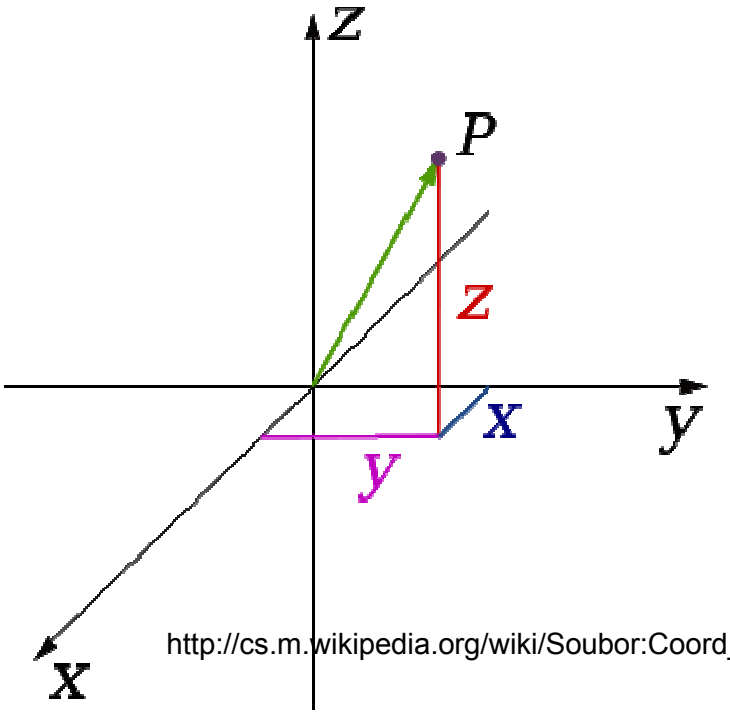
4. Prostor, čas, pohyb

Prostor, čas
Základy kinematiky
Základy dynamiky
  - Newtonovy zákony
Rotace

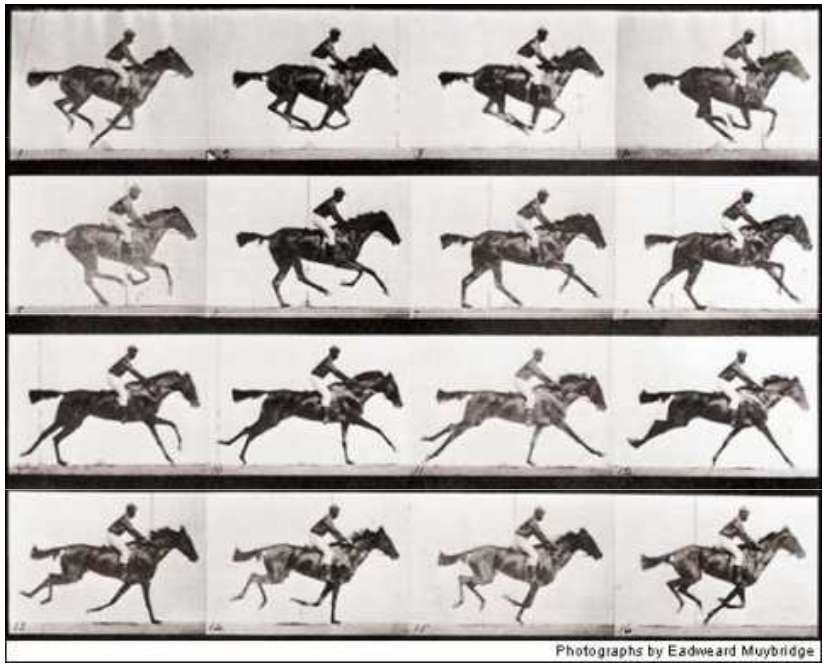


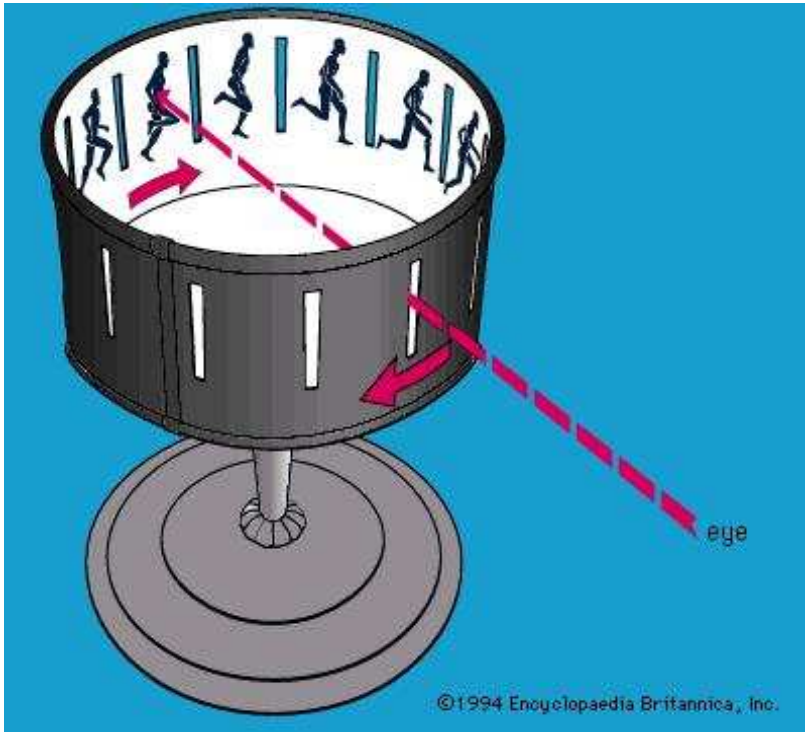


http://www.bbc.co.uk/science/space/solarsystem/collections/space_exploration



http://cs.m.wikipedia.org/wiki/Soubor:Coord_XYZ.svg



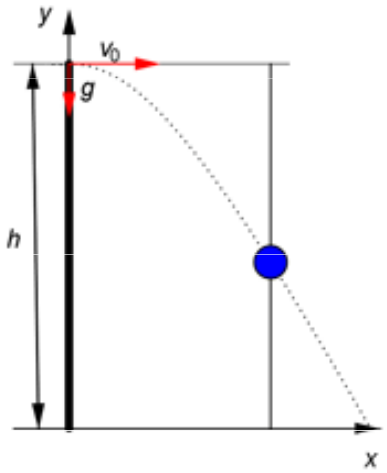


http://iands.wordpress.com/schedule/02-primitive-cinemacinema-of-entertainmentnarrative/

http://agile101.net/2009/07/10/whats-my-team-velocity/

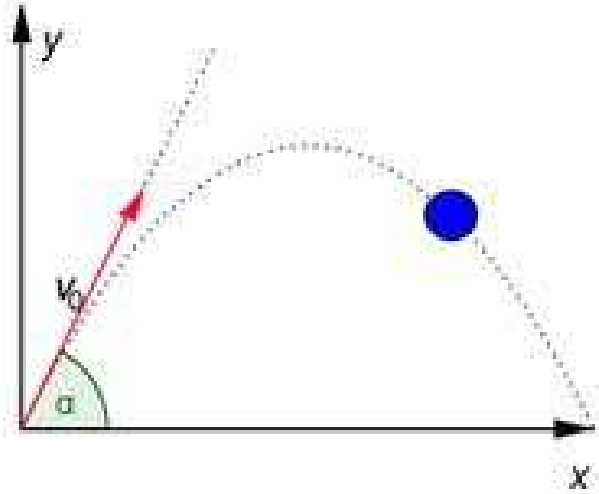
http://www.novinky.cz/domaci/

https://activephysics-pvrhsd.wikispaces.com/Laga



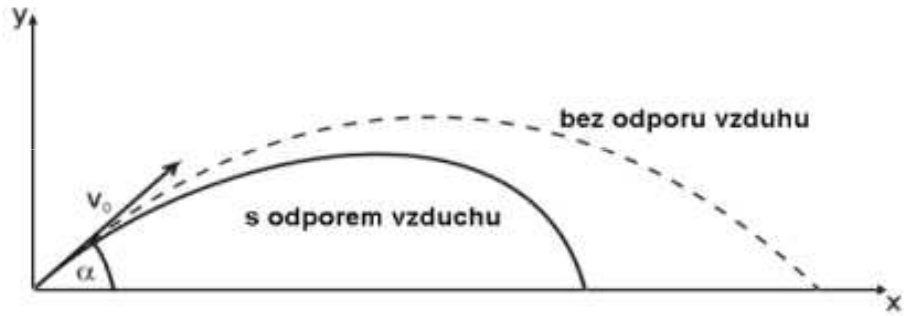
http://www.kuf.cz/Astoria/Cesta%2014/Cesta14.html

https://sites.google.com/site/atletikahodostepem/barbora-spotakova



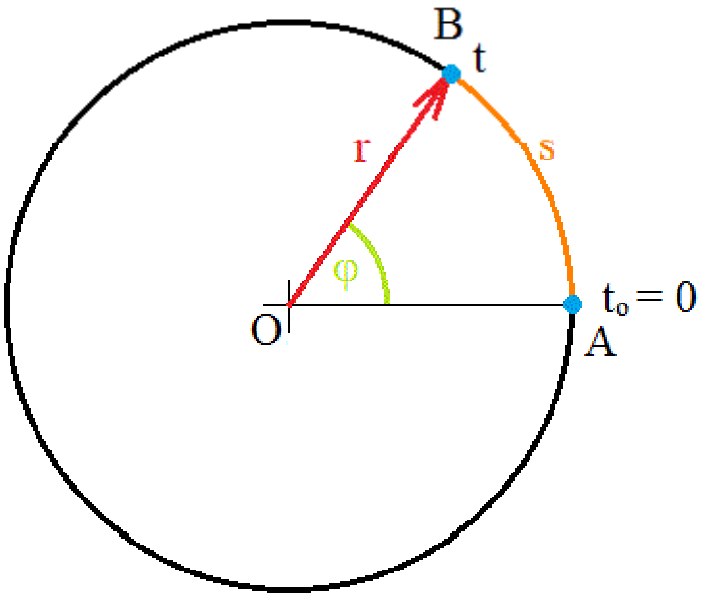
http://techmania.cz/edutorium/

http://www.lidovky.cz/parasutista-po-selhani-padaku-dopadl



http://www.kme.zcu.cz/kmet/bio/prikladvrh.php

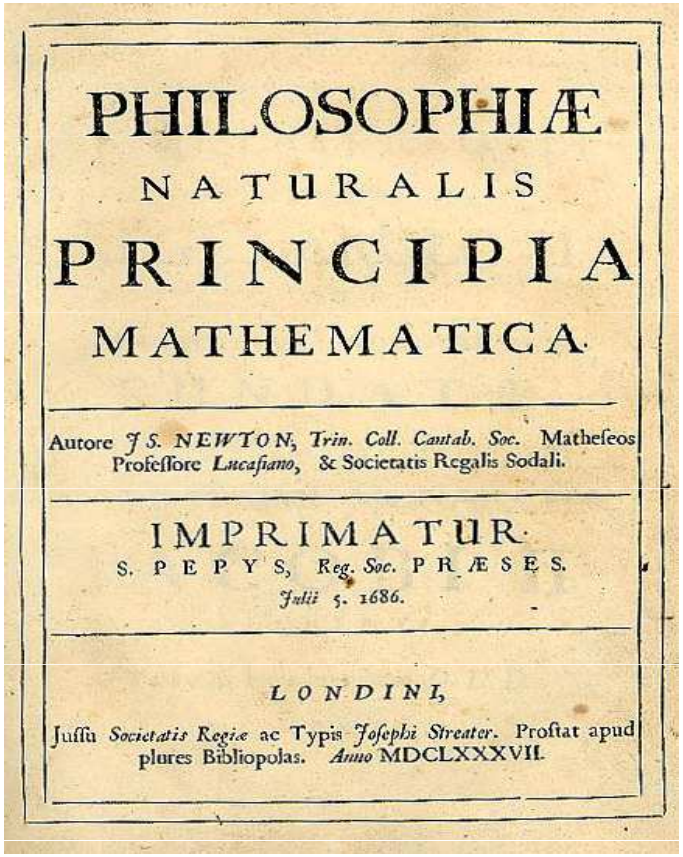
http://www.zenyprozeny.cz/art/393-z-kolotocu-mam-hruzu/



http://techmania.cz/edutorium/

Balla, Giacomo
Dynamism of a Dog on a Leash
1912
Oil on canvas
35 3/8 x 43 1/4 (89.9 x 109.9)
Albright-Knox Art Gallery, Buffalo, New York

GIACOMO BALLA
Speed car 1913



PHILOSOPHIÆ
NATURALIS
PRINCIPIA
MATHEMATICA.

Autore *J. S. NEWTON*, *Trin. Coll. Cantab. Soc.* Matheſeos Profeſſore *Lucaſiano*, & Societatis Regalis Sodali.

IMPRIMATUR.
S. PEPYS, *Reg. Soc.* PRÆSES.
Julii 5. 1686.

LONDINI,
Juſſu *Societatis Regiæ* ac Typis *Joſephi Streater*. Proſtat apud plures Bibliopolas. *Anno* MDCLXXXVII.

http://files.libertyfund.org/files/1254/0741_Bk.pdf

AXIOMATA SIVE LEGES MOTUS

Lex. I.

Corpus omne perseverare in statu suo quiescendi vel movendi uniformiter in directum, nisi quatenus a viribus impressis cogitur statum illum mutare.

Projectilia perseverant in motibus suis nisi quatenus a resistentia aeris retardantur & vi gravitatis impelluntur deorsum. Trochus, cujus partes cohærendo perpetuo retrahunt sese a motibus rectilineis, non cessat rotari nisi quatenus ab aere retardatur. Majora autem Planetarum & Cometarum corpora motus suos & progressivos & circulares in spatiis minus resistentibus factos conservant diutius.

Lex. II.

Mutationem motus proportionalem esse vi motrici impressæ, & fieri secundum lineam rectam qua vis illa imprimitur.

Si vis aliqua motum quemvis generet, dupla duplum, tripla triplum generabit, sive simul & semel, sive gradatim & successive impressa fuerit. Et hic motus quoniam in eandem semper plagam cum vi generatrice determinatur, si corpus antea movebatur, motui ejus vel conspiranti additur, vel contrario subducitur, vel obliquo obliquæ adjicitur, & cum eo secundum utriusq; determinationem componitur.

Lex. III.

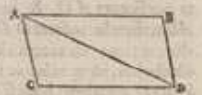
Lex. III.

Actioni contrariam semper & æqualem esse reactionem: sive corporum duorum actiones in se mutuo semper esse æquales & in partes contrarias dirigi.

Quicquid premit vel trahit alterum, tantundem ab eo premitur vel trahitur. Siquis lapidem digito premit, premitur & hujus digitus a lapide. Si equus lapidem funi allegatum trahit, retrahetur etiam & equus æqualiter in lapidem: nam funis utrinq; distentus eodem relaxandi se conatu urgebit Equum versus lapidem, ac lapidem versus equum, tantumq; impediet progressum unius quantum promovet progressum alterius. Si corpus aliquod in corpus aliud impingens, motum ejus vi sua quomodocunq; mutaverit, idem quoque vicissim in motu proprio eandem mutationem in partem contrariam vi alterius (ob æqualitatem pressionis mutuæ) subibit. His actionibus æquales fiunt mutationes non velocitatum sed motuum, (scilicet in corporibus non aliunde impeditis.) Mutationes enim velocitatum, in contrarias itidem partes factæ, quia motus æqualiter mutantur, sunt corporibus reciproce proportionales.

Corol. I.

Corpus viribus conjunctis diagonalem parallelogrammi eodem tempore describere, quo latera separatis.



Si corpus dato tempore, vi sola *M*, ferretur ab *A* ad *B*, & vi sola *N*, ab *A* ad *C*, compleatur parallelogrammum *ABDC*, & vi utraq; feretur id eodem tempore ab *A* ad *D*. Nam quoniam vis *N* agit secundum lineam *AC* ipsi *BD* parallelam, hæc vis nihil mutabit velocitatem accedendi ad lineam illam *BD* a vi altera genitam. Accedet igitur corpus eodem tempore ad lineam *BD* sive vis *N* imprimatur, sive non, atq; adeo in fine illius temporis reperietur alicubi in linea illa

Lex. I.

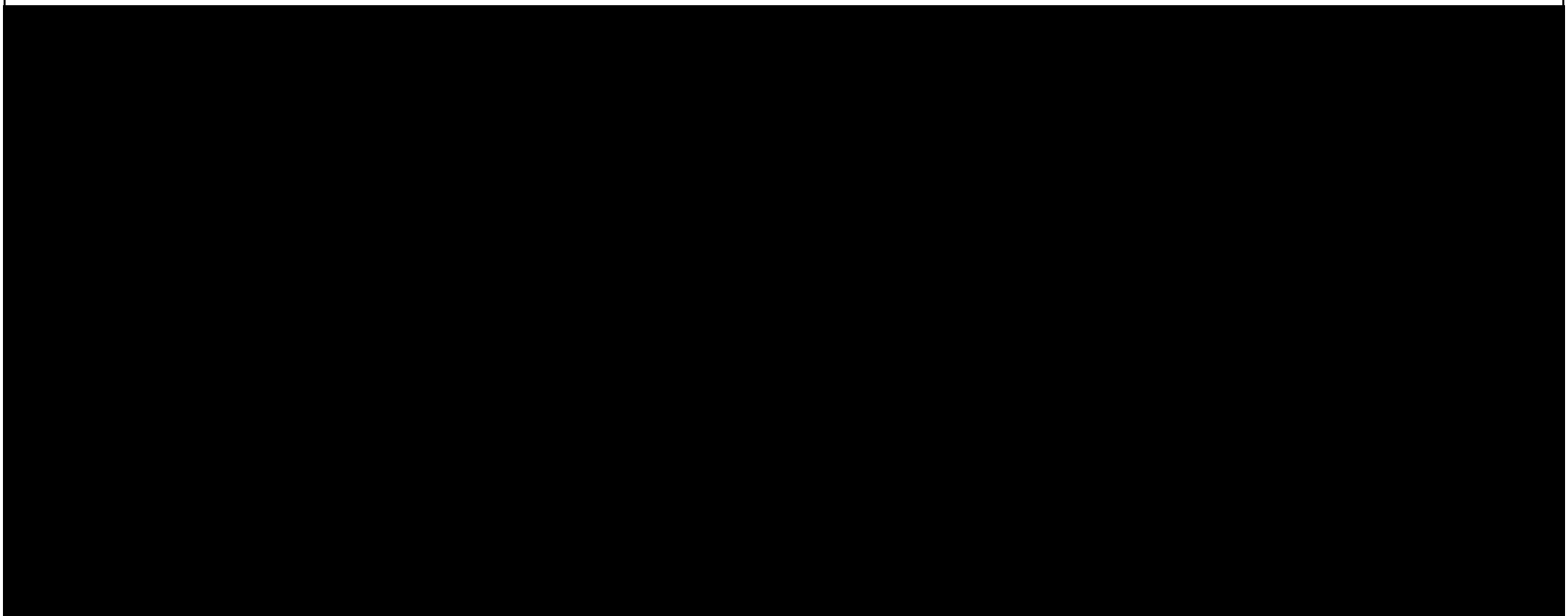
Corpus omne perseverare in statu suo quiescendi vel movendi uniformiter in directum, nisi quatenus a viribus impressis cogitur statum illum mutare

Lex. II.

Mutationem motus proportionalem esse vi motrici impressæ, & fieri secundum lineam rectam qua vis illa imprimitur.

Lex. III.

Actioni contrariam semper & æqualem esse reactionem: sive corporum duorum actiones in se mutuo semper esse æquales & in partes contrarias dirigi.

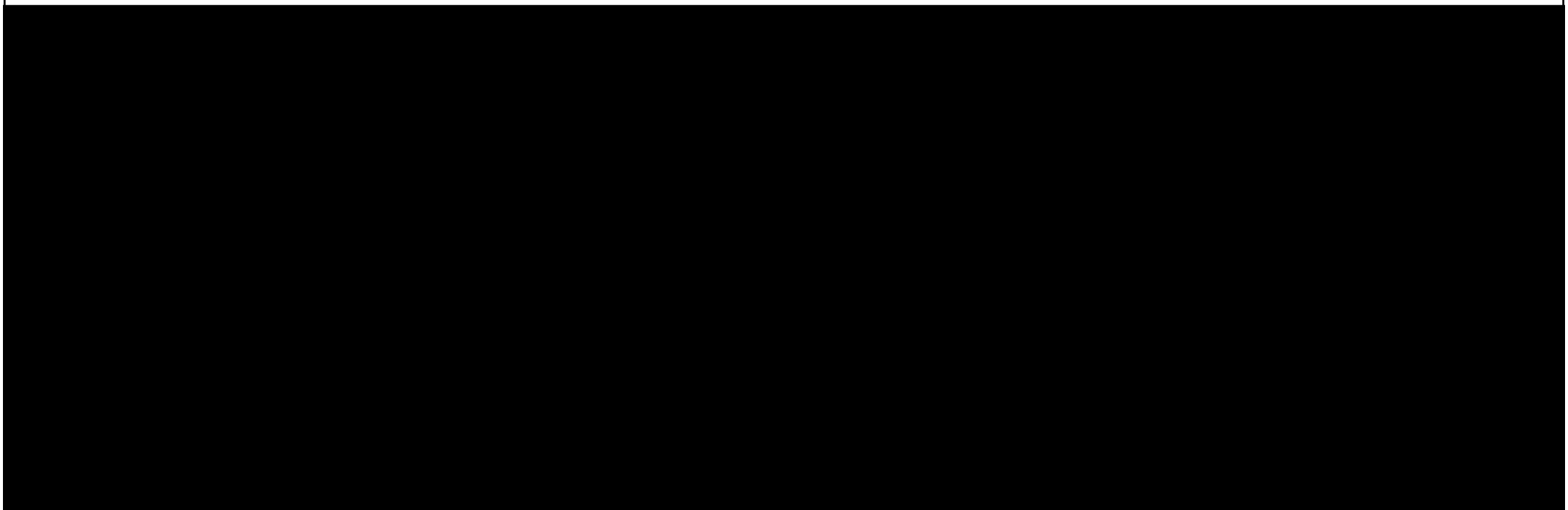


Every body perseveres either in its state of resting or of moving uniformly in a direction, unless that is compelled to change its state by impressed forces.

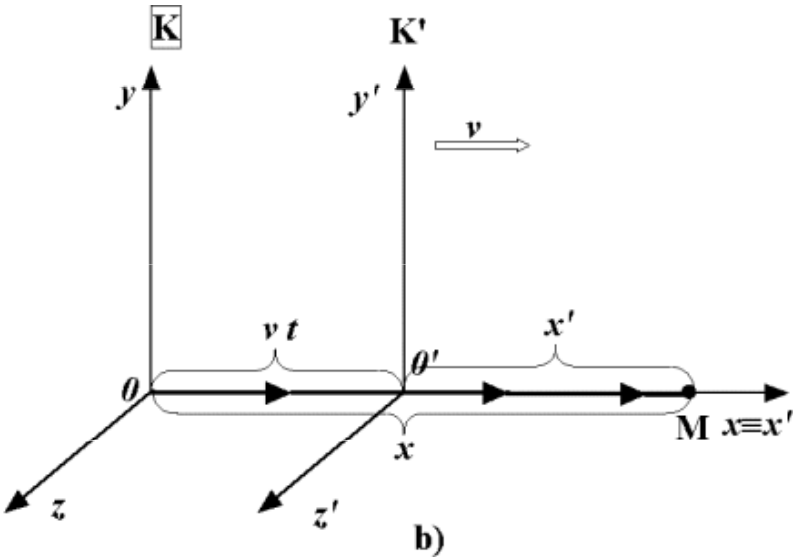
The change of motion is proportional to the [*magnitude of the*] *impressed motive force, and to be made along the right line by which that force is impressed.*

To an action there is always an equal and contrary reaction : *or the actions of two bodies between themselves are always mutually equal and directed in opposite directions.*

http://www.17centurymaths.com/contents/newton/defs%20axioms.pdf



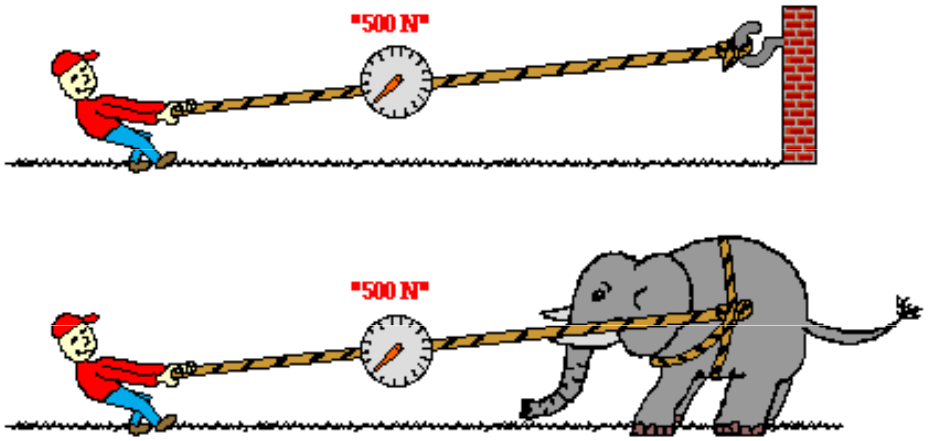
http://blog.craniumfitteds.com/



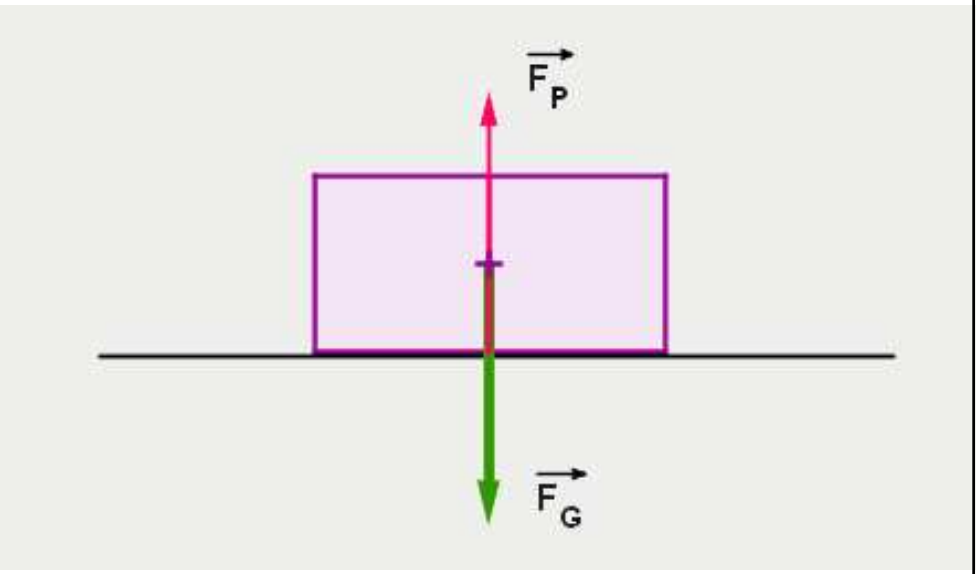
http://www.ktf.upol.cz/joch/kinematika/

$$\mathbf{F} = \frac{\mathrm{d}\mathbf{p}}{\mathrm{d}t} = \frac{\mathrm{d}(m\mathbf{v})}{\mathrm{d}t}$$

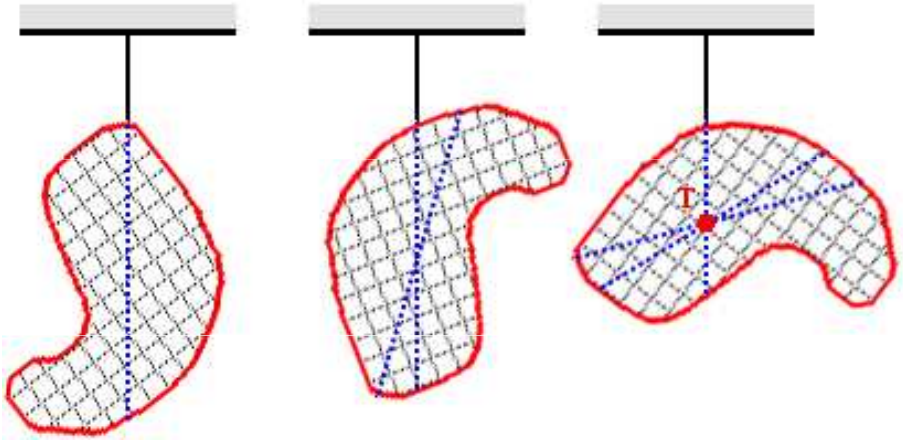
http://en.wikipedia.org/wiki/Space_Shuttle



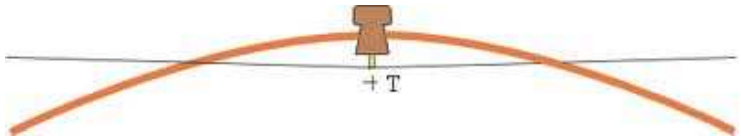
http://www.physicsclassroom.com/



http://www.nabla.cz/obsah/fyzika/

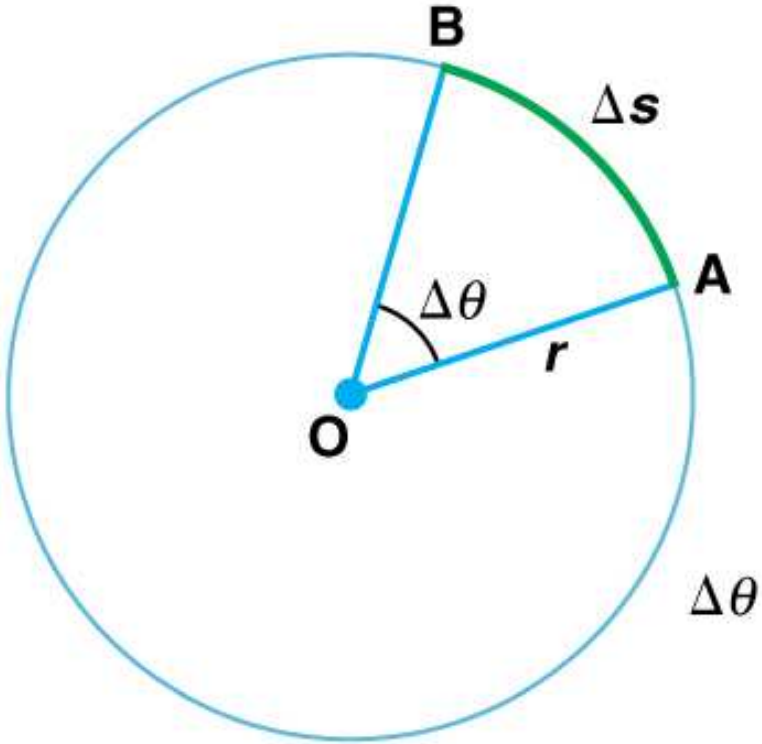


http://clanky.rvp.cz/clanek/t/GMB/2271/URCOVANI-POLOHY-TEZISTE-TELESA.html/

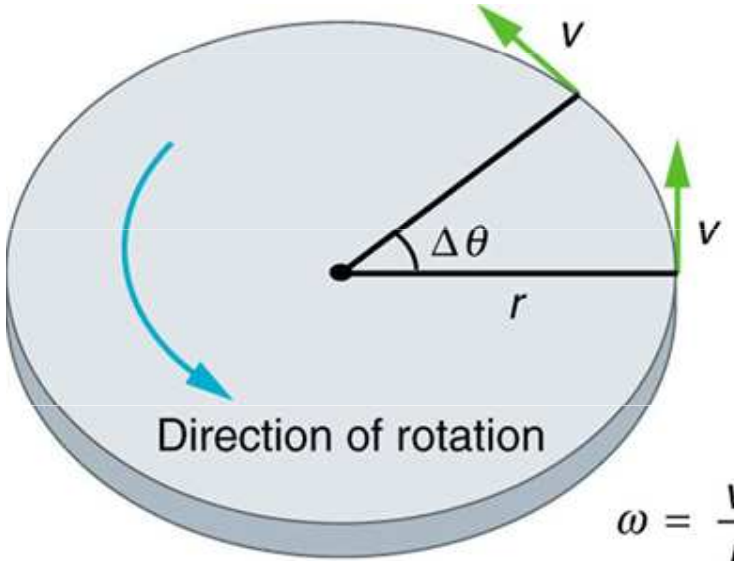


http://fyzweb.cz/materialy/sily/tezist/stabil.php

http://zpravy.ihned.cz/c1-60123770-foto-nad-propasti-presel-400-metru-dlouhe-lano-provazochodec-pokoril-grand-canyon

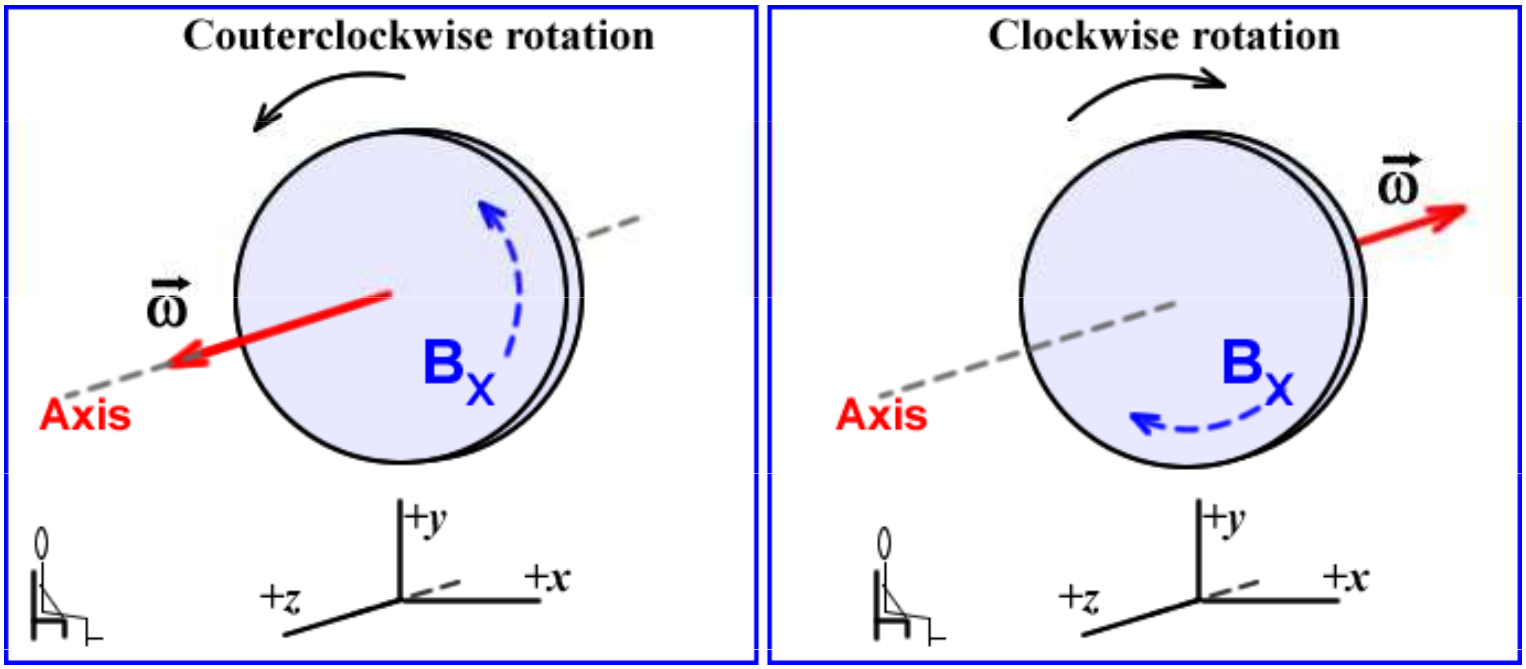


$$\Delta\theta = \frac{\Delta s}{r}$$

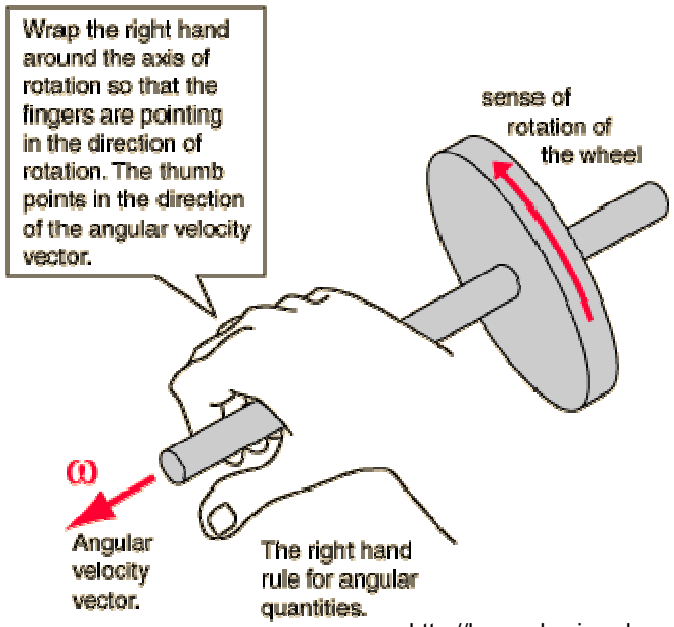


$$\omega = \frac{v}{r}$$

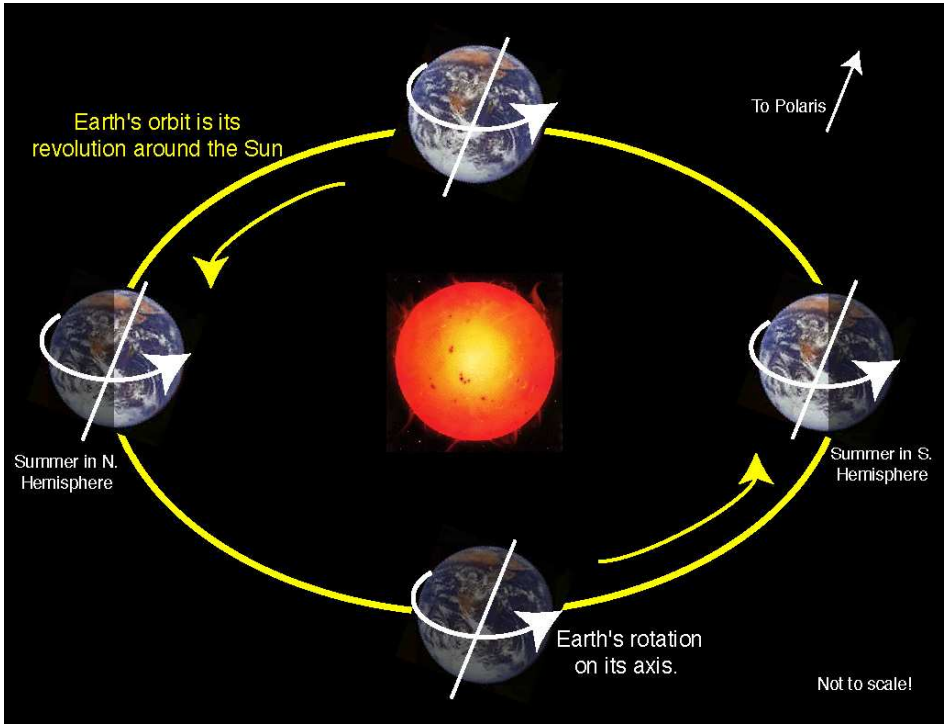
https://www.boundless.com/physics/



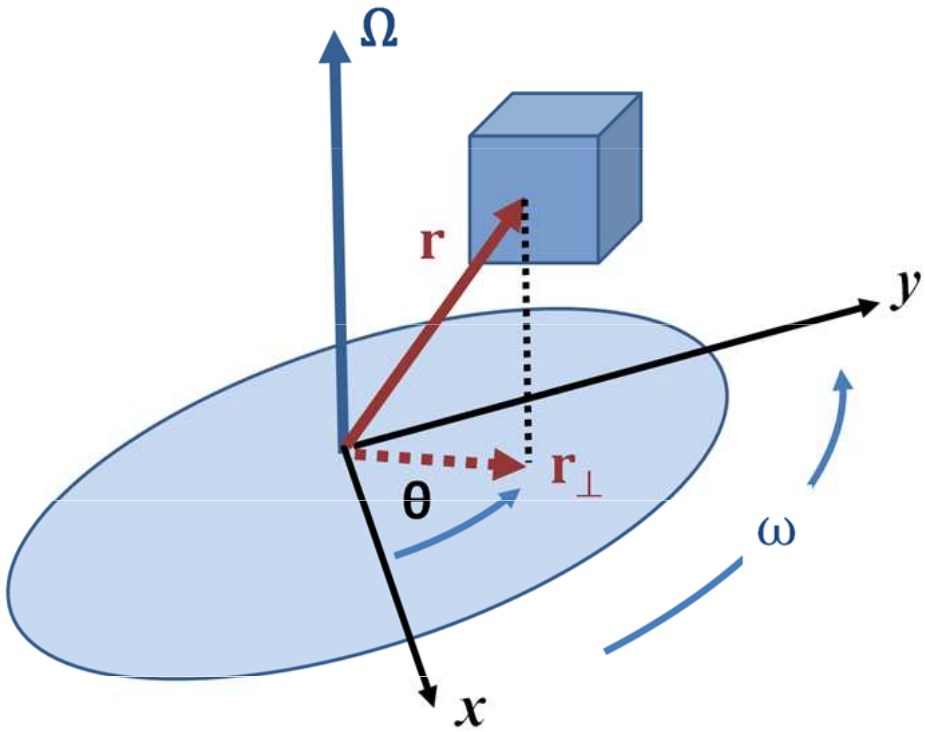
http://scripts.mit.edu/



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

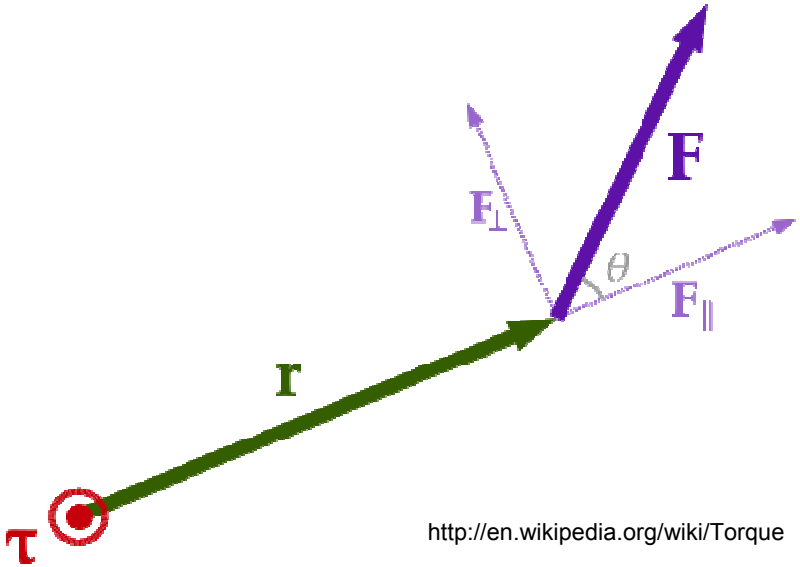


http://scienceblogs.com/startswithabang/2012/02/29/the-physics-of-leap-day/

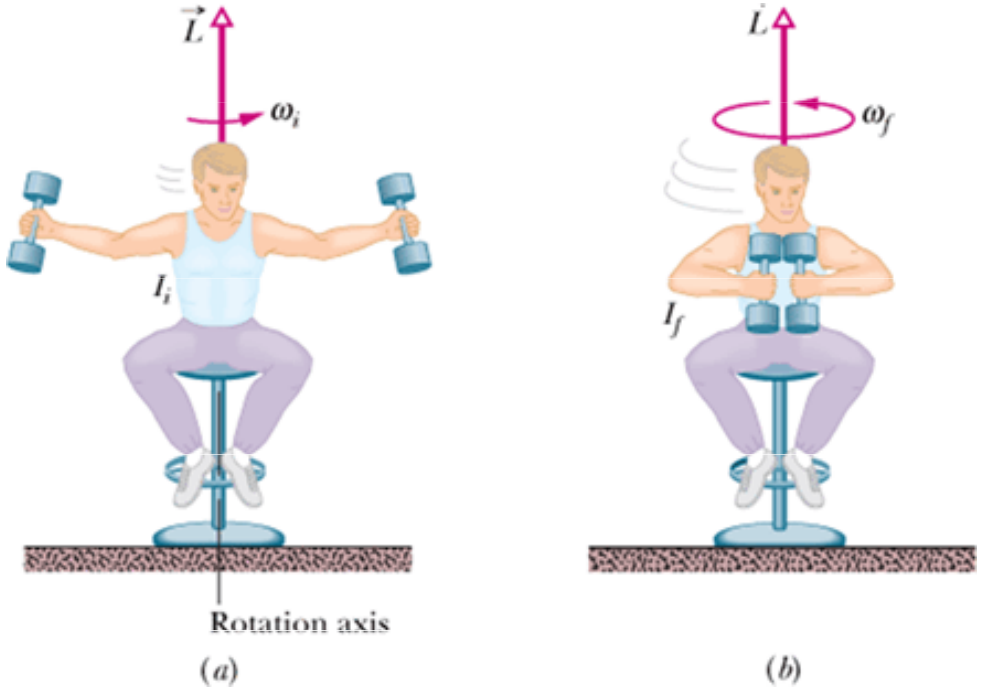


http://necyklopedie.wikia.com/wiki/Soubor:Rotace_krychle.PNG

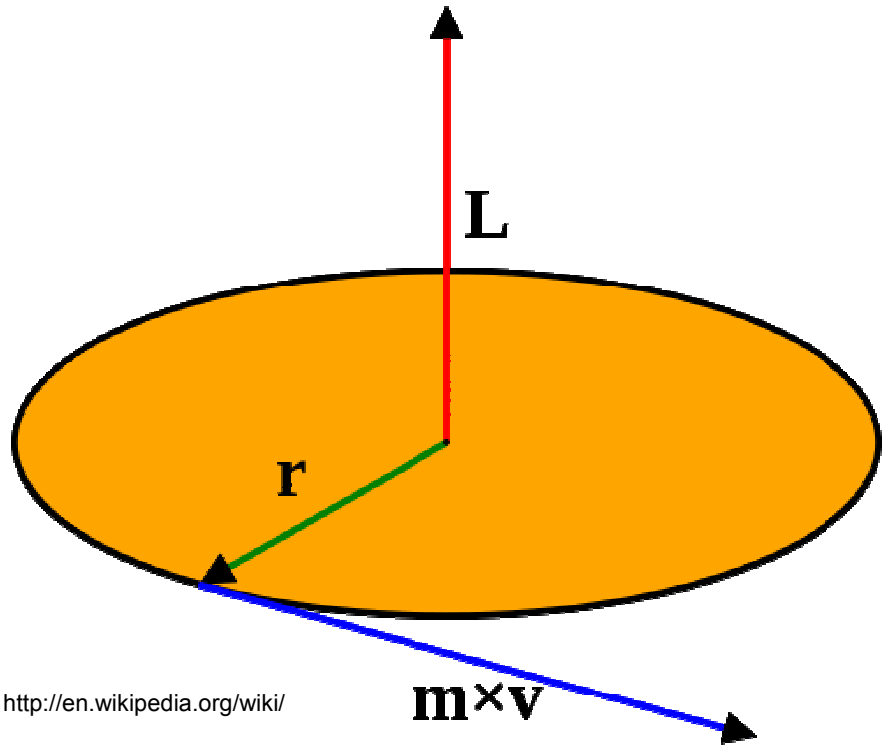
http://www.truckinweb.com/



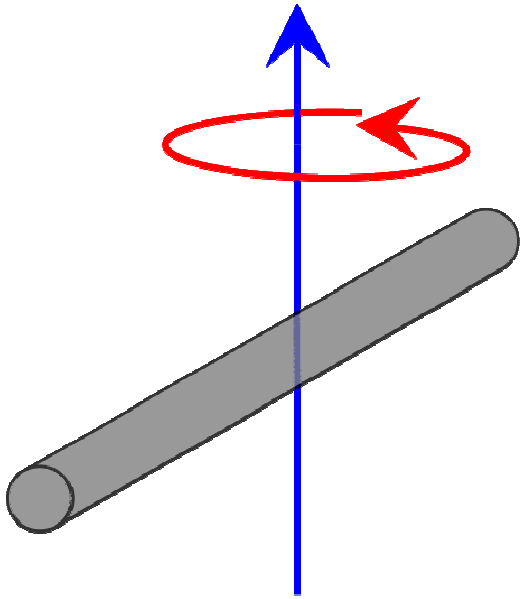
http://en.wikipedia.org/wiki/Torque



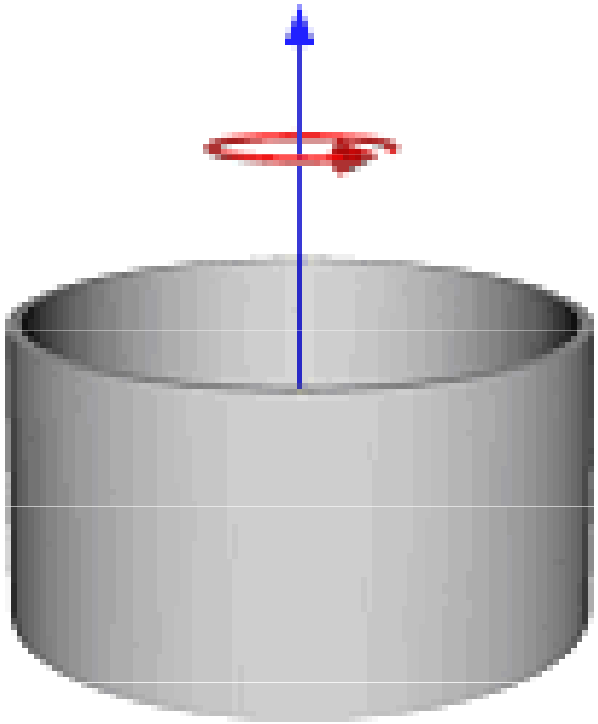
http://www.rakeshkapoor.us/ClassNotes



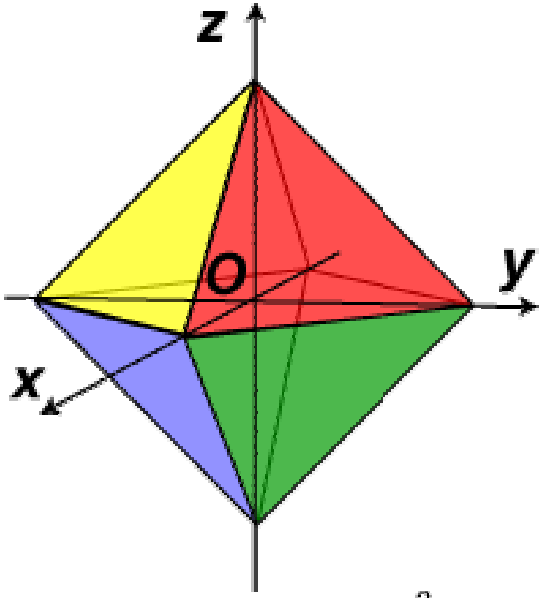
http://en.wikipedia.org/wiki/



$$I_{\text{center}} = \frac{mL^2}{12}$$



$$I = mr^2$$



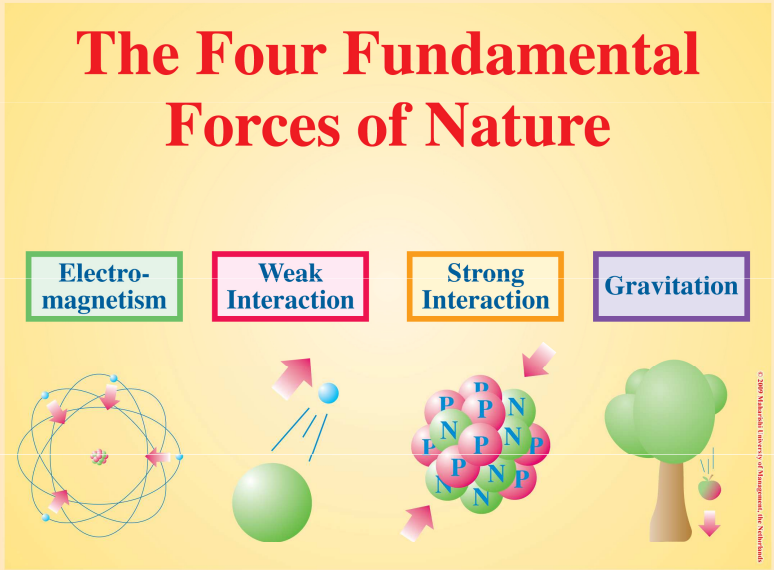
$$I_z = I_x = I_y = \frac{ms^2}{6}$$

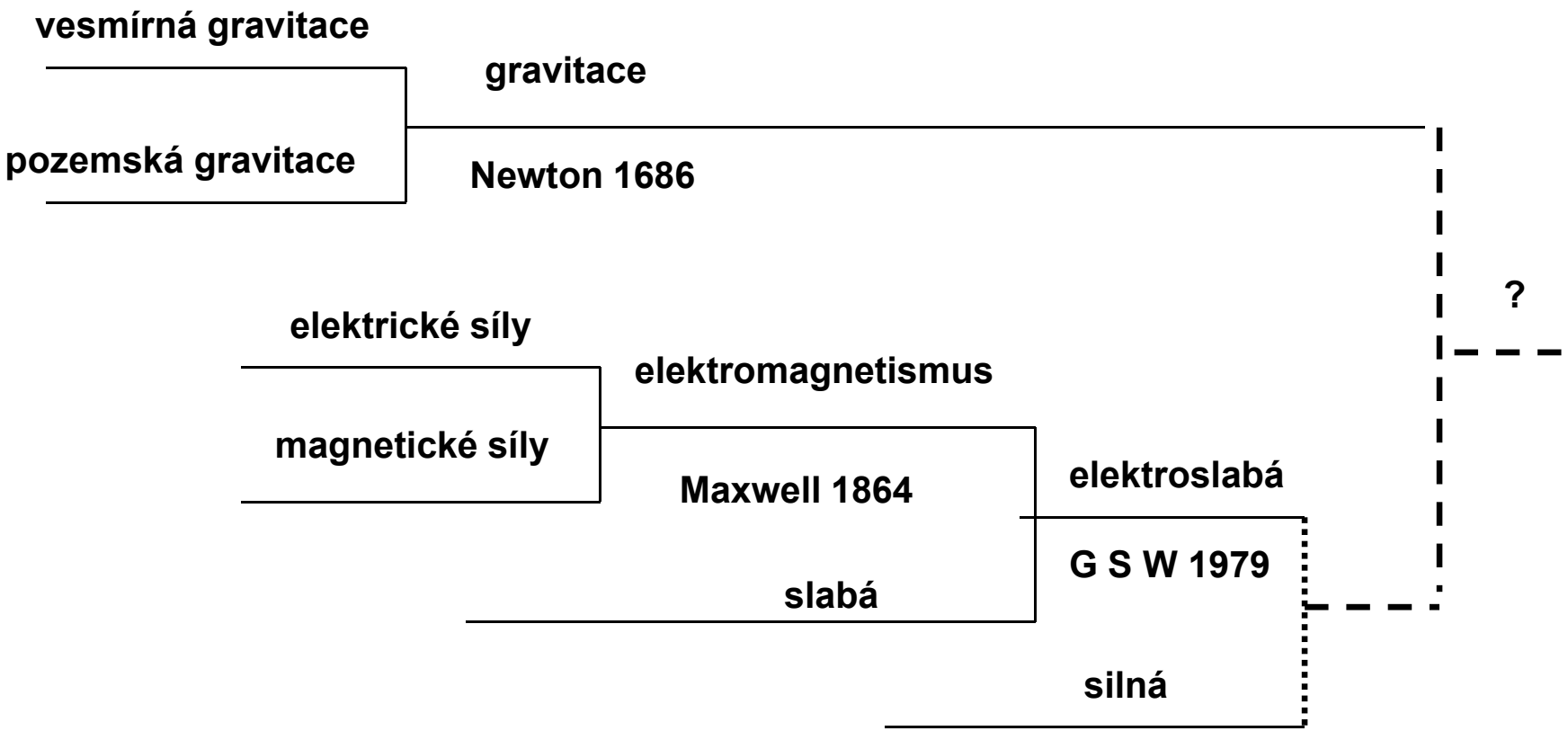
http://maragoniravi.blogspot.cz/

5. Síly, pole

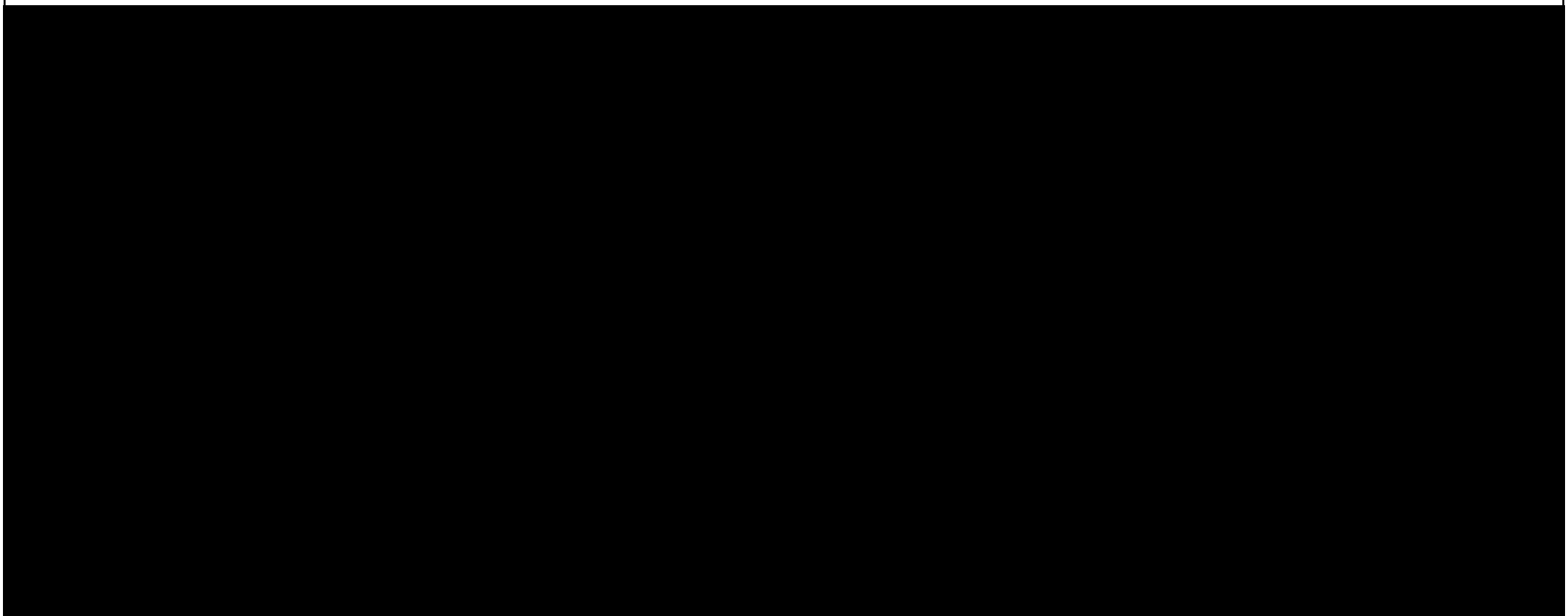
Síly v přírodě
- -gravitační síla
- -elektrická síla
- -silná jaderná interakce
- -slabá interakce

Pole
- - gravitační pole
- - elektrické pole



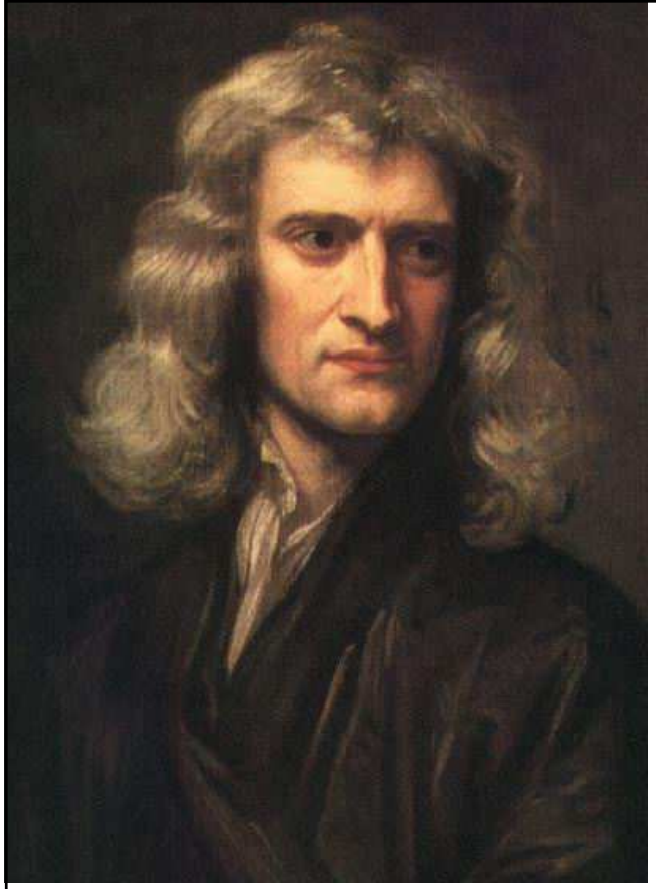

vesmírná gravitace
pozemská gravitace
gravitace
Newton 1686
?
elektrické síly
magnetické síly
elektromagnetismus
Maxwell 1864
elektroslabá
G S W 1979
slabá
silná

interakce		rel.vel.		dosah
gravitační	„gravitony“	10^{-38}	$1/r^2$	∞
slabá	W a Z bozony	10^{-15}		10^{-18}
elektromagnetická	fotony	10^{-2}	$1/r^2$	∞
silná	gluony	1		10^{-15}



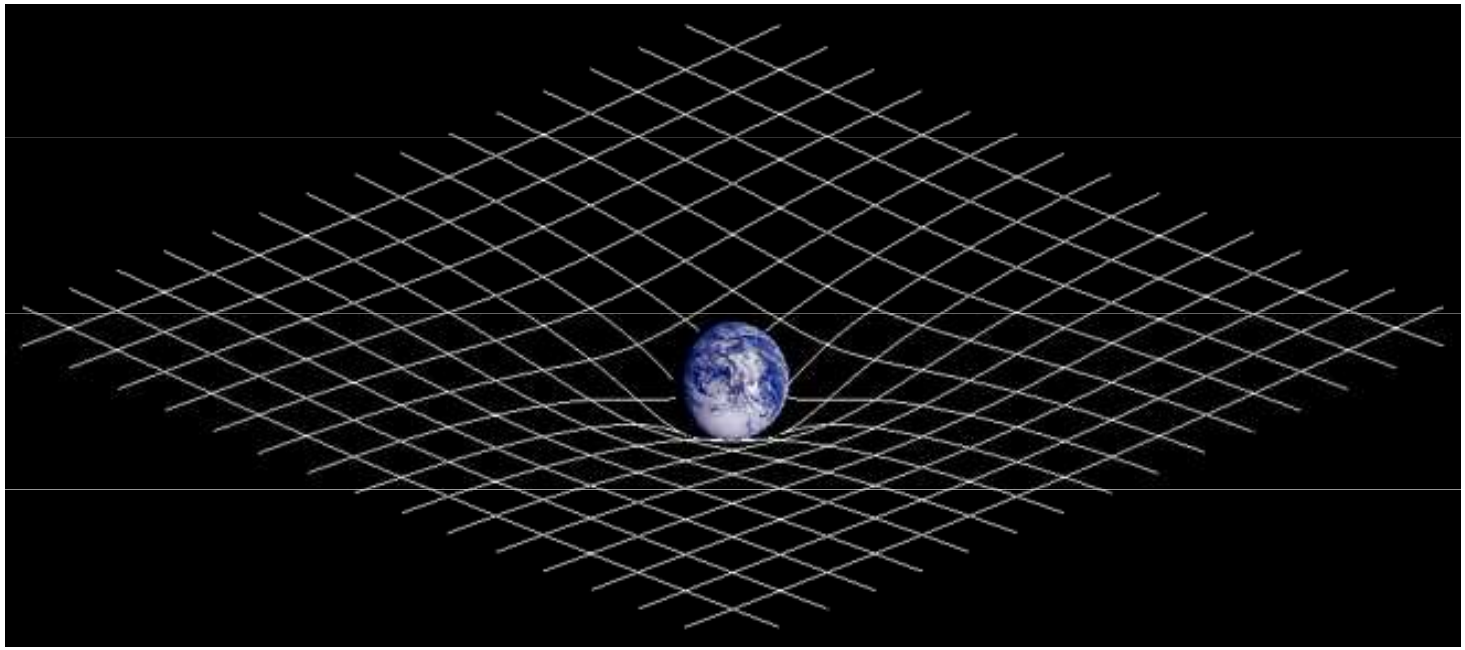
interakce	e-ν	e-p	p-p	p-n,n-n
gravitační	0	10^{-41}	10^{-38}	10^{-38}
slabá	10^{-15}	10^{-15}	10^{-15}	10^{-15}
elektromagnetická	0	10^{-2}	10^{-2}	0
silná	0	0	1	1

relativní velikost pro vzdálenost 10^{-15}m

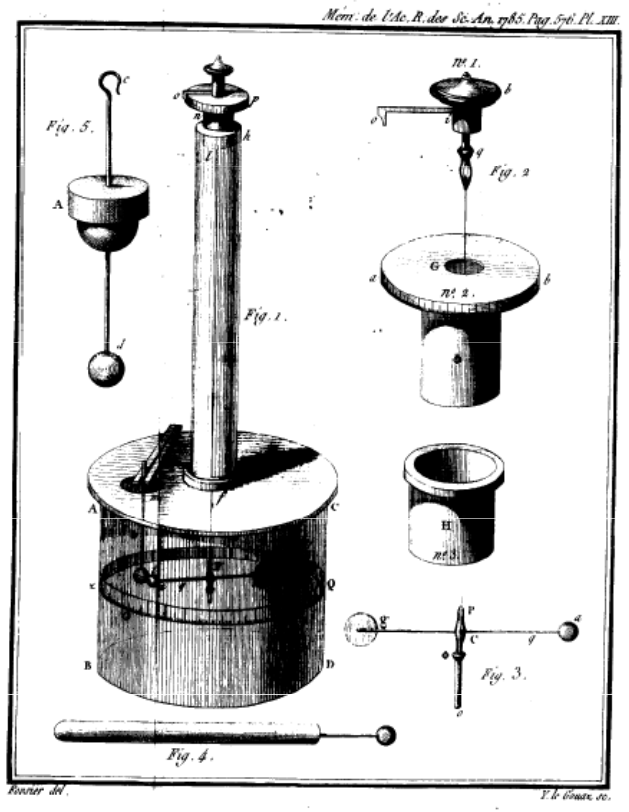


Isaac Newton 1643-1727

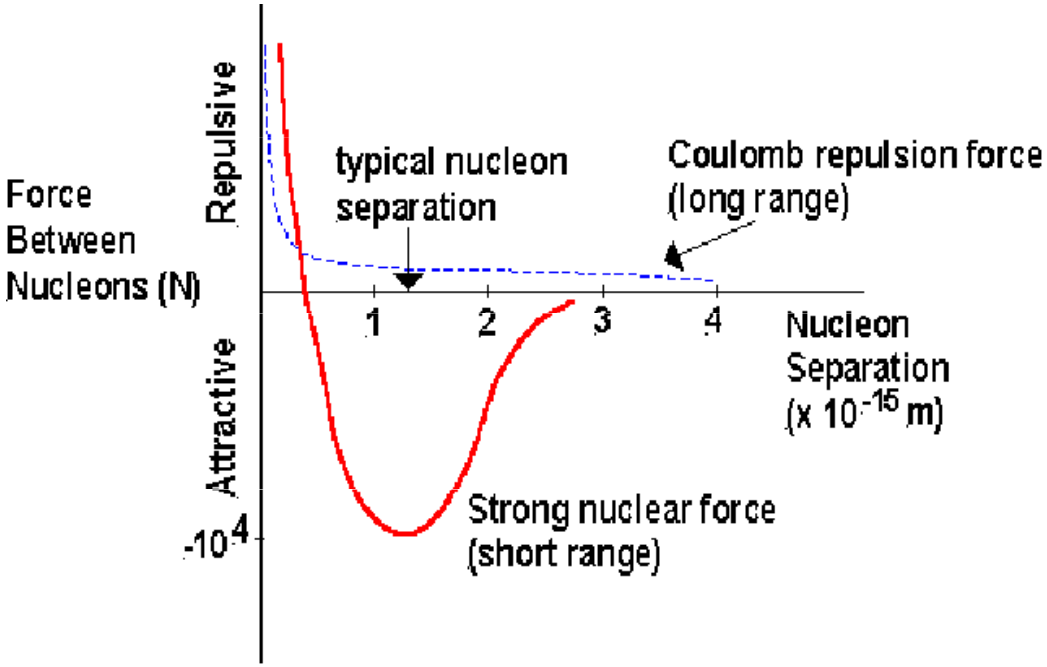
Henry Cavendish 1731-1810

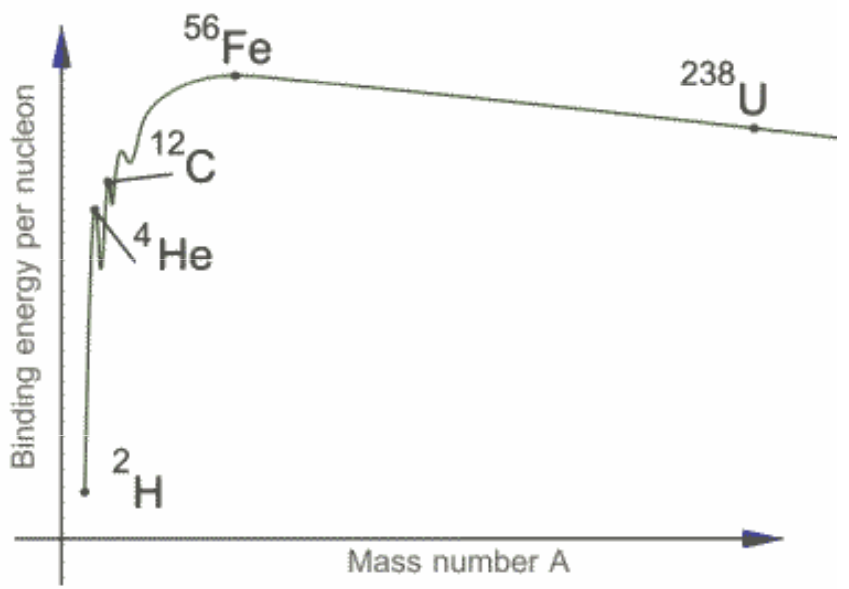


Dvoudimenzionální znázornění zakřivení časoprostoru. Přítomnost hmoty mění geometrii časoprostoru a tato (zakřivená) geometrie je chápána jako gravitace(wiki)

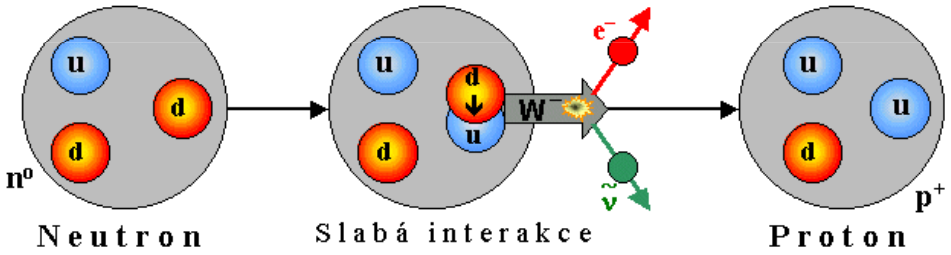


Charles-Augustin de Coulomb
1736-1806

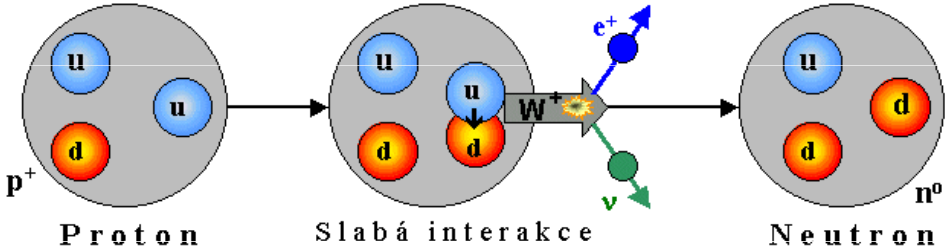

Force Between Nucleons (N)
Repulsive
Attractive
-10^4
typical nucleon separation
Coulomb repulsion force (long range)
Strong nuclear force (short range)
1
2
3
4
Nucleon Separation (x 10^-15 m)


Binding energy per nucleon
56Fe
238U
12C
4He
2H
Mass number A

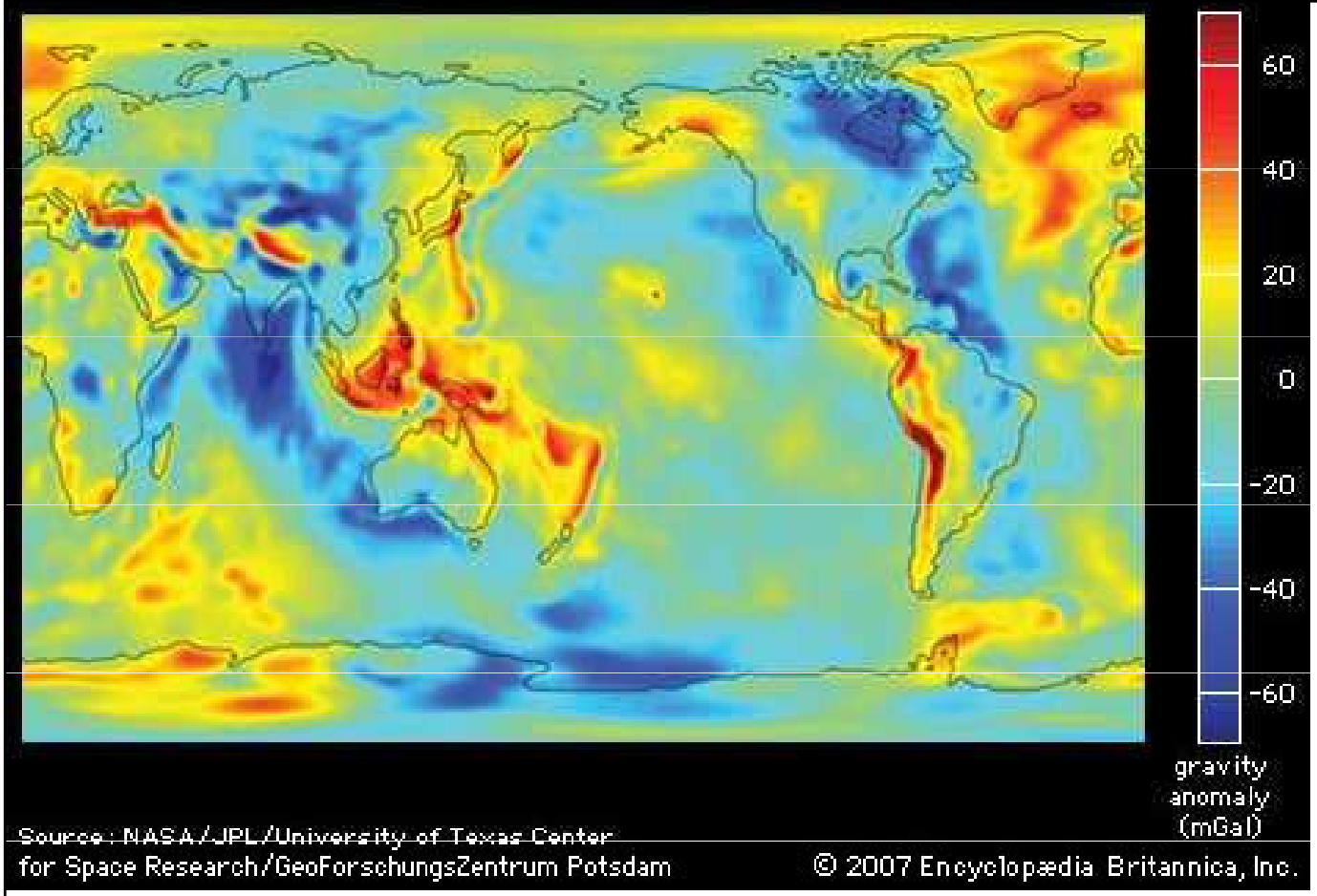
Beta⁻ - rozpad neutronu : $n^0 \rightarrow p^+ + e^- + \tilde{\nu}$

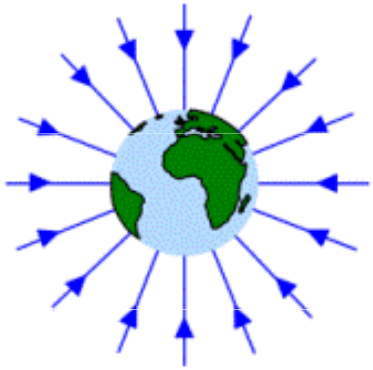


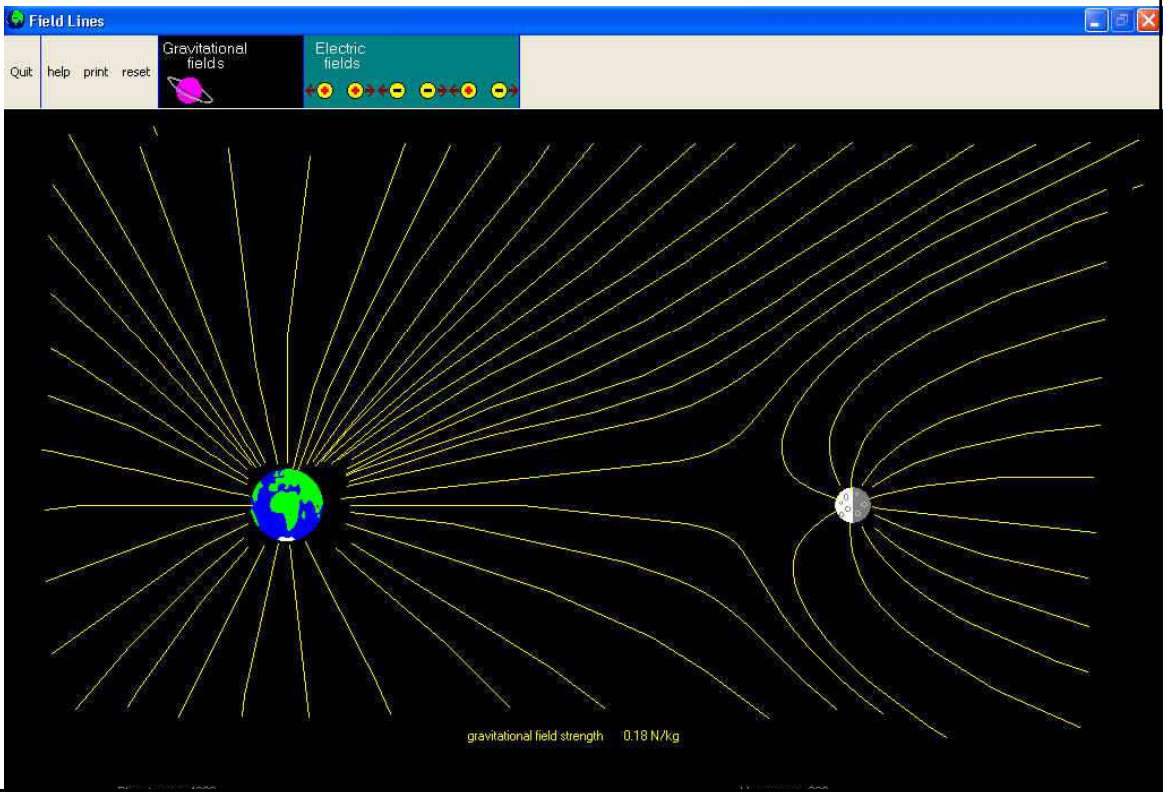
Beta⁺ - přeměna protonu : $p^+ \rightarrow n^0 + e^+ + \nu$

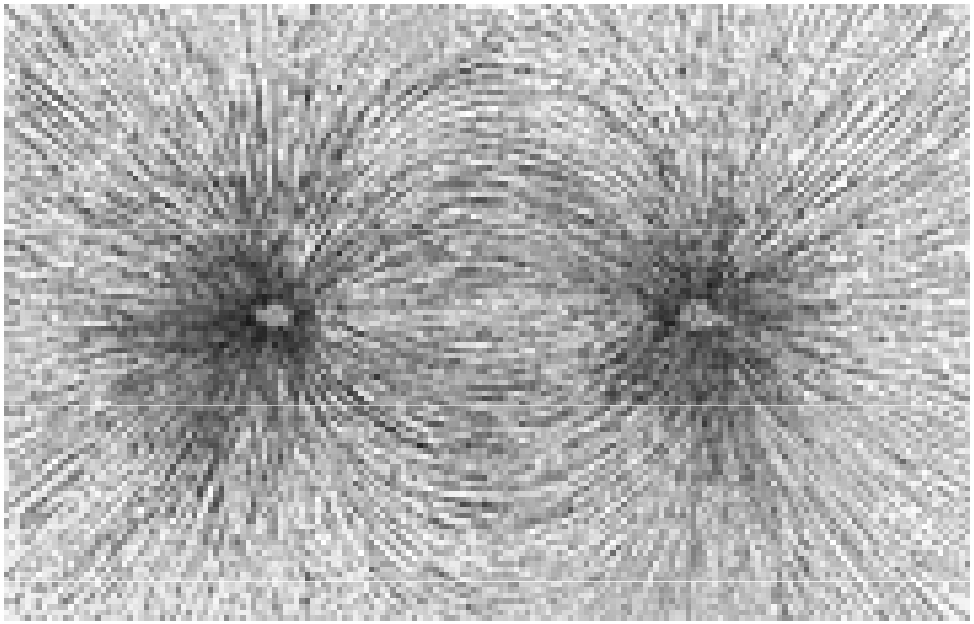


http://astronuklfyzika.cz/

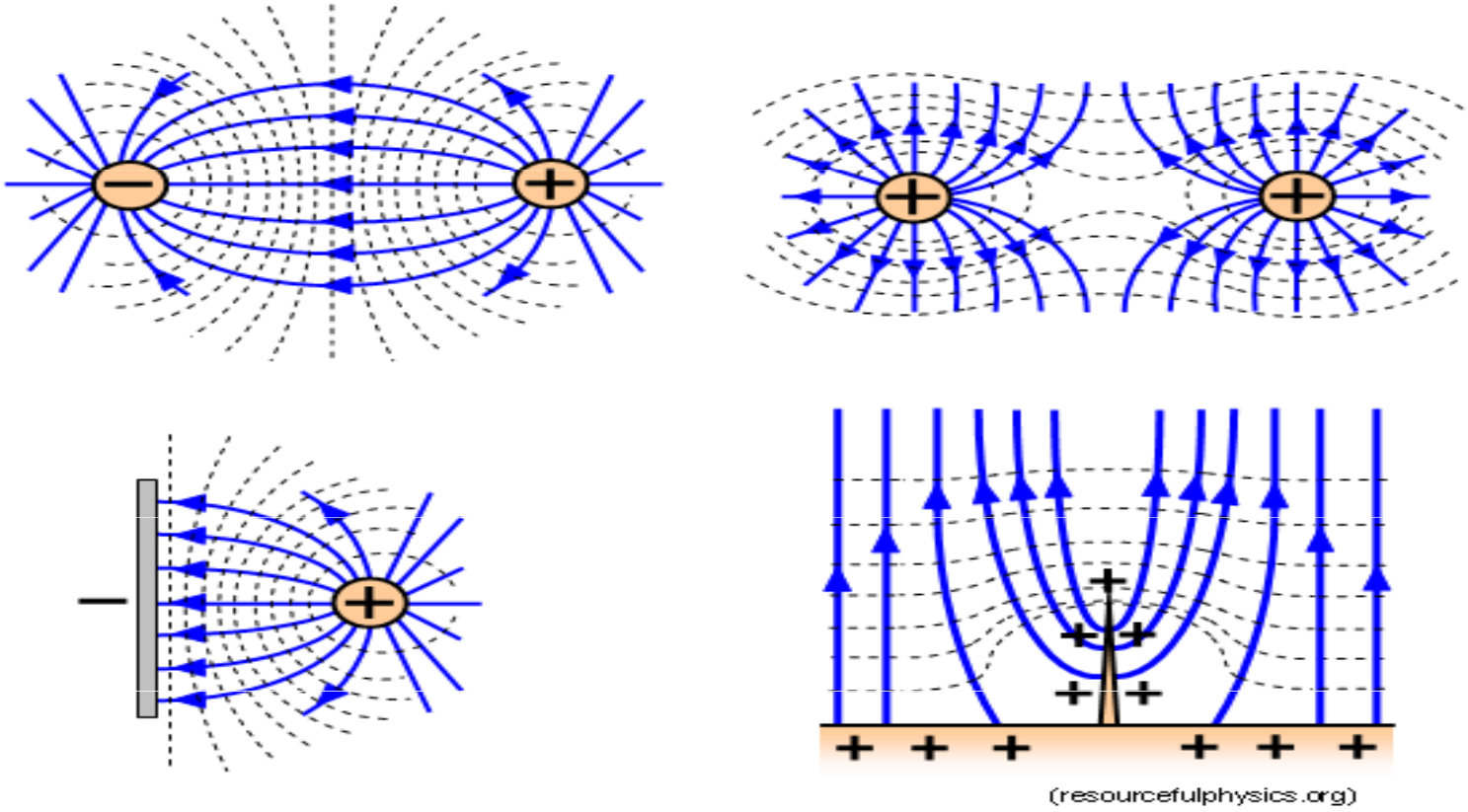

60
40
20
0
-20
-40
-60
gravity
anomaly
(mGal)
Source: NASA/JPL/University of Texas Center
for Space Research/GeoForschungsZentrum Potsdam
© 2007 Encyclopædia Britannica, Inc.

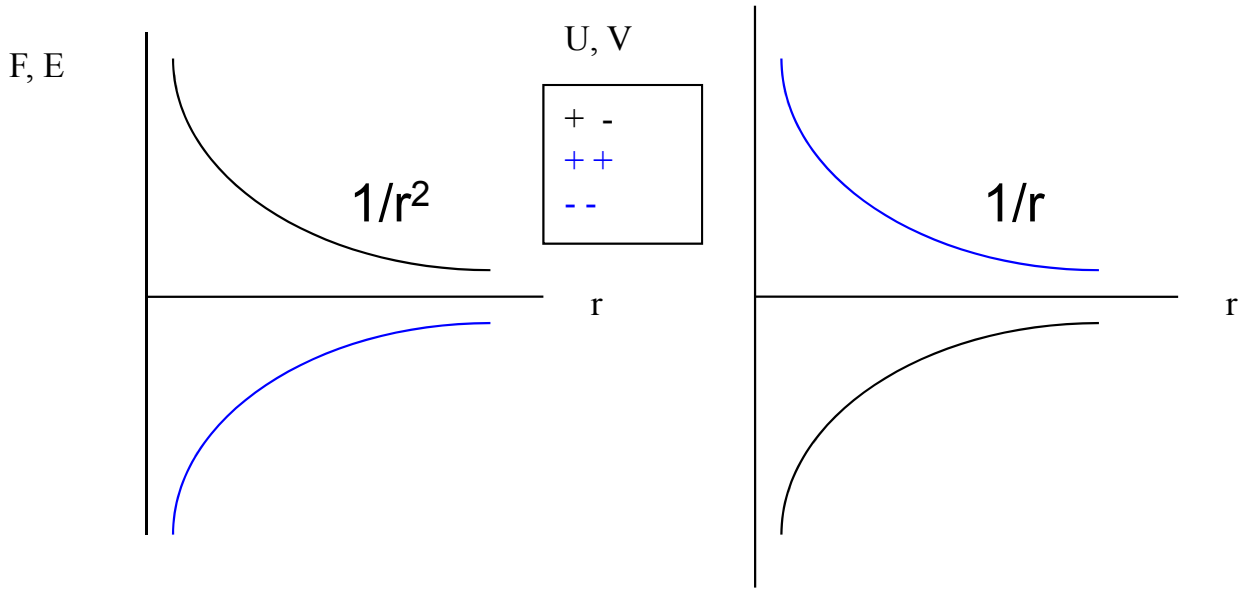


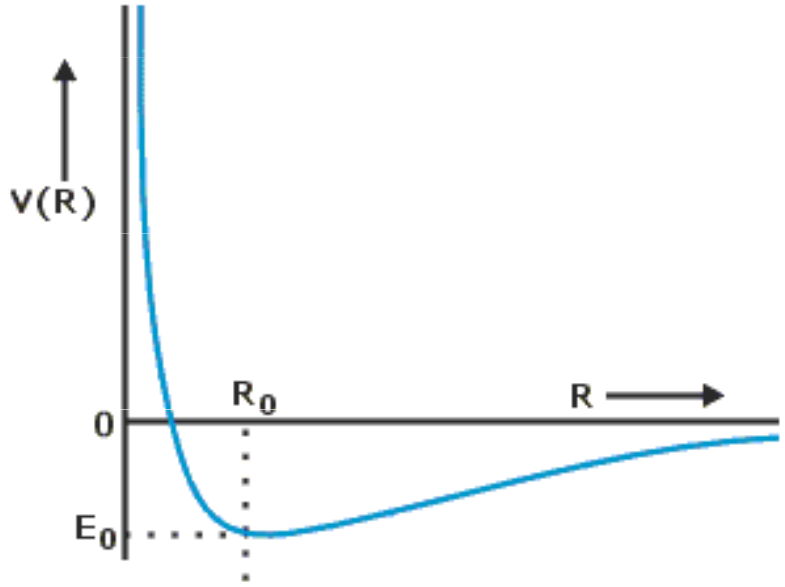

Field Lines
Quit
help
print
reset
Gravitational fields
Electric fields
gravitational field strength 0.18 N/kg



Řez magnetickým polem - (Googel)

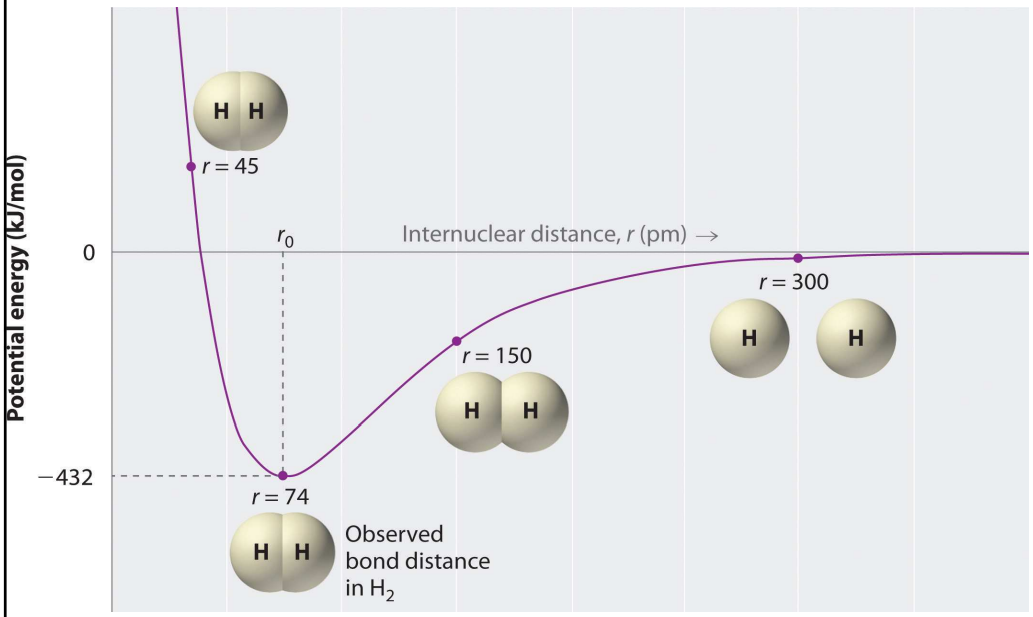

(resourcefulphysics.org)

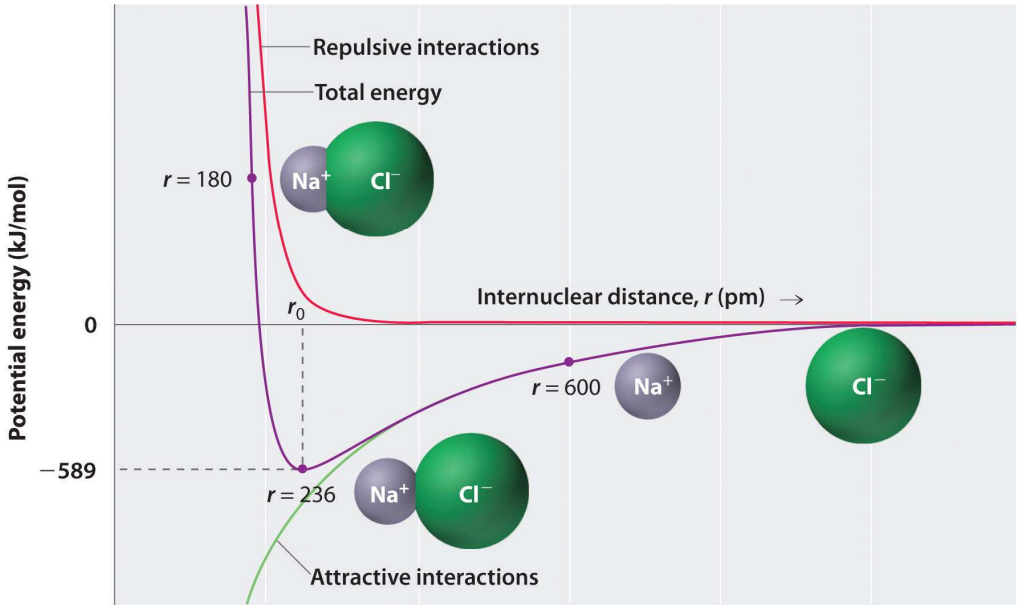

F, E
U, V
+ -
++
- -
1/r2
r
1/r
r



Interatomic potential energy V (R) between two identical atoms as a function of separation R between their nuclei

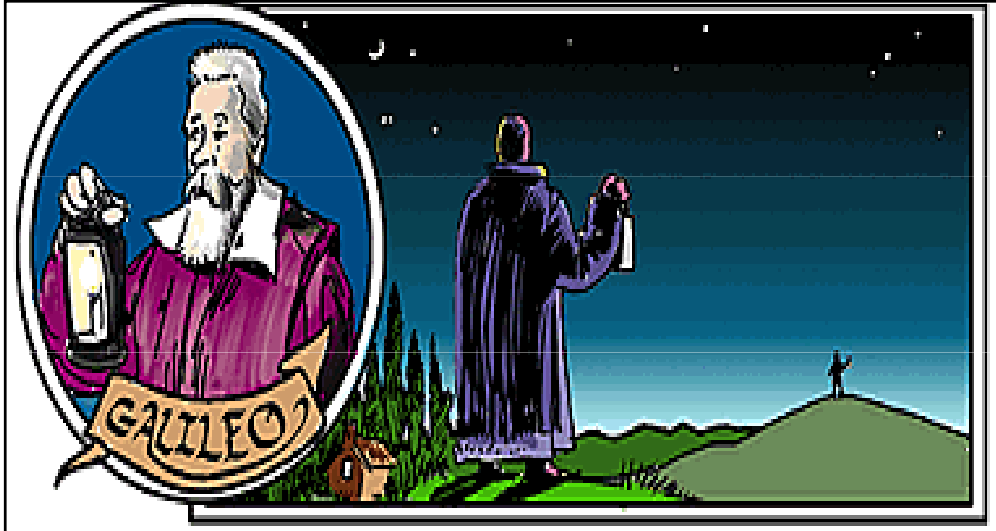
http://www.tutorvista.com/

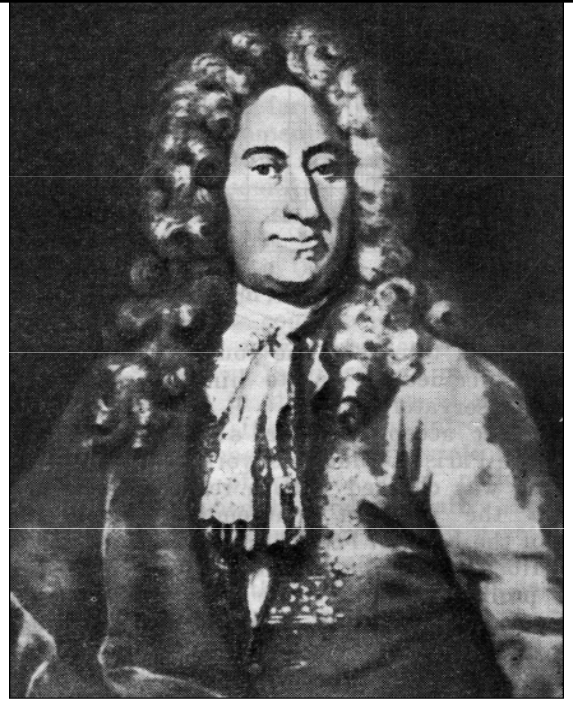

Potential energy (kJ/mol)
0
−432
r_0
Internuclear distance, r (pm) →
H H
r = 45
r = 74
H H
Observed bond distance in H_2
r = 150
H H
r = 300
H
H


Potential energy (kJ/mol)
0
−589
Repulsive interactions
Total energy
r = 180
Na^+
Cl^-
r_0
Internuclear distance, r (pm) →
r = 600
Na^+
Cl^-
r = 236
Na^+
Cl^-
Attractive interactions

6. Základní fyzikální konstatnty

Rychlost světla - c
Elementární náboj - e, e/m
Planckova konstatnta - h





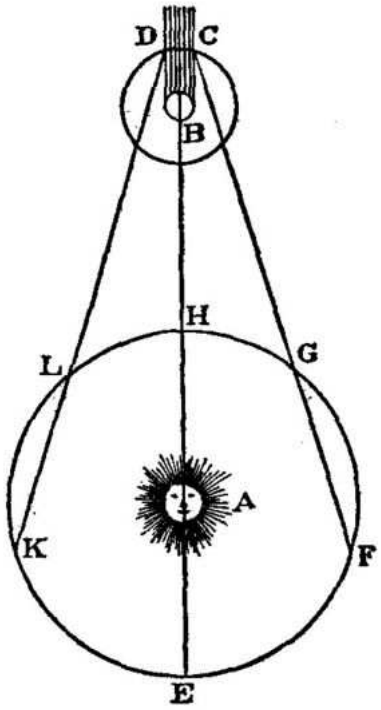
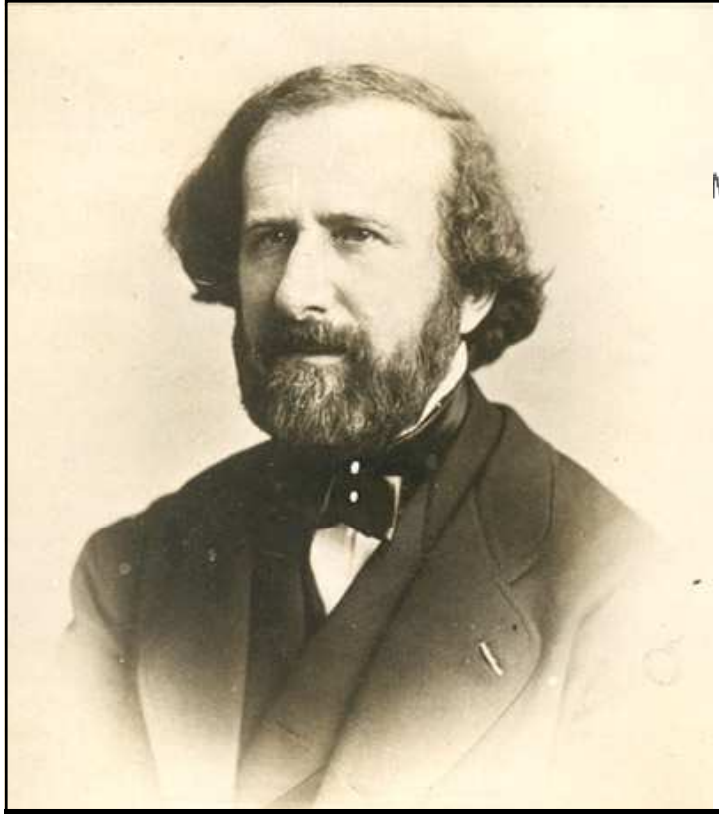
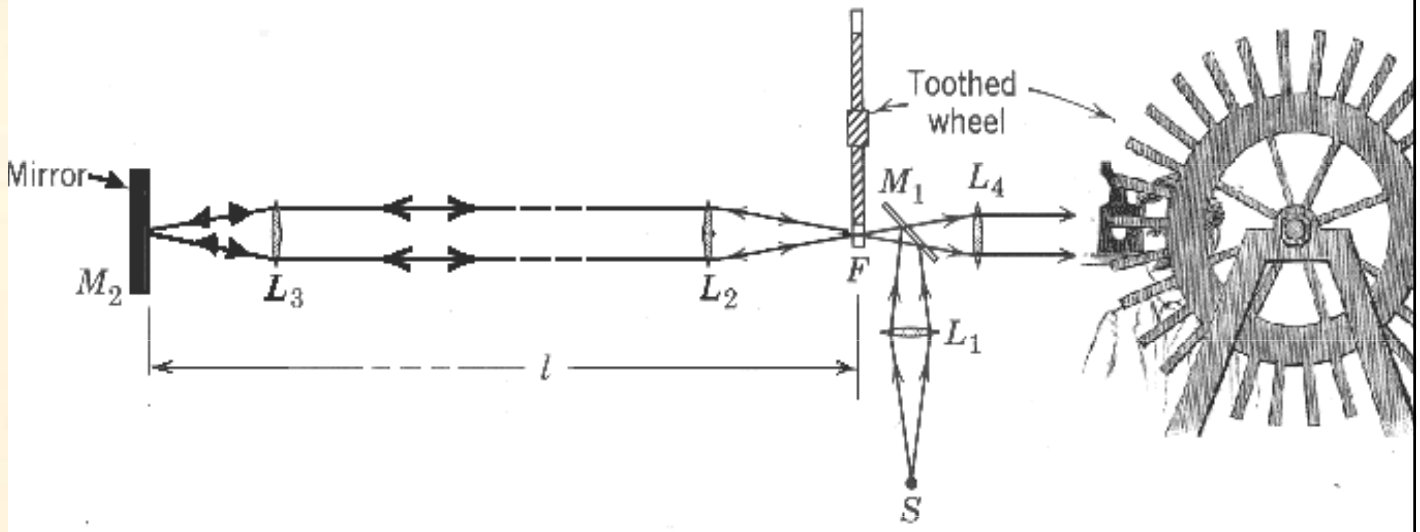


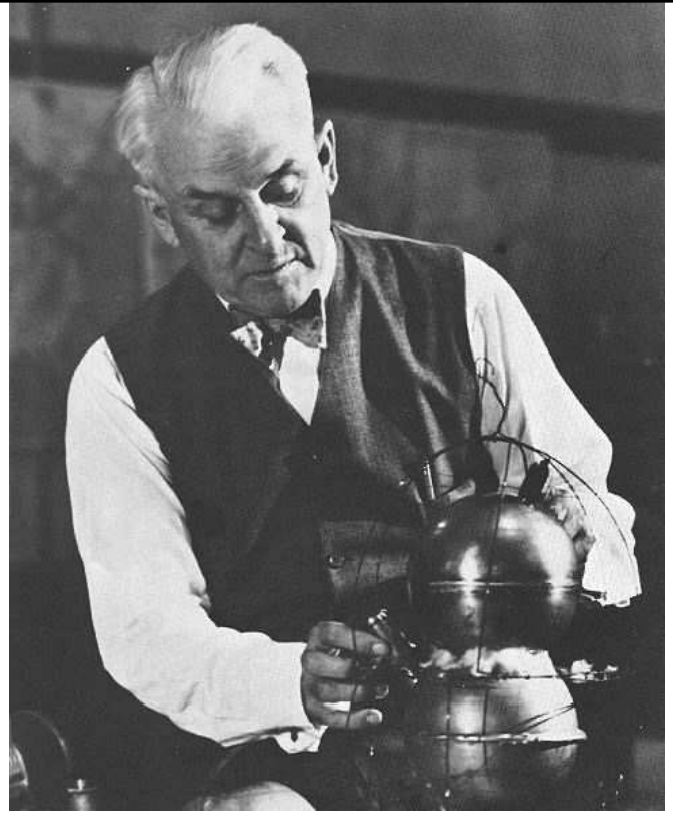
FIG. 70.

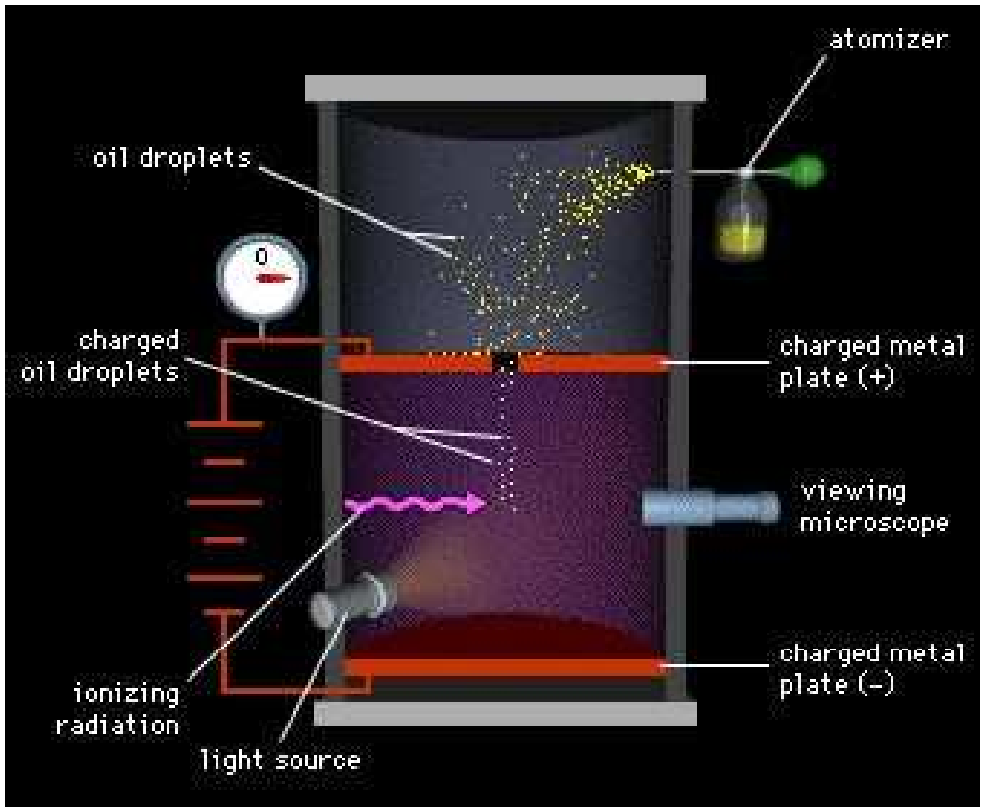
Olaf (Ole) Roemer (1644-1710)



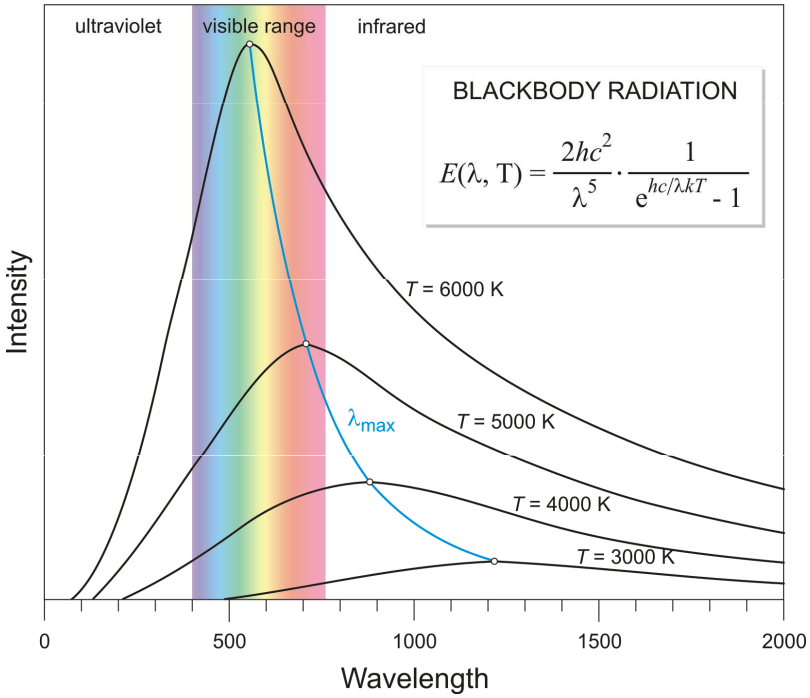


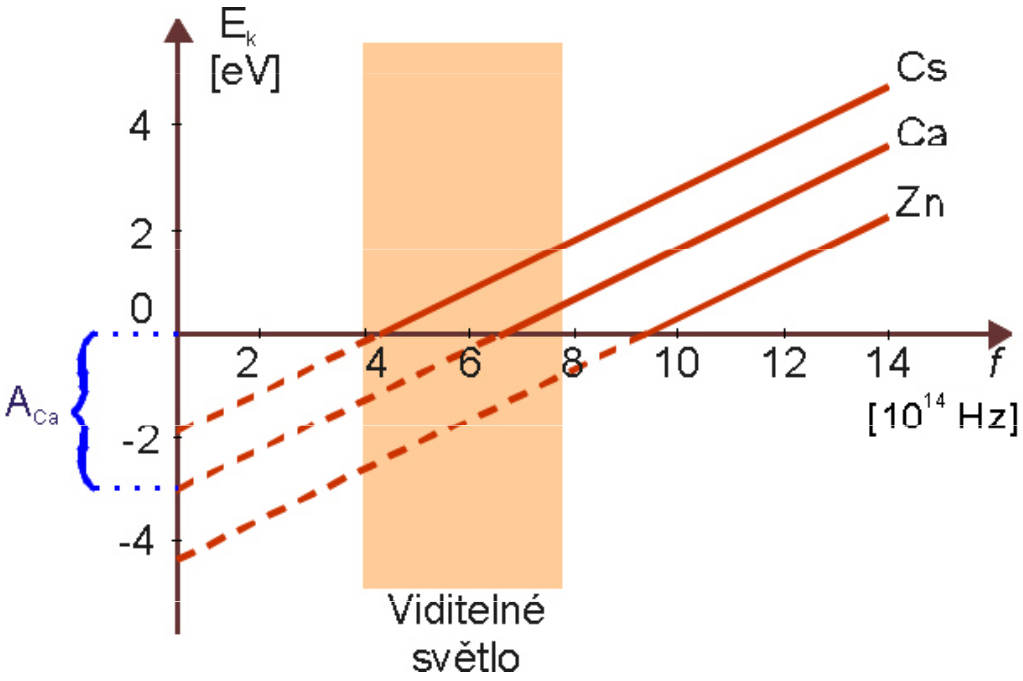
Hippolyte Fizeau 1919-1896





Robert Andrews Millikan 1868-1953

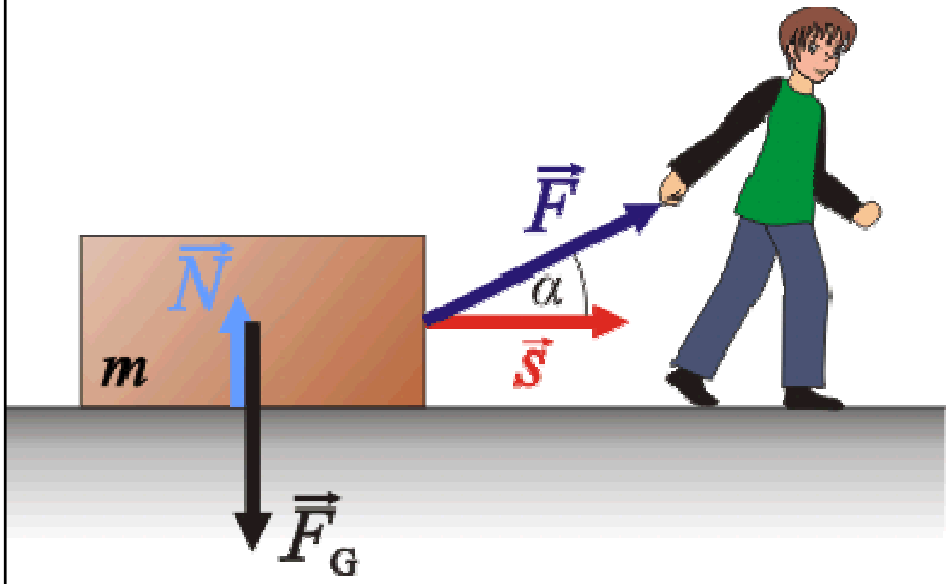




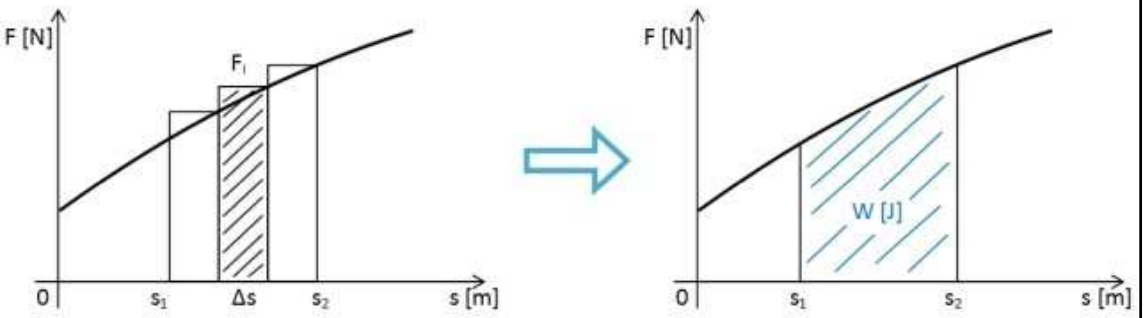
h=6.62606957 × 10-34 m2 kg / s

7. Zákony zachování

Zákon zachování energie
Zákon zachování hybnosti
Zákon zachování momentu hybnosti
Zákon zachování náboje
Symetrie a zákony zachování



http://fyzikalniulohy.cz



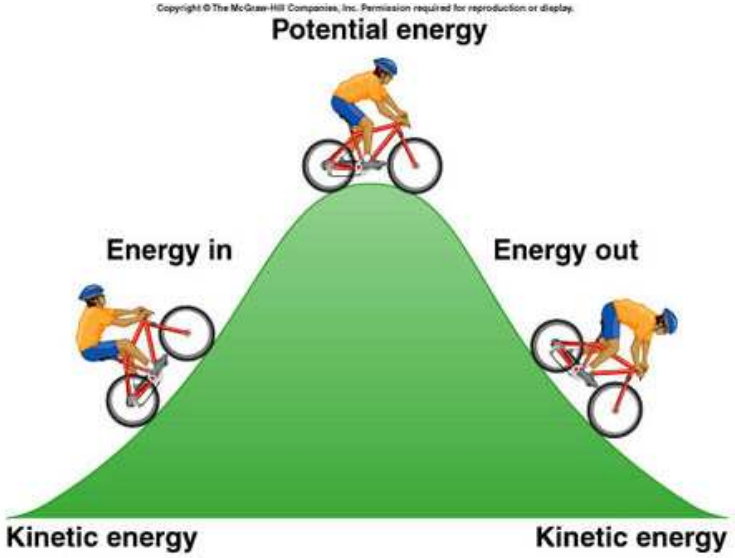
http://www.fyzika007.cz/

http://imgace.com/pic/2012

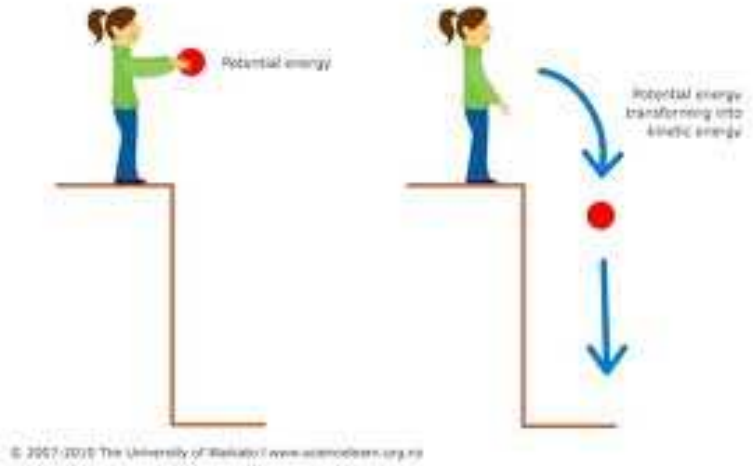
usain bolt sets new world record 9.63 secs for 100m

http://dfern3.wix.com/

http://hep.physics.lsa.umich.edu/

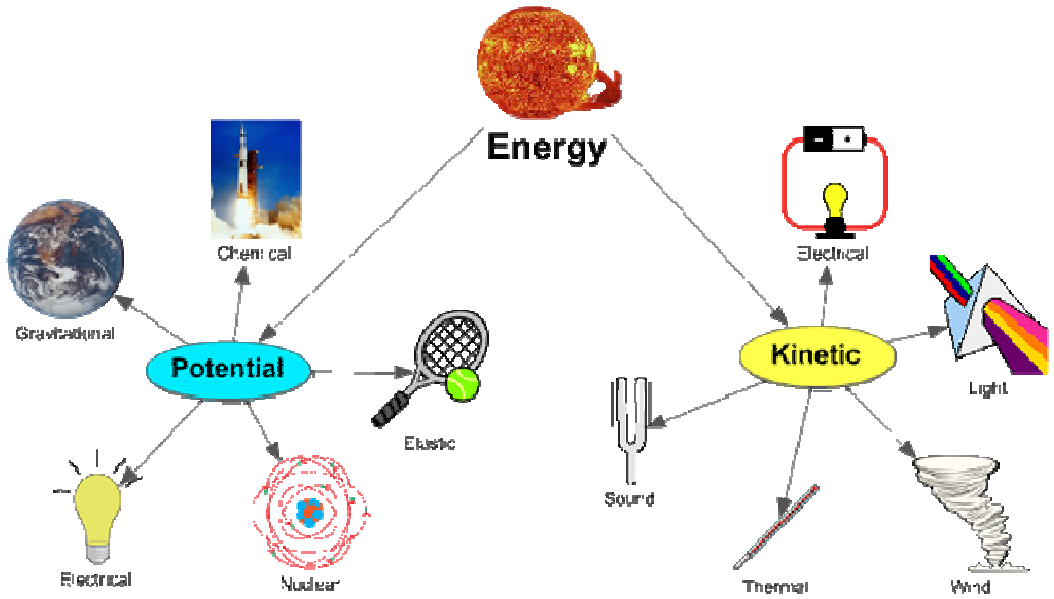


http://www.citruscollege.edu/



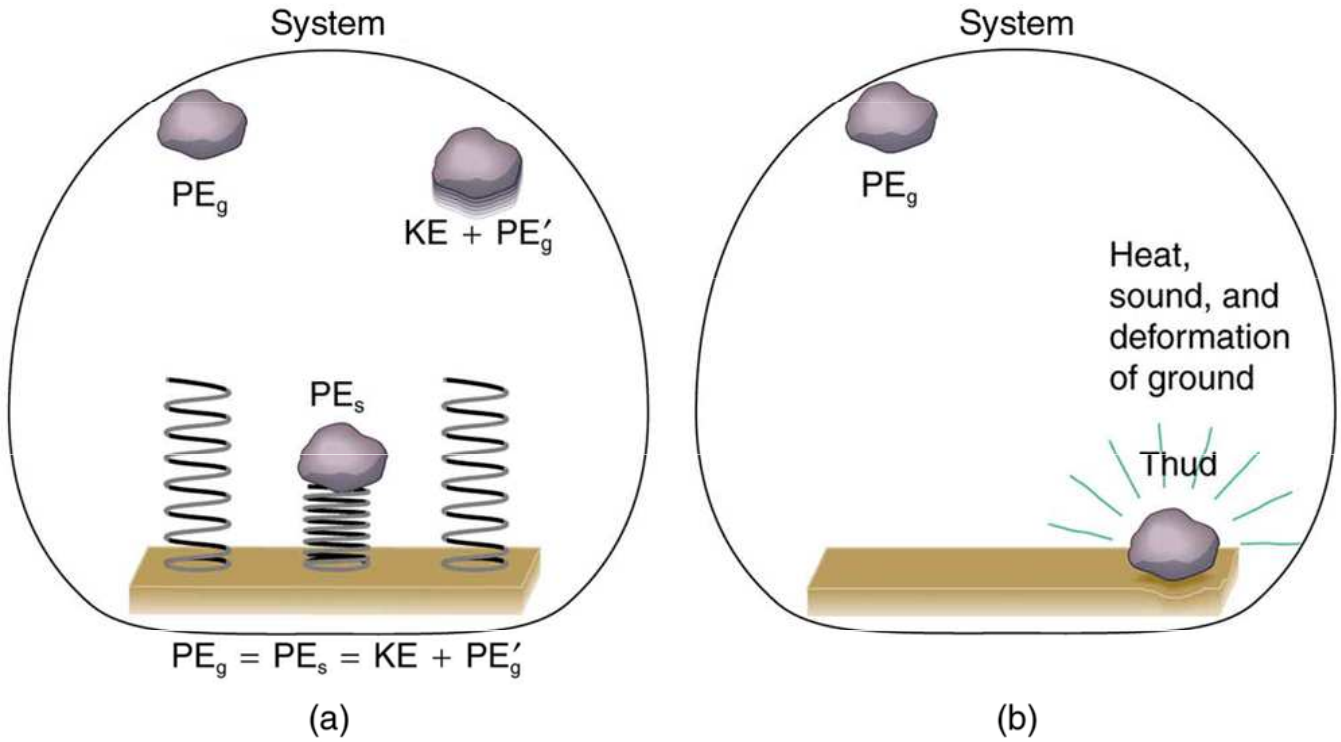
http://cvut-archery.cz

http://en.wikipedia.org/

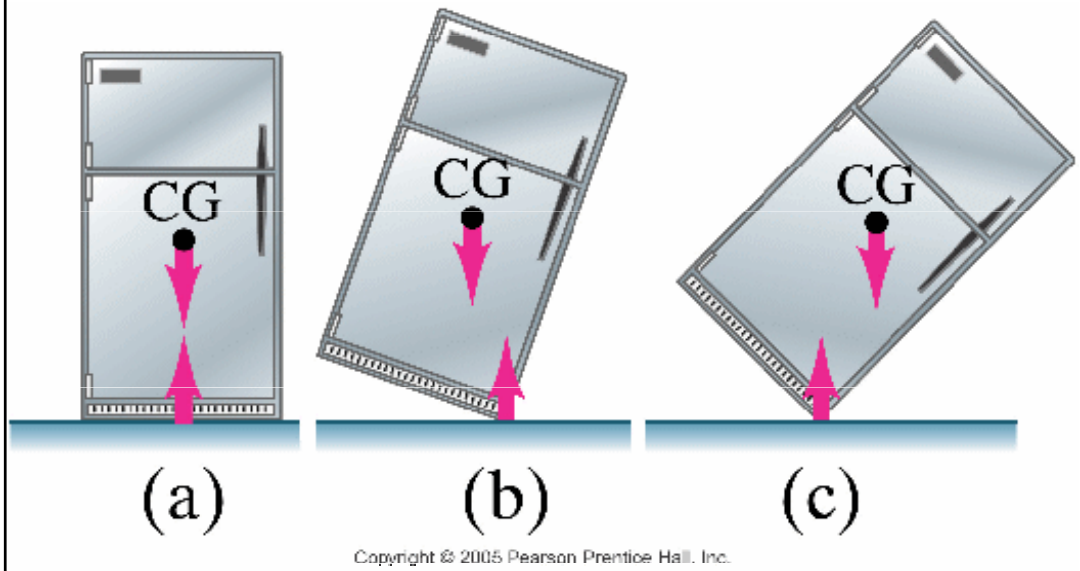


http://aplusphysics.com/

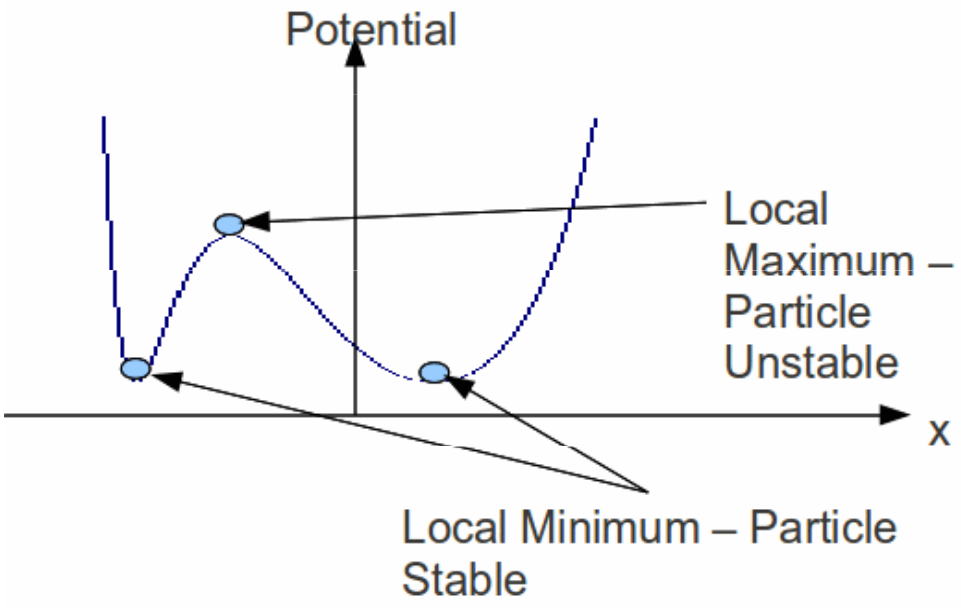
http://www.buzzle.com/



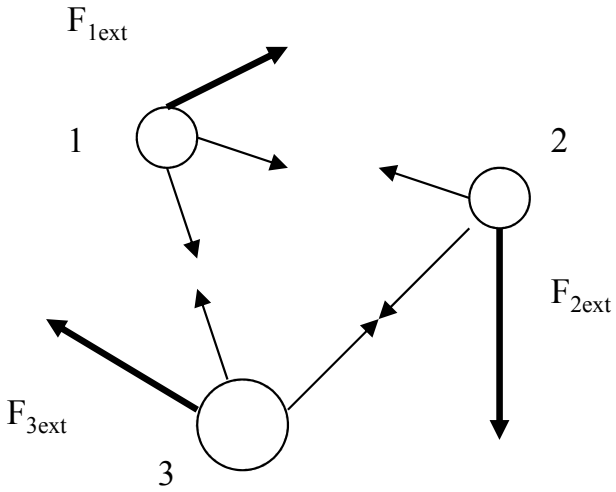
:p://cnx.org/content/m42150/l

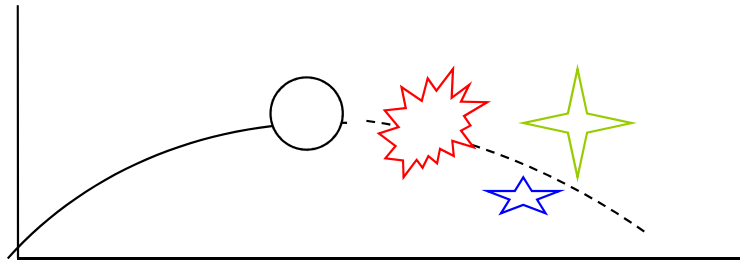


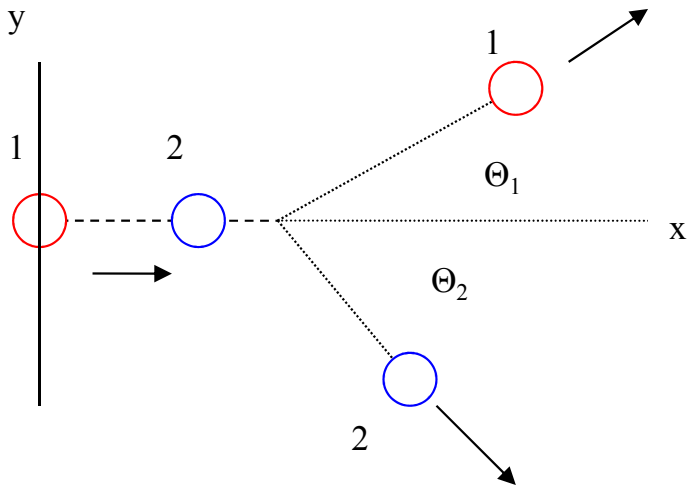
http://www4.uwsp.edu/

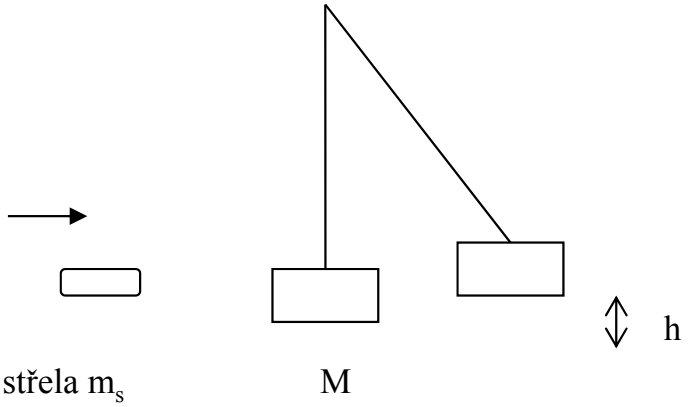


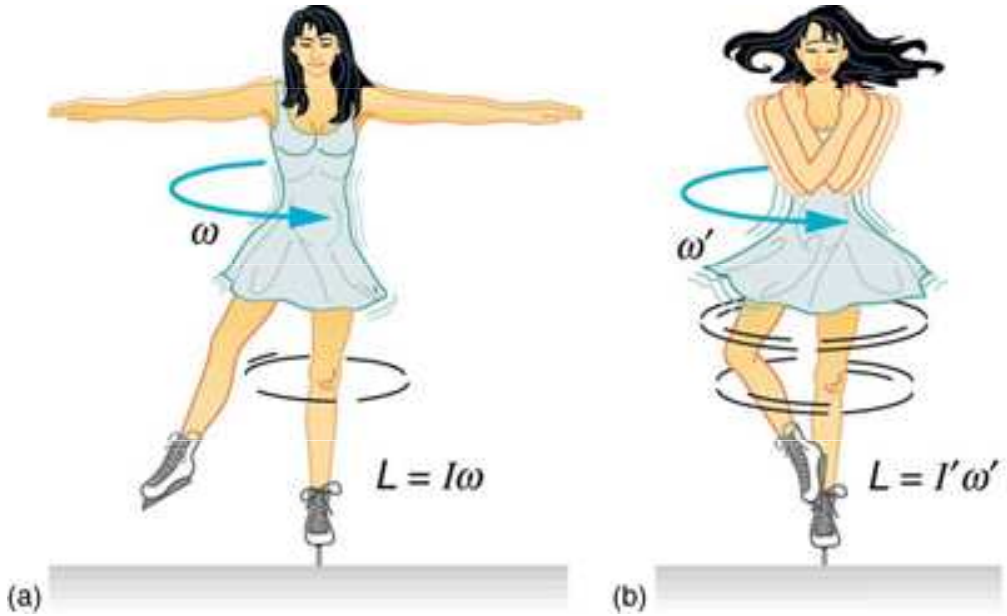
http://www.astarmathsandphysics.com


F1ext
1
2
F2ext
F3ext
3



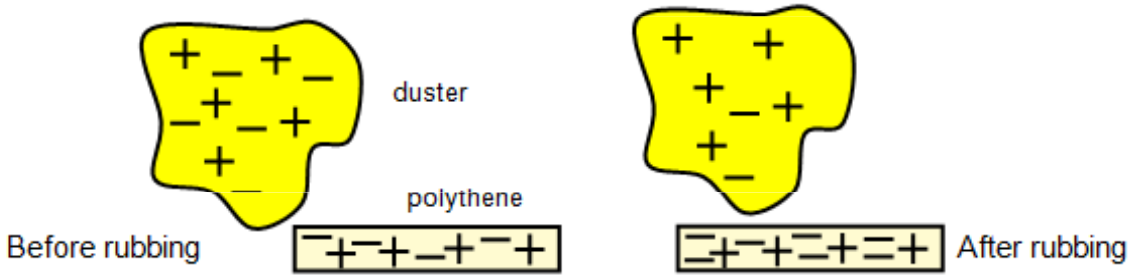

y
1
2
1
Θ1
x
Θ2
2


střela ms
M
h

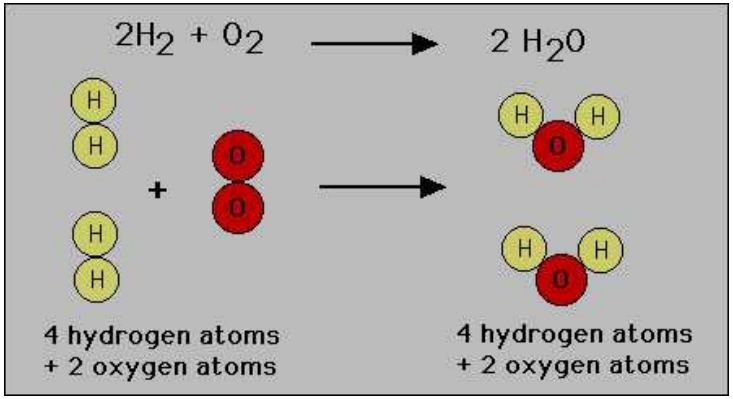


https://www.boundless.com/physics/

http://www.ifa.hawaii.edu



http://www.schoolphysics.co.uk/

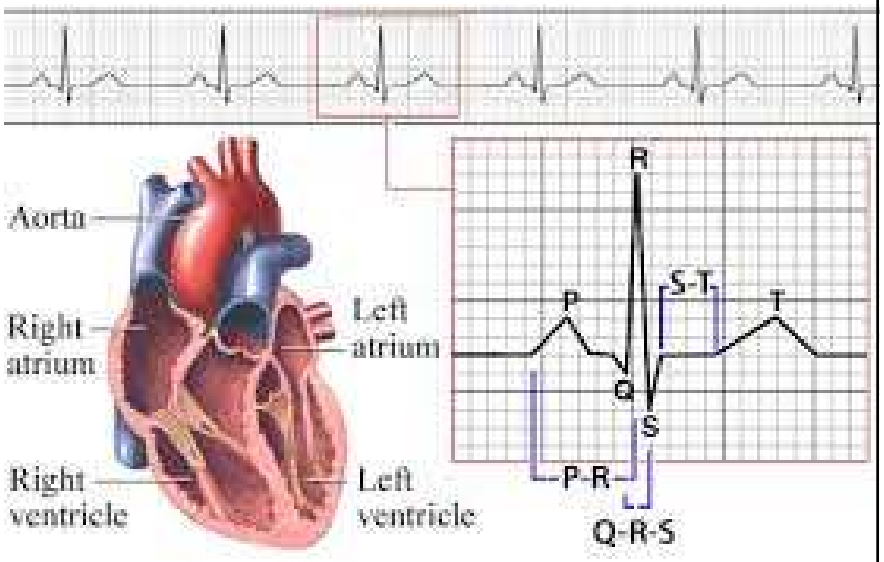


http://www.iun.edu/

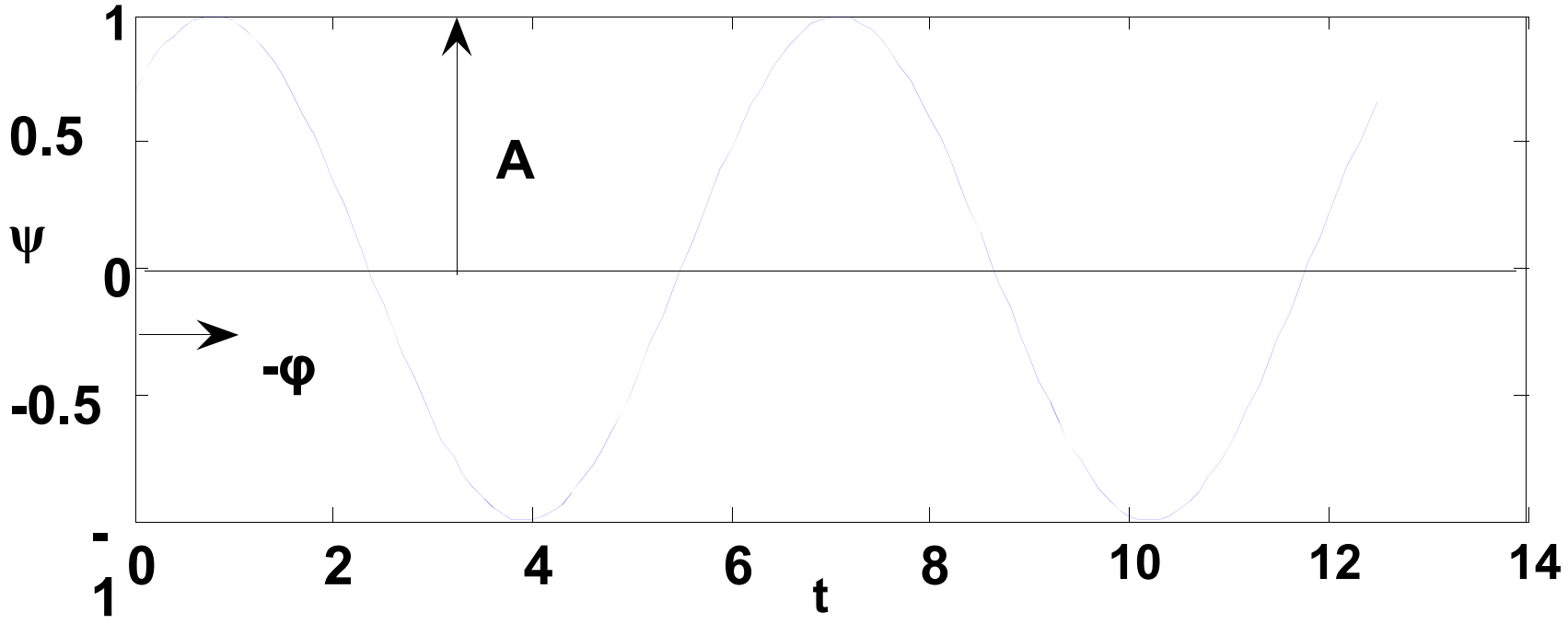
8. Kmity, vlny, světlo

Kmity

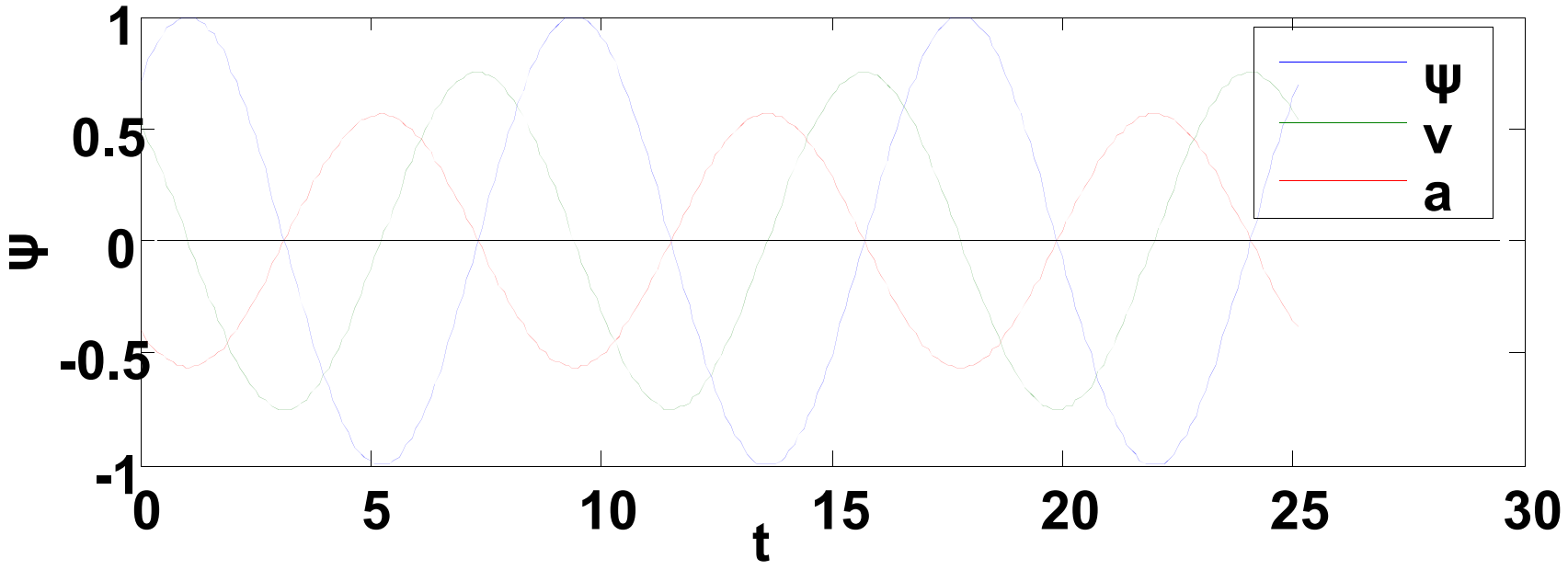
Harmonický oscilátor – jeden stupeň volnosti
Kinematika volného, harmonického netlumeného kmitu
Dynamika
Energie harmonického oscilátoru
Základní typy oscilátorů
Tlumený oscilátor, vynucené kmity
Počáteční podmínky, chaos



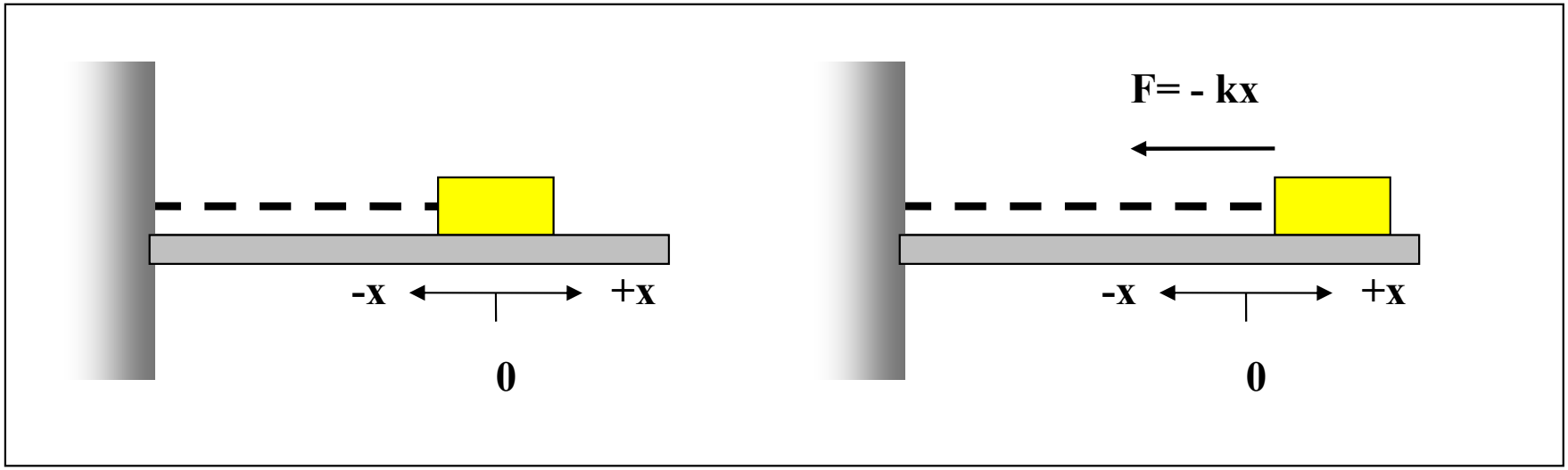
http://askep-net.blogspot.cz/2012/04/ekg-elektrokardiogram.html



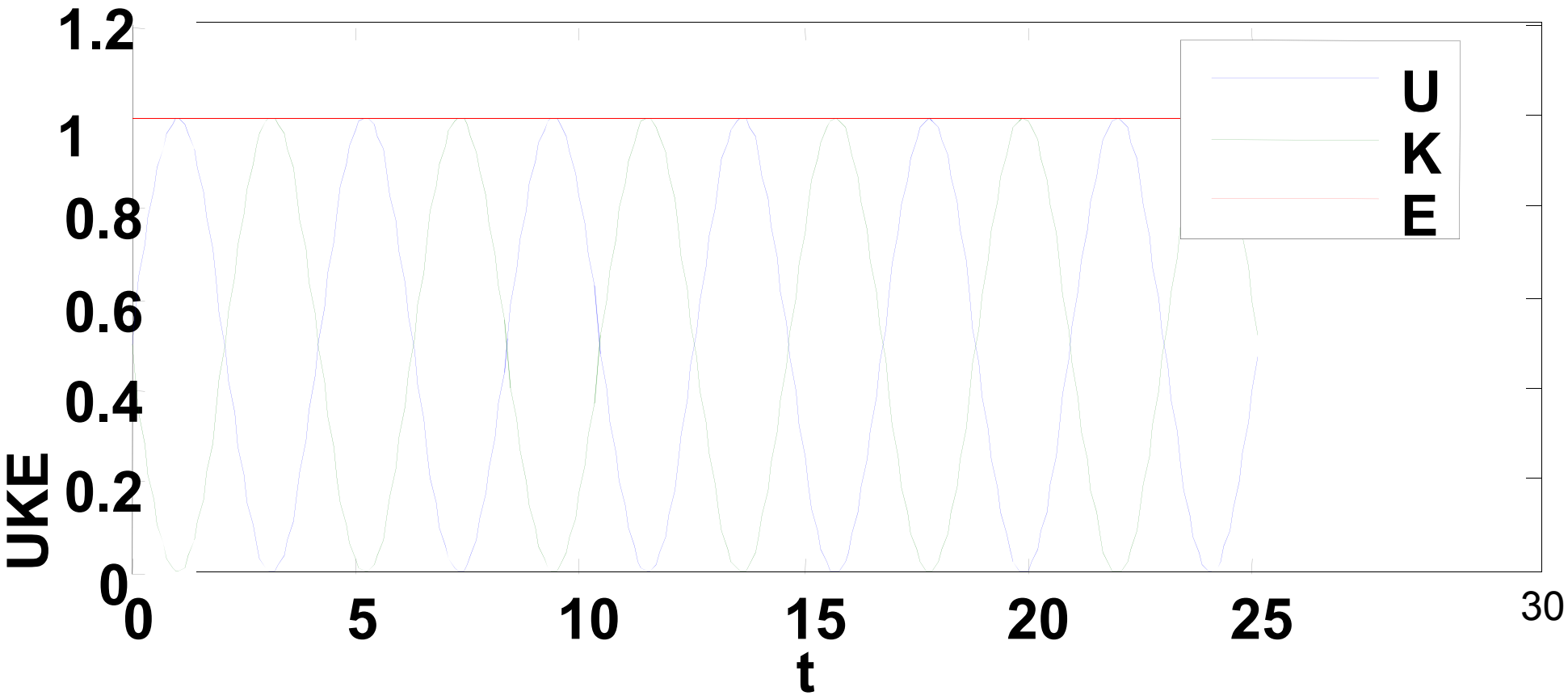
Harmonický kmit



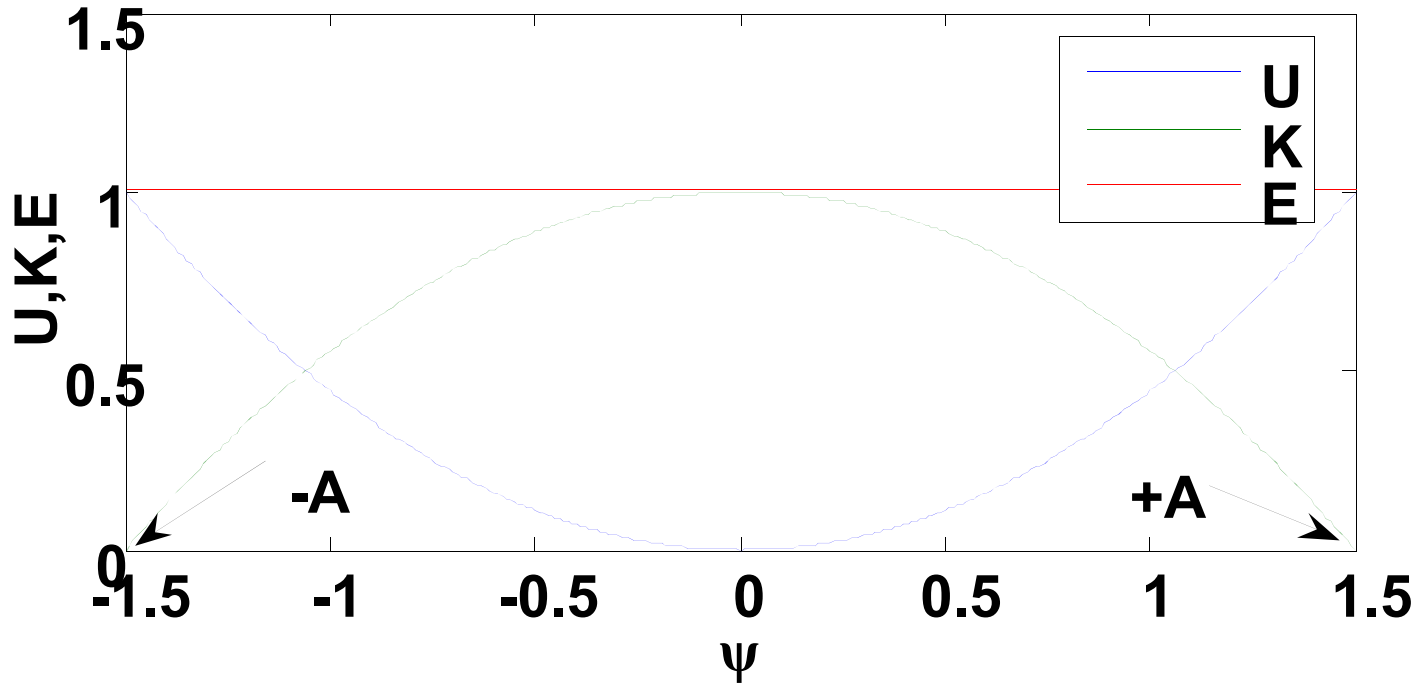
Výchylka, její rychlost a zrychlení harmonického kmitu.



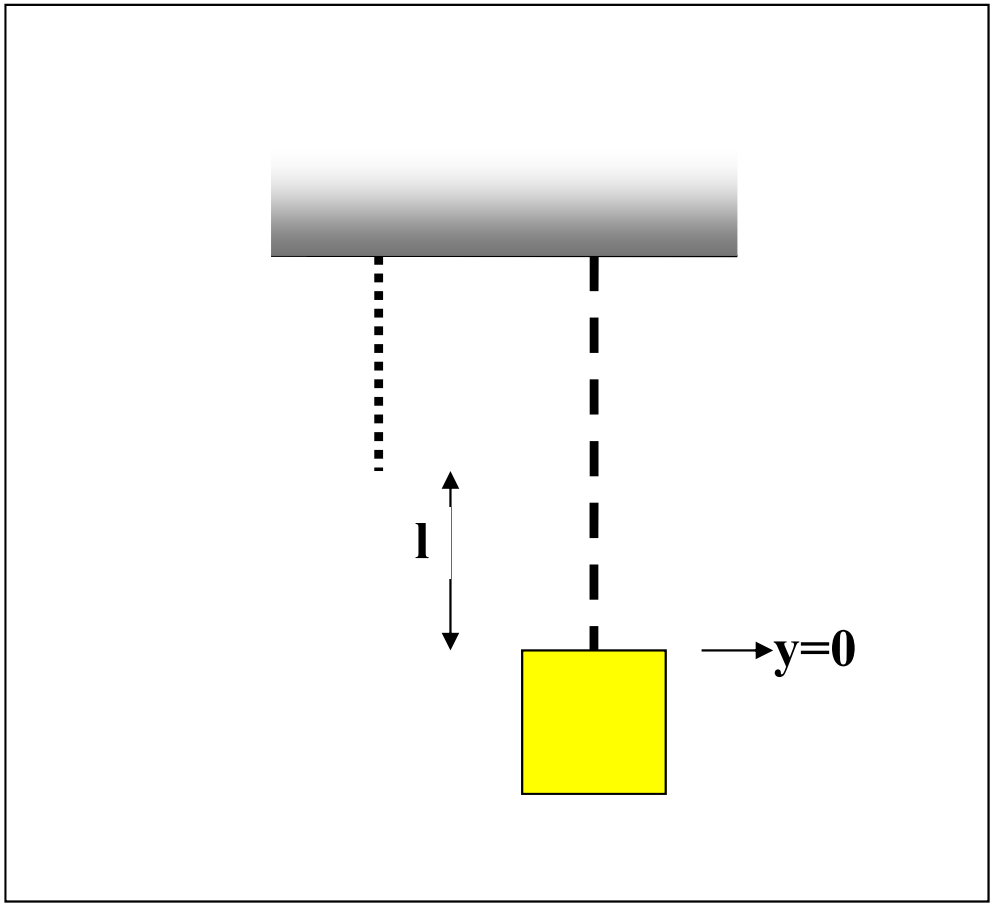
Kmitající těleso na vodorovné podložce bez tření.



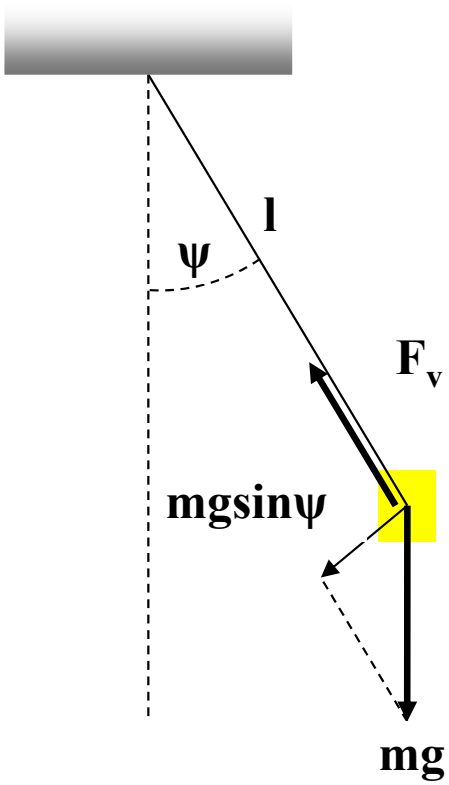
Enegie (v rel. jednotkách) harmonického oscilátoru v závislosti na čase



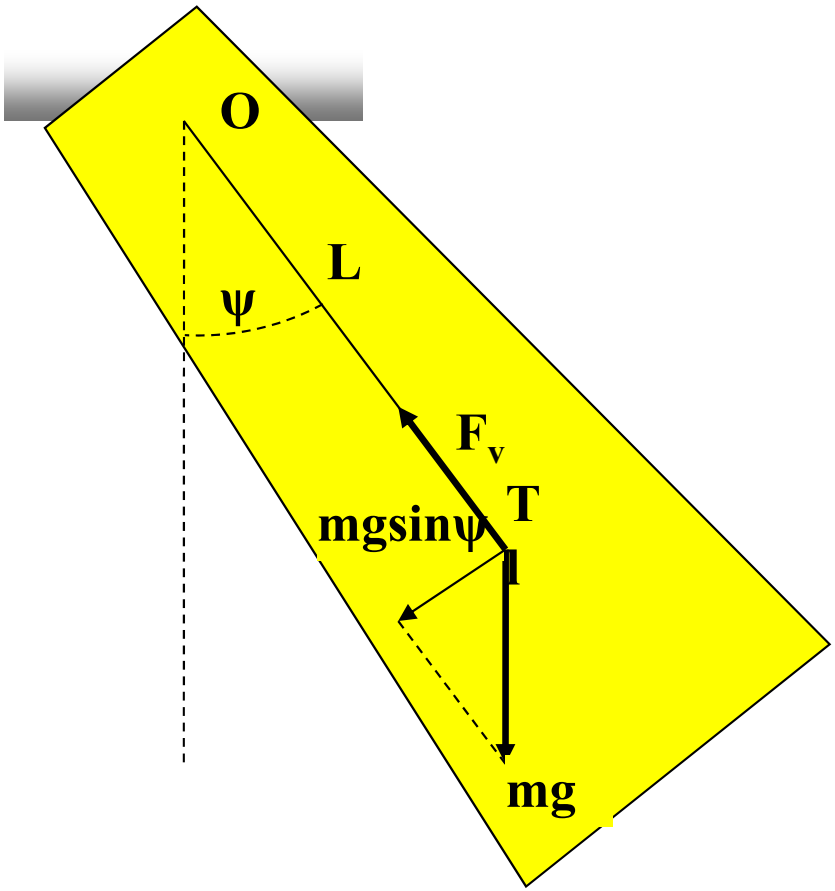
Závislost energií harmonického oscilátoru na výchylce.



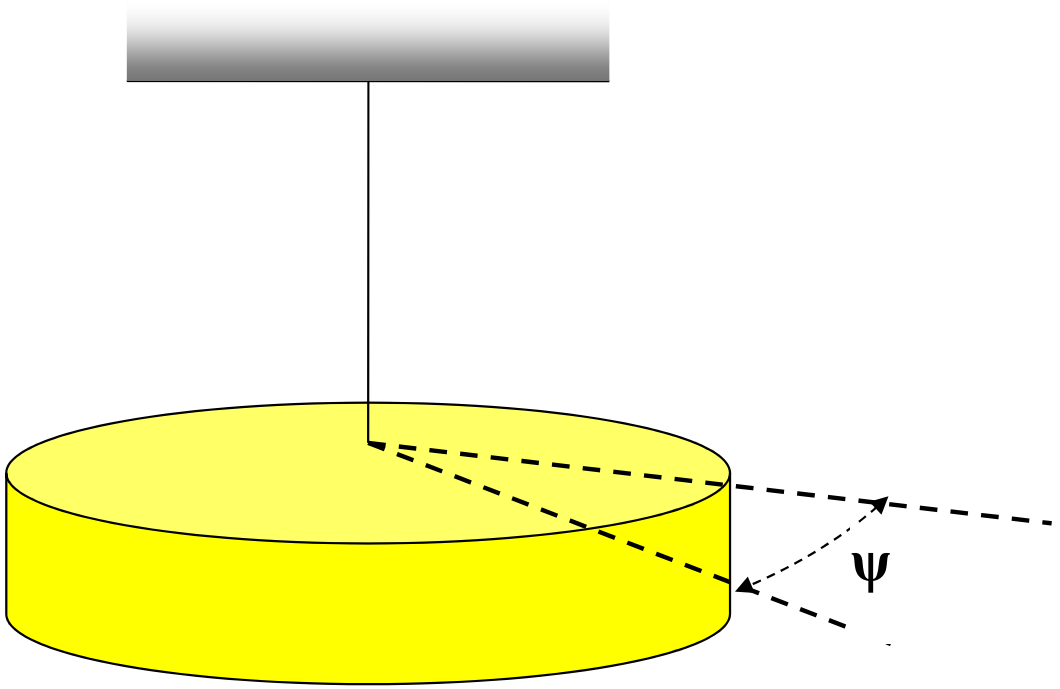
Těleso na pružině



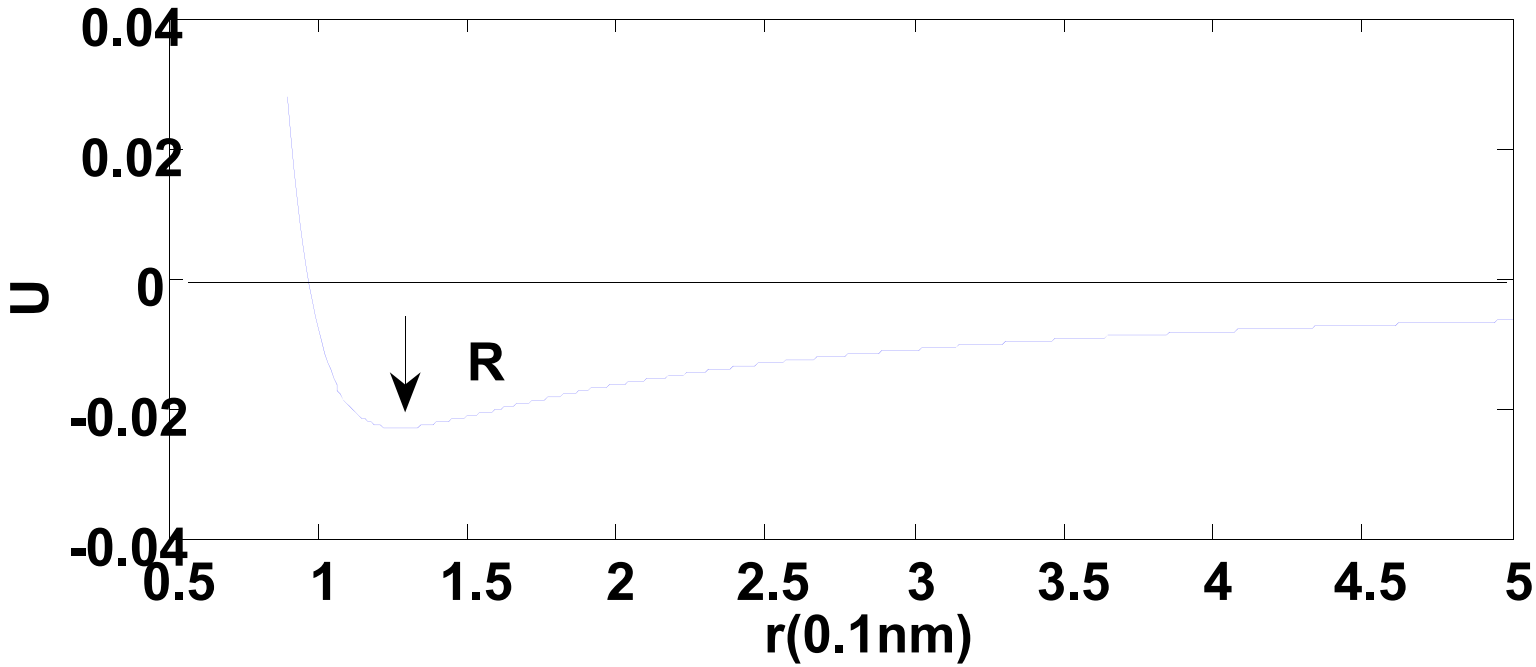
. ***Matematické kyvadlo***



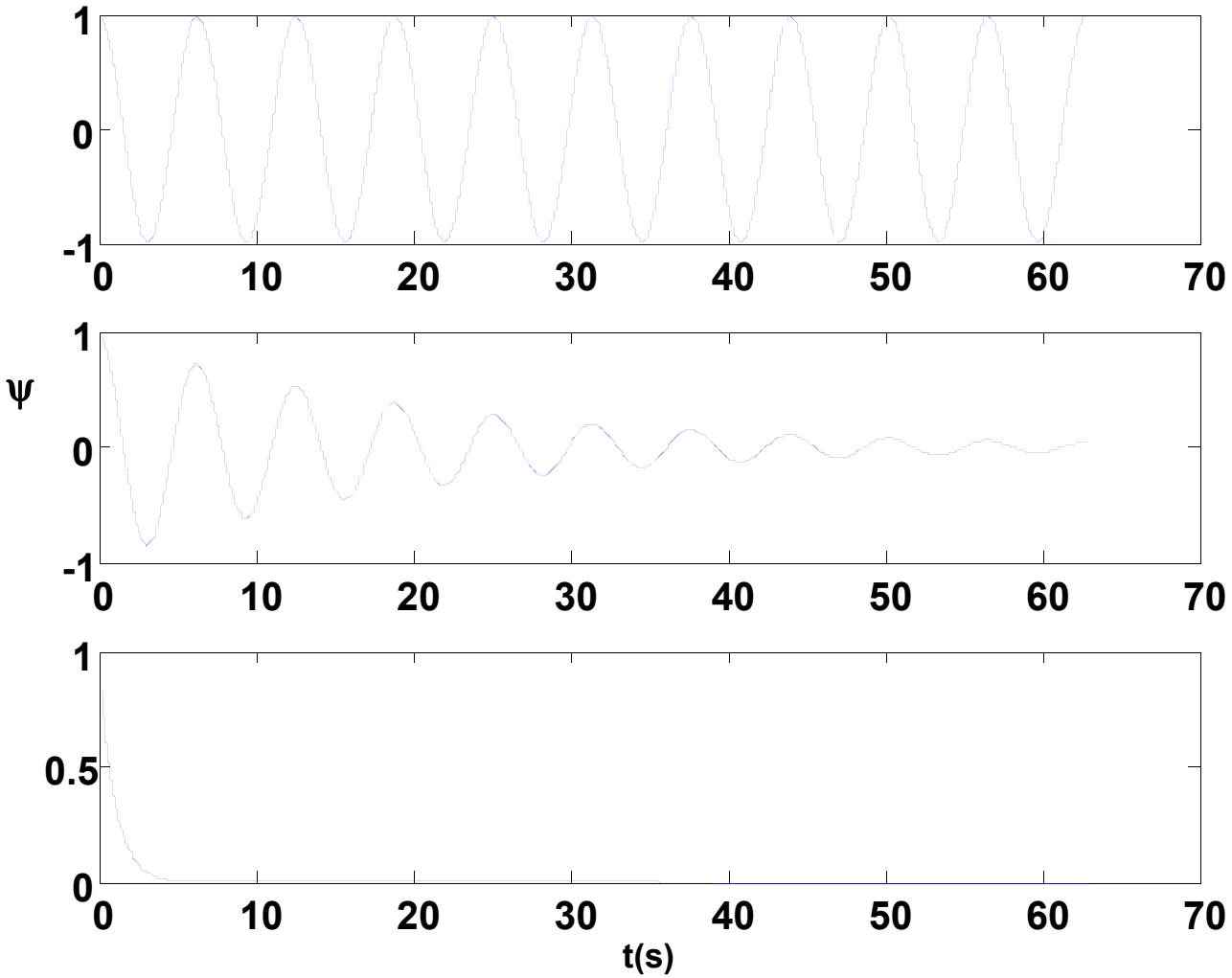
Fyzikální kyvadlo



Torzní kyvadlo



Průběh potenciální energie(U v rel. jednotkách) molekuly HCl na vzdáleností atomů.



Oscilátor: netlumený

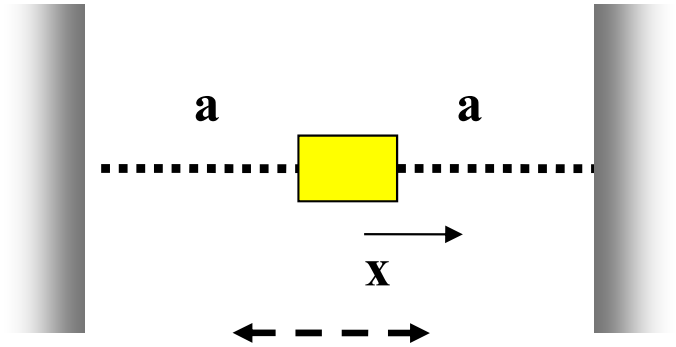
$$\omega_0 = 1\mathrm{s}^{-1}, \Gamma = 0$$

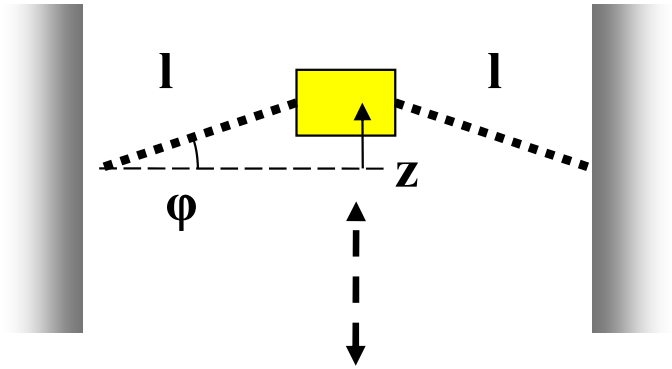
slabě tlumený

$$\Gamma = 0.1\mathrm{s}$$

kriticky tlumený

$$\Gamma = 2\mathrm{s}$$





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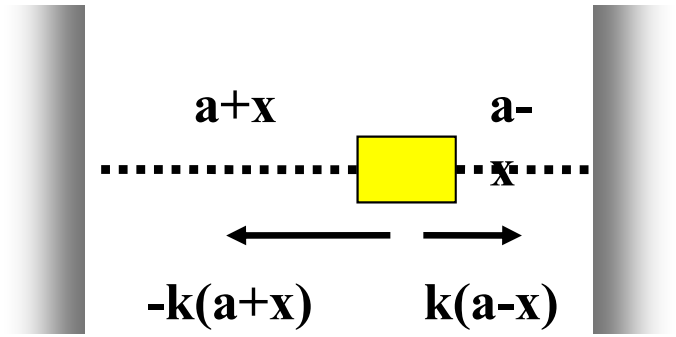
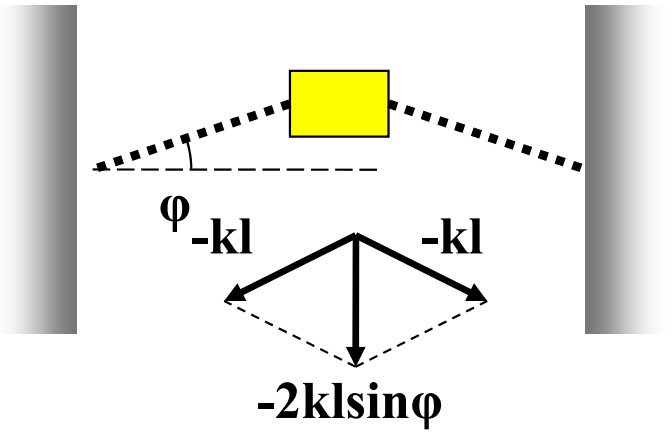
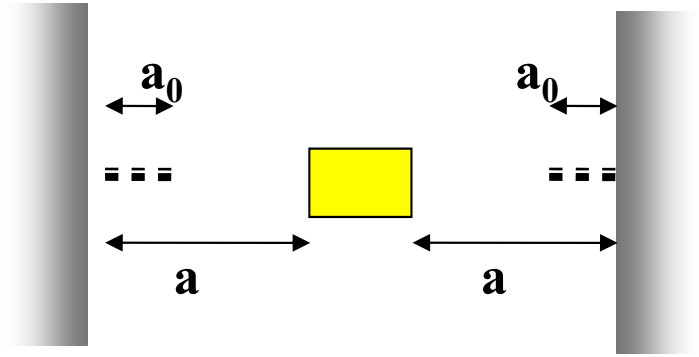
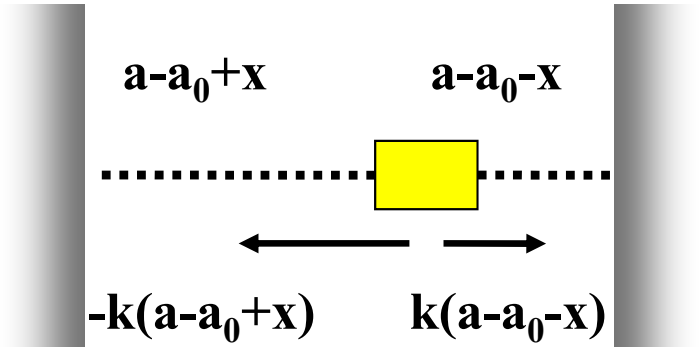
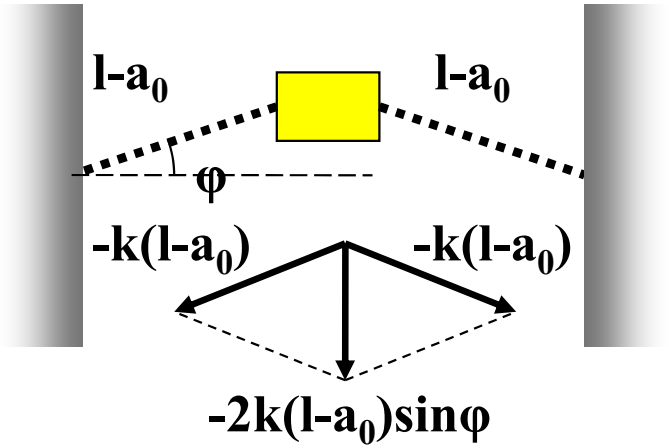




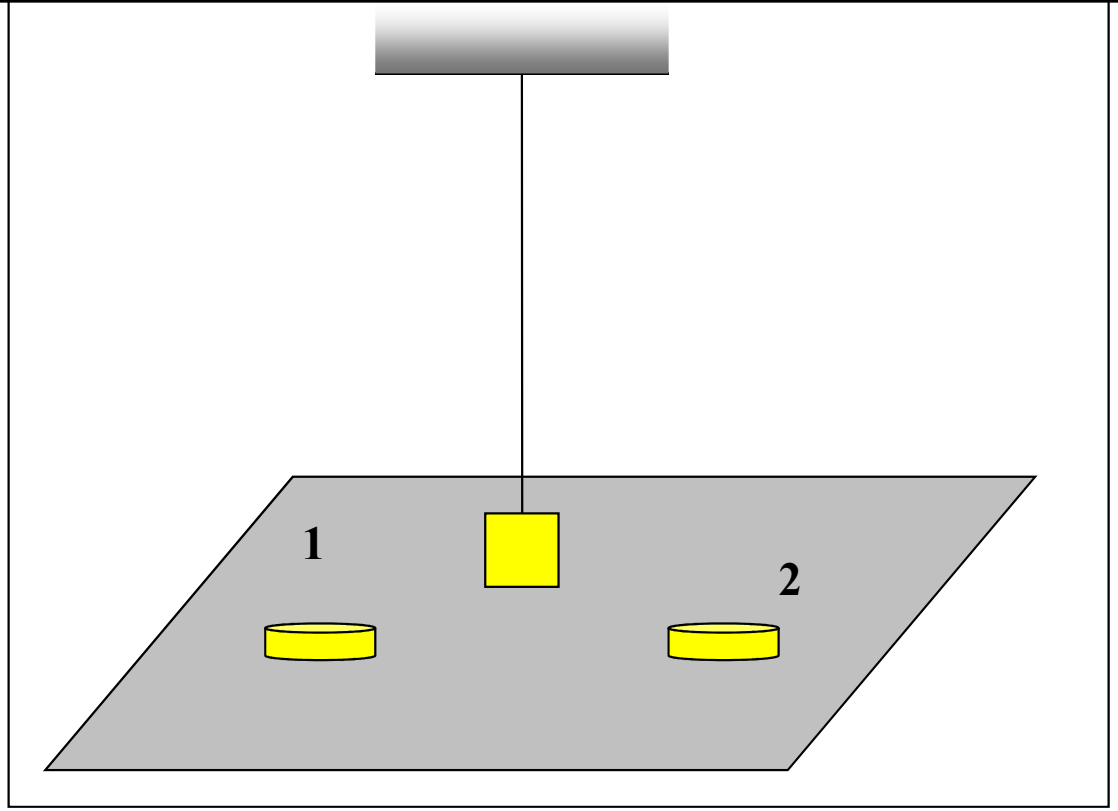
Podélné a příčné kmity



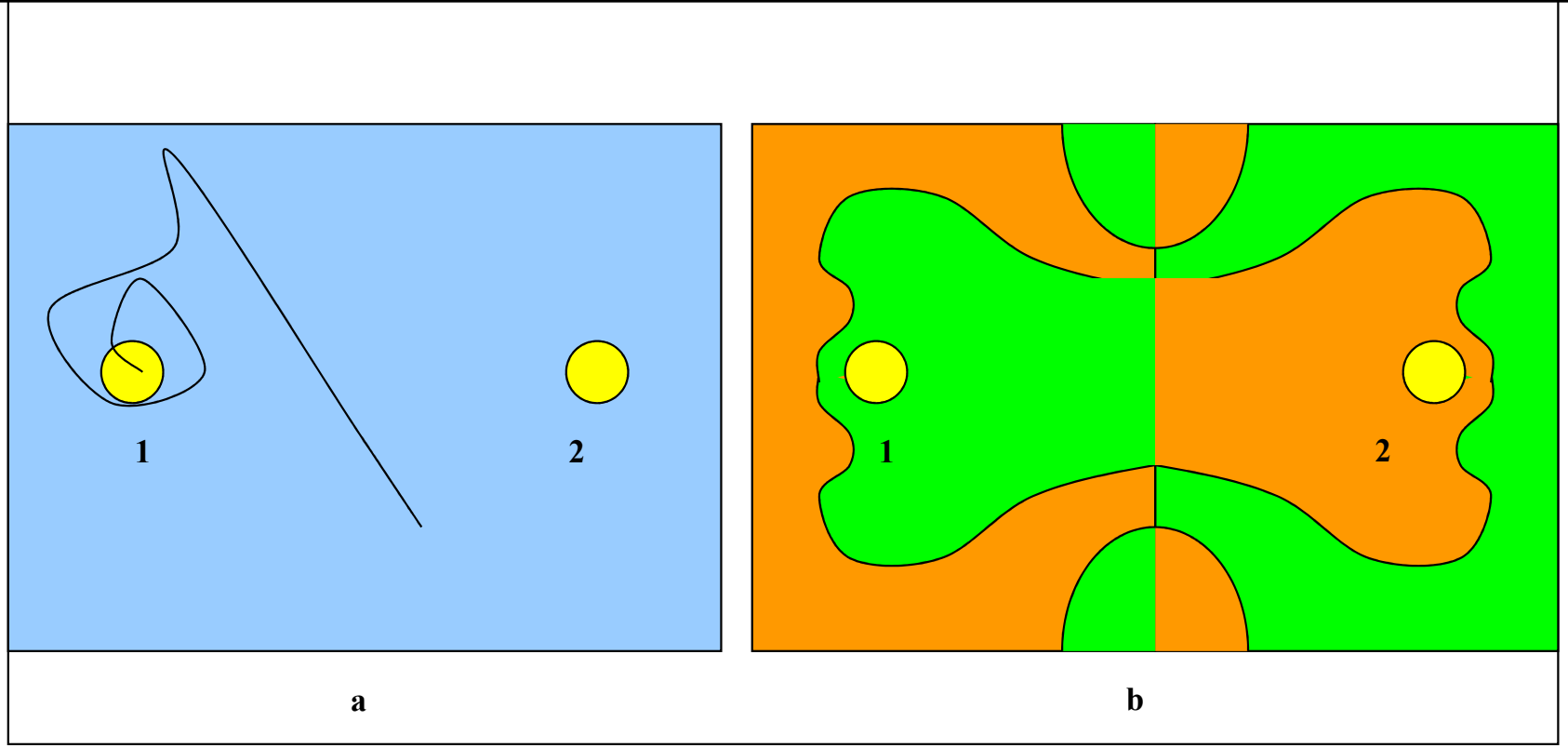




Podélné a příčné kmity (konečná délka nenatažené pružiny)



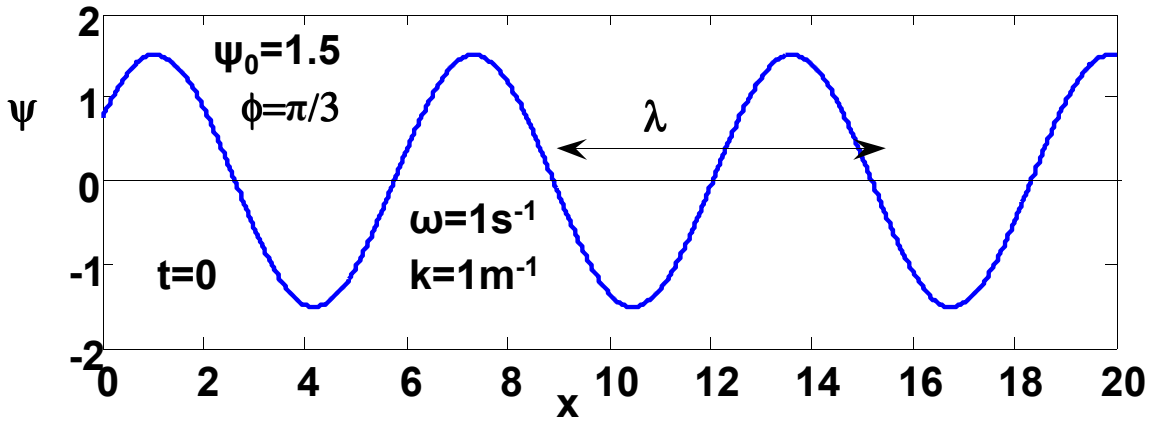
Demonstrace chaotického pohybu.

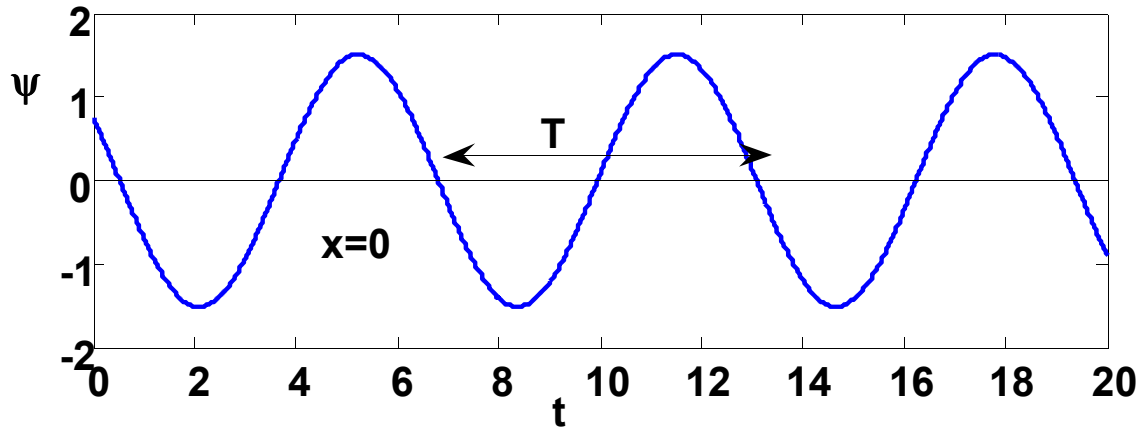


a. Schematicky znázorněná možná dráha kyvadla.
b. Přibližné zobrazení ploch s různými počátečními podmínkami.

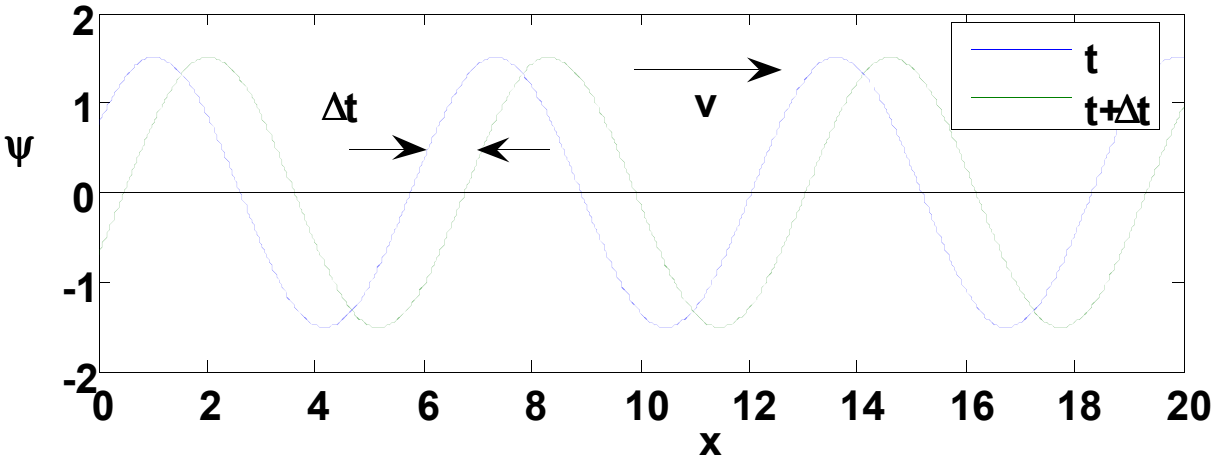
Vlny
Harmonické vlny v 1dm
- Základní vlastnosti harmonické vlny
Princip superpozice
Interference vln

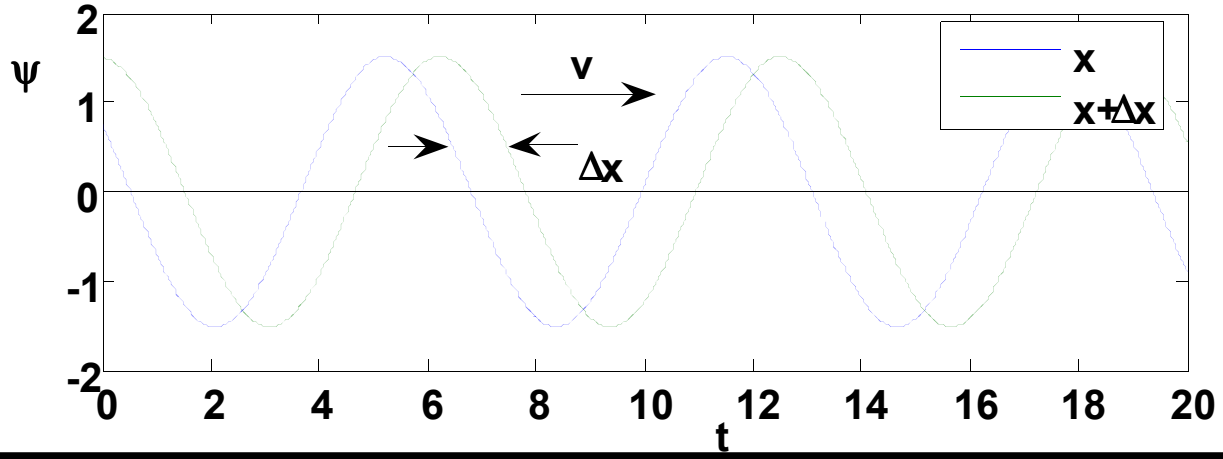
http://commons.wikimedia.org/wiki/File:Great_Wave_Hokusai



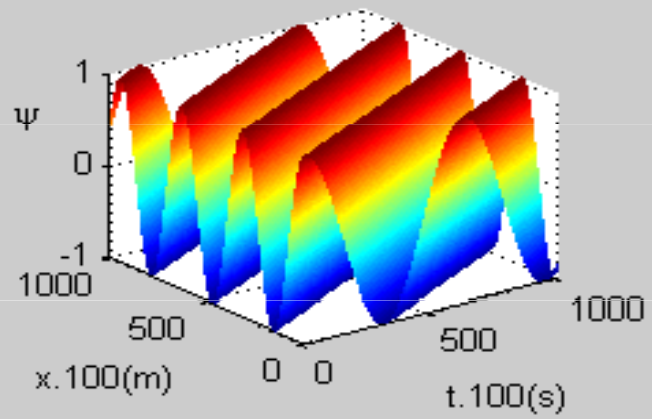


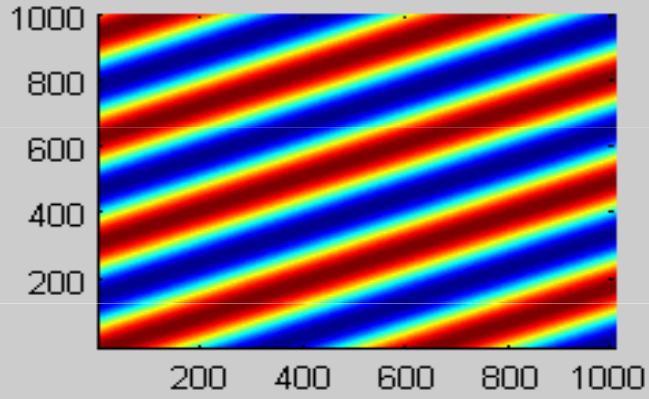
Harmonická vlna, prostorová a časová závislost.

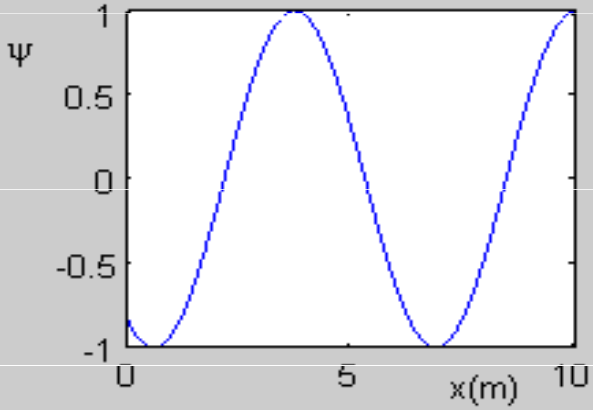


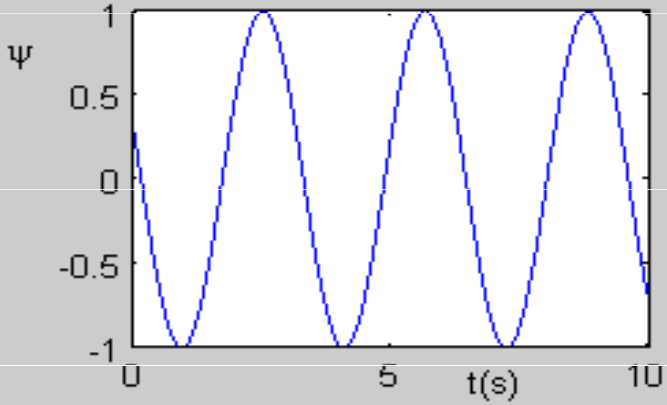


Posuv harmonické vlny v prostoru a čase.

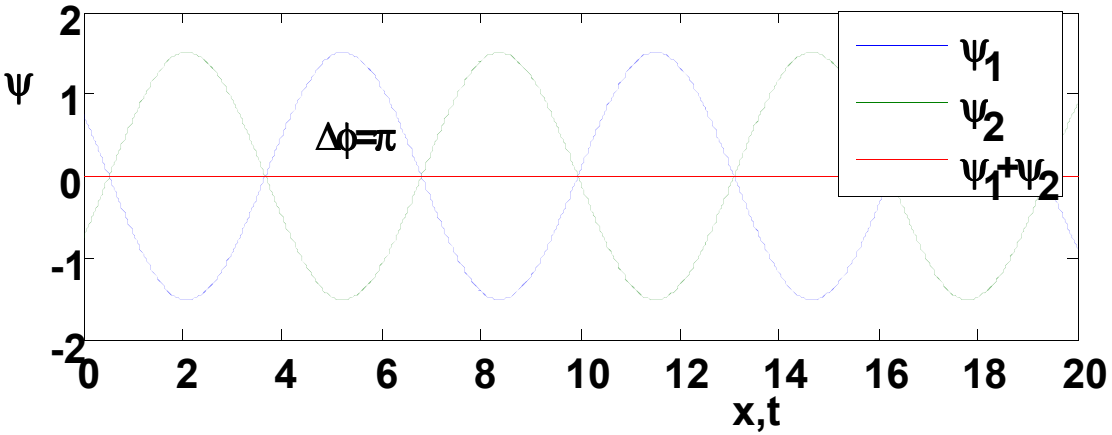


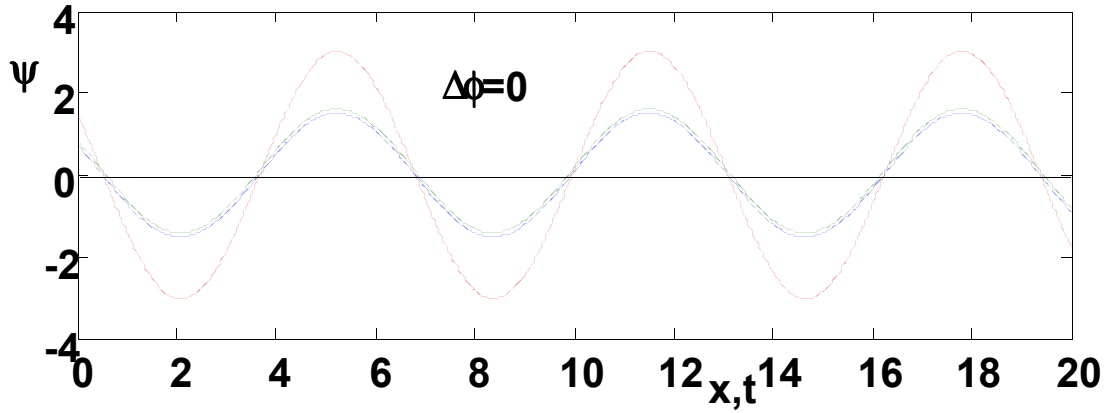




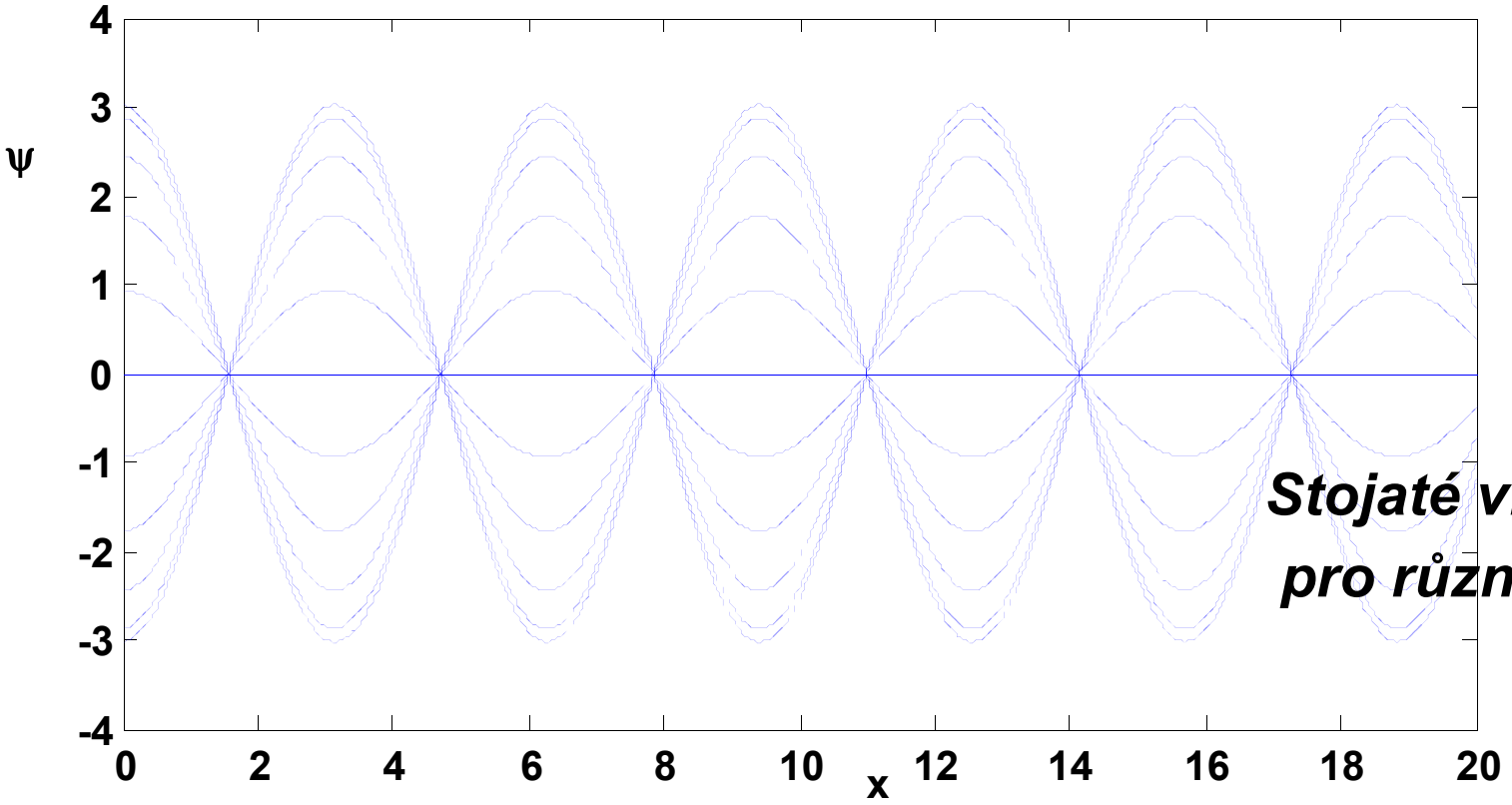


Zobrazení harmonické vlny v časoprostoru

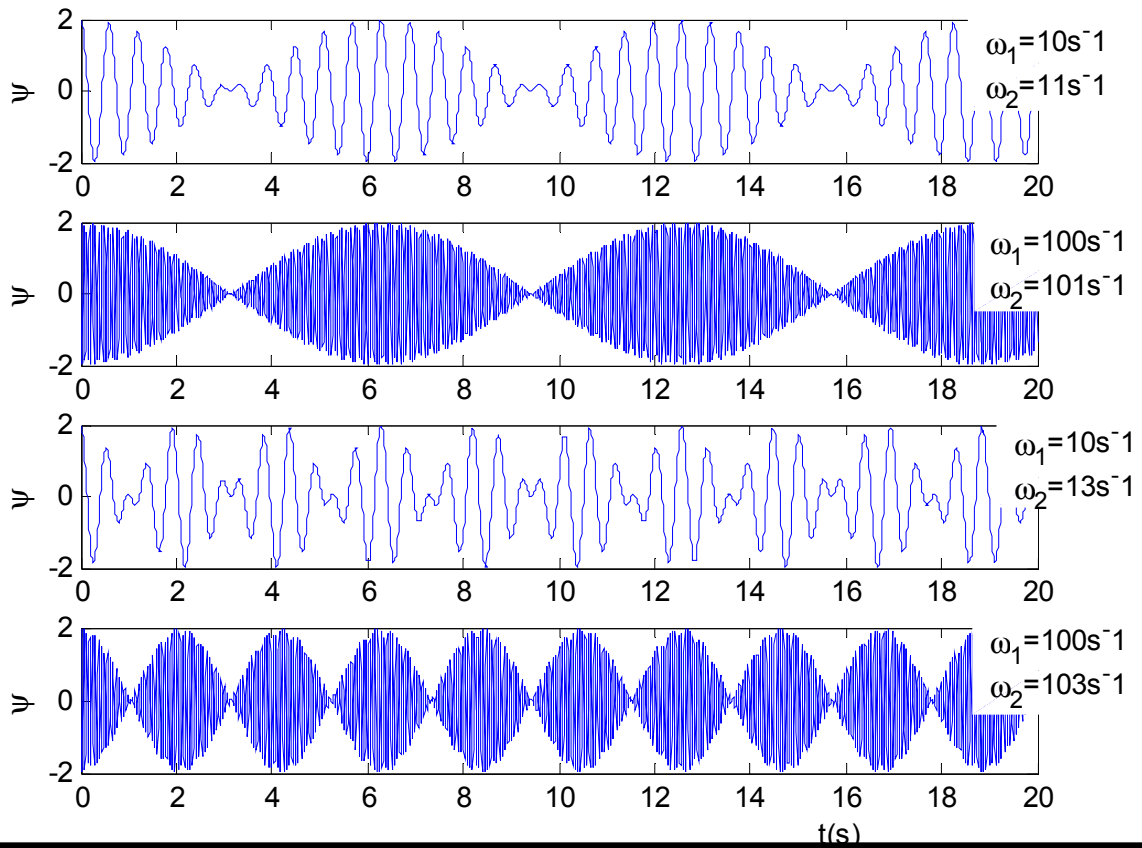


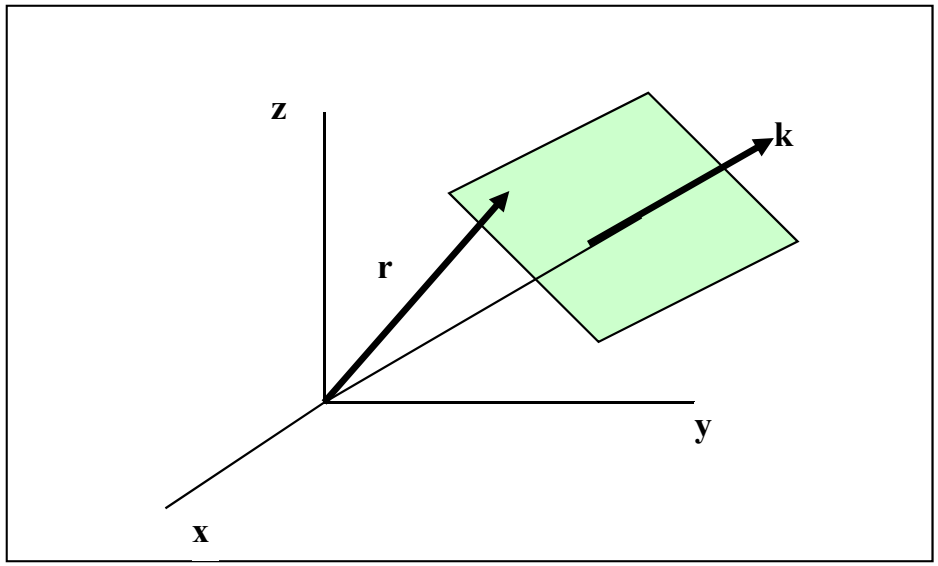


Destruktivní a konstruktivní interference.



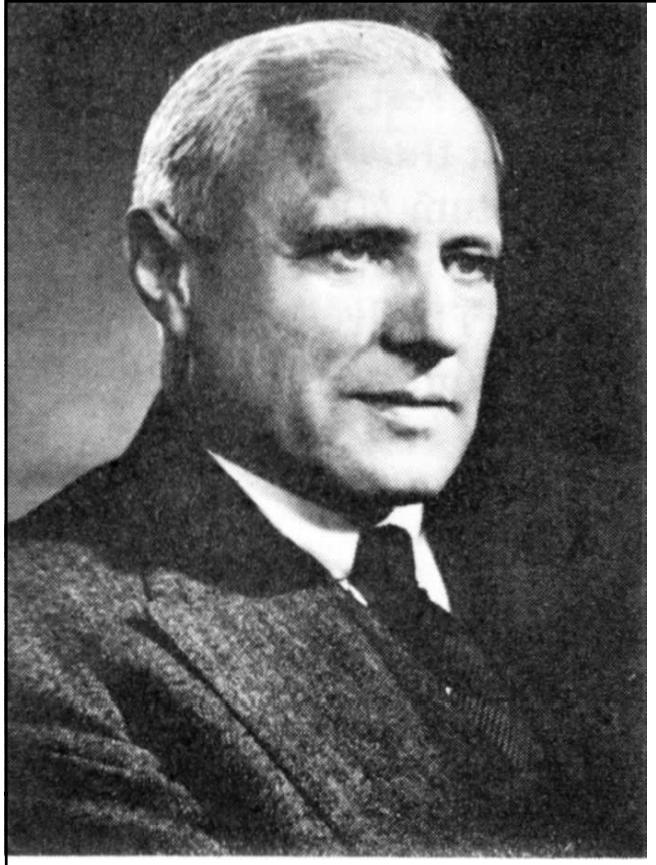
Stojaté vlnění v prostoru pro různé časové okamžiky


ψ
2
0
-2
0 2 4 6 8 10 12 14 16 18 20
ω1=10s-1
ω2=11s-1
ω1=100s-1
ω2=101s-1
ω1=10s-1
ω2=13s-1
ω1=100s-1
ω2=103s-1
t(s)

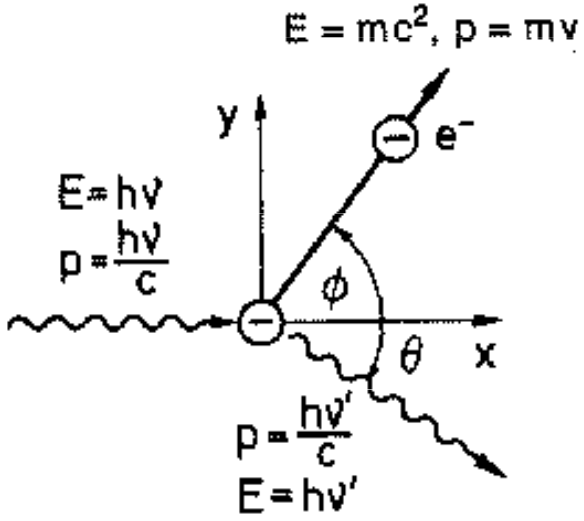

z
k
r
y
x

9. Mikrosvět

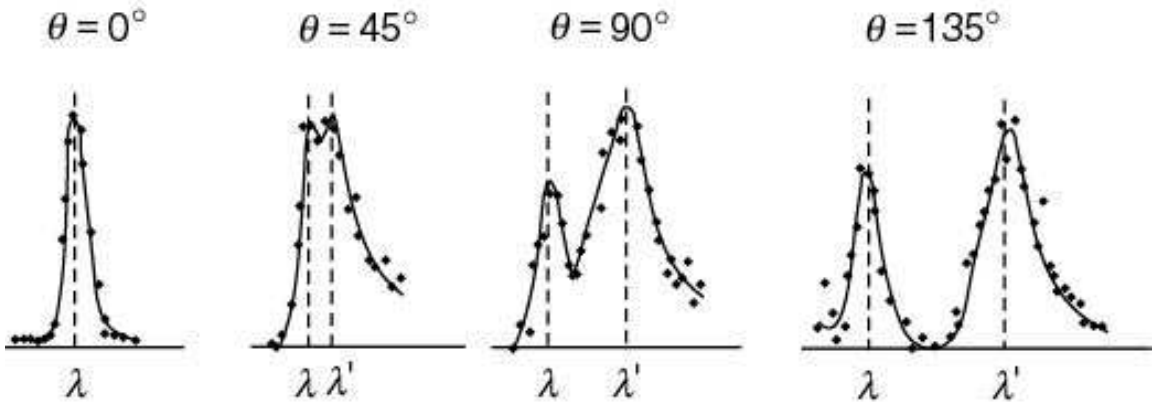
Kvantování energie záření
-záření absolutně černého tělesa
Vlna – částice
-fotoefekt
-Comptonův jev
-paprsky X
Optická spektra
Bohrův model atomu
Základy kvantové mechaniky



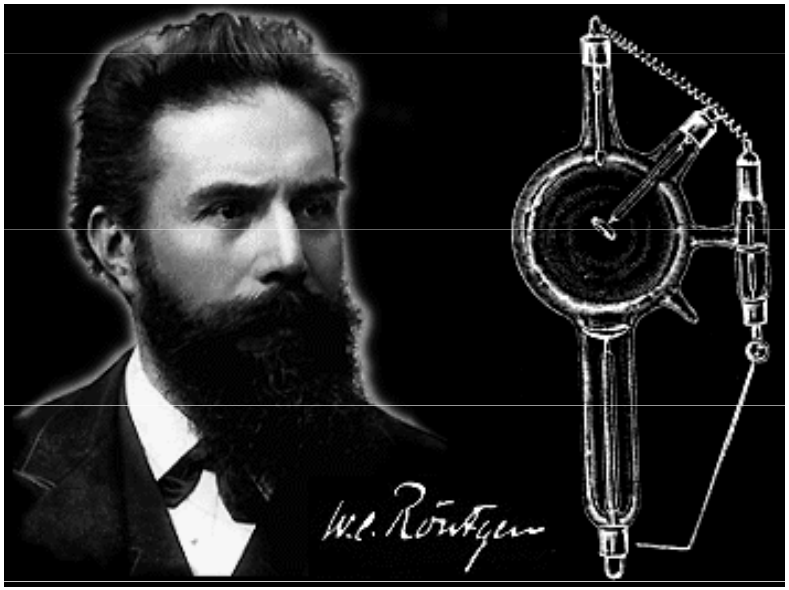
Arhtur Holly Compton
(1892-1962)



http://canov.jergym.cz/applety/com_jev.htm

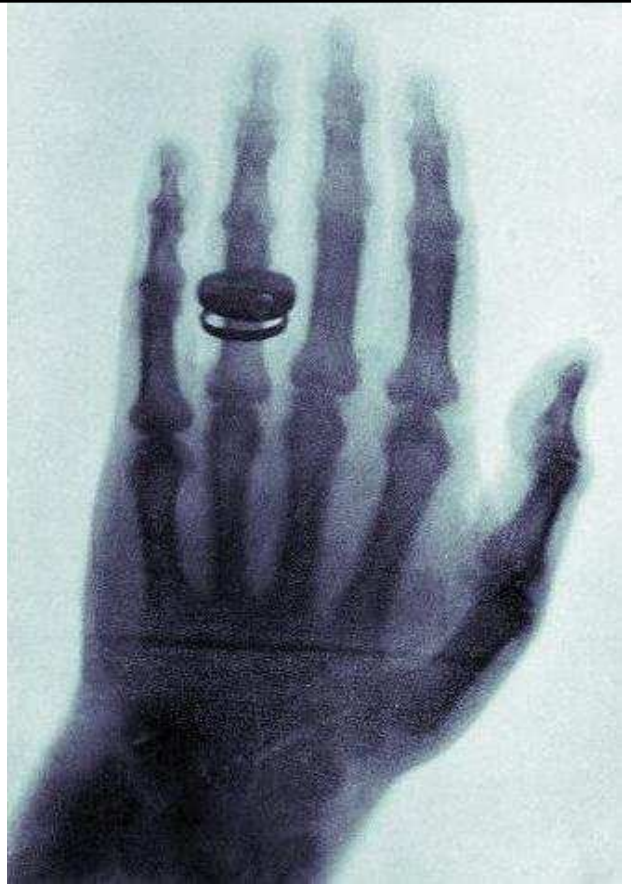


http://www.kutl.kyushu-u.ac.jp/seminar/

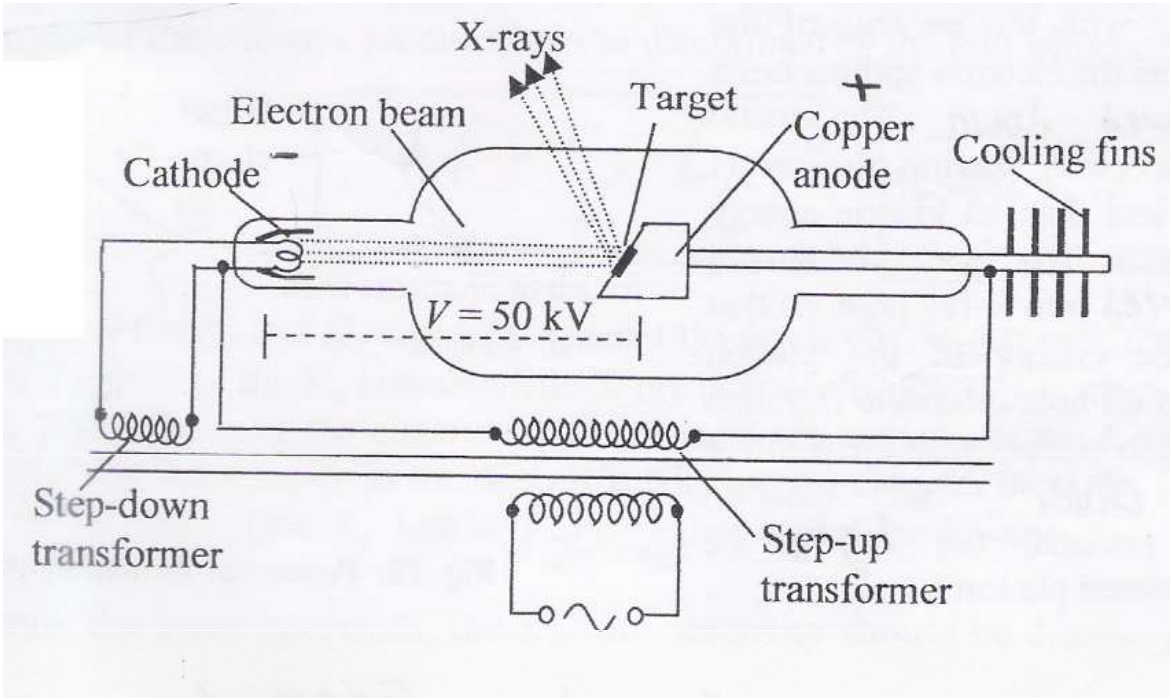


http://www.rentgenmedikal.cz/

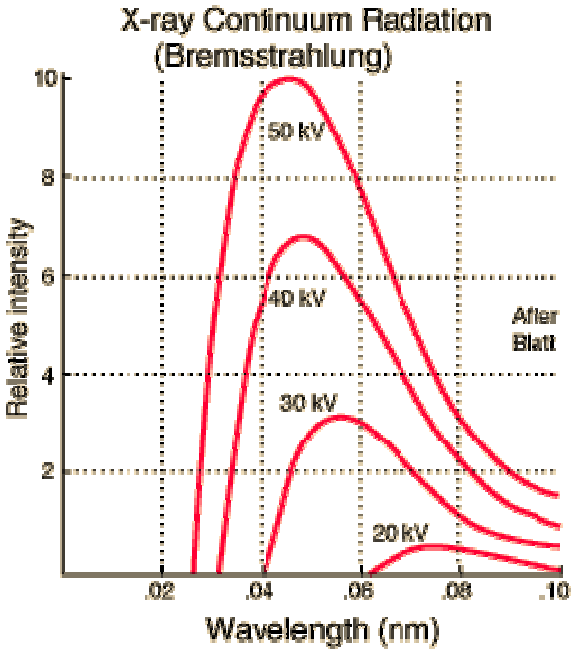
Wilhelm Röntgen 1845-1923

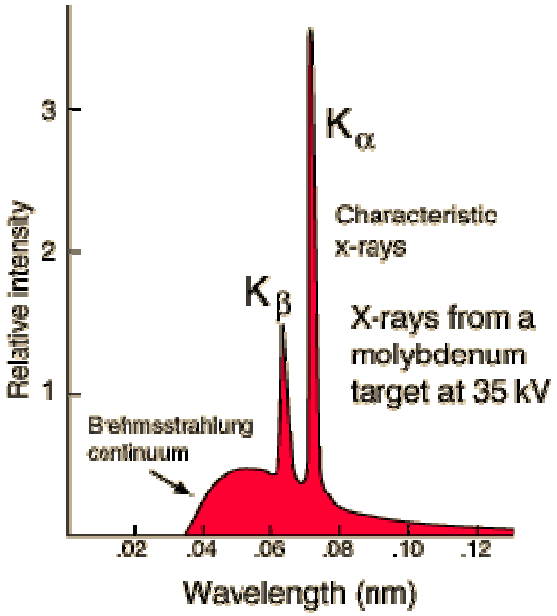


http://cs.wikipedia.org/wiki/Rentgenov%C3%A9_z%C3%A1%C5%99en%C3%AD

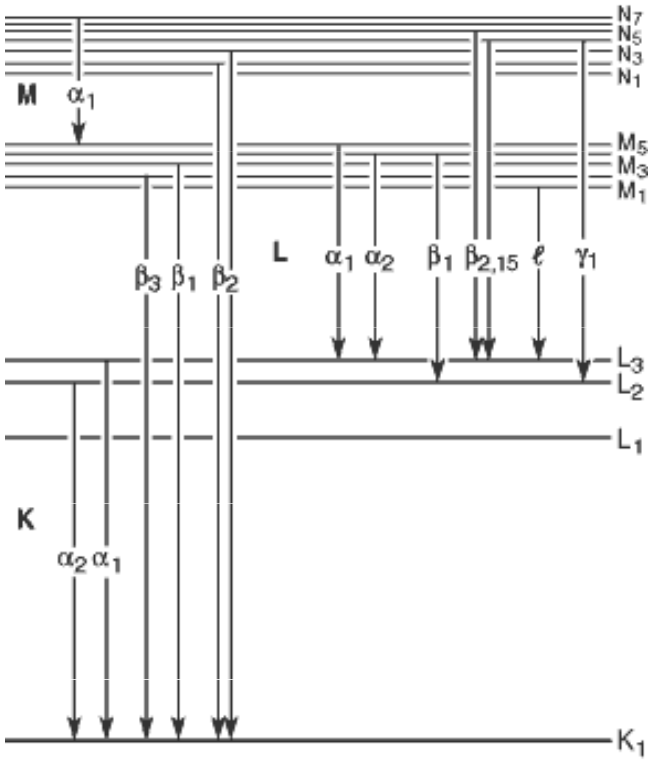


http://www.miniphysics.com/2010/11/coolidge-x-ray-tube.html

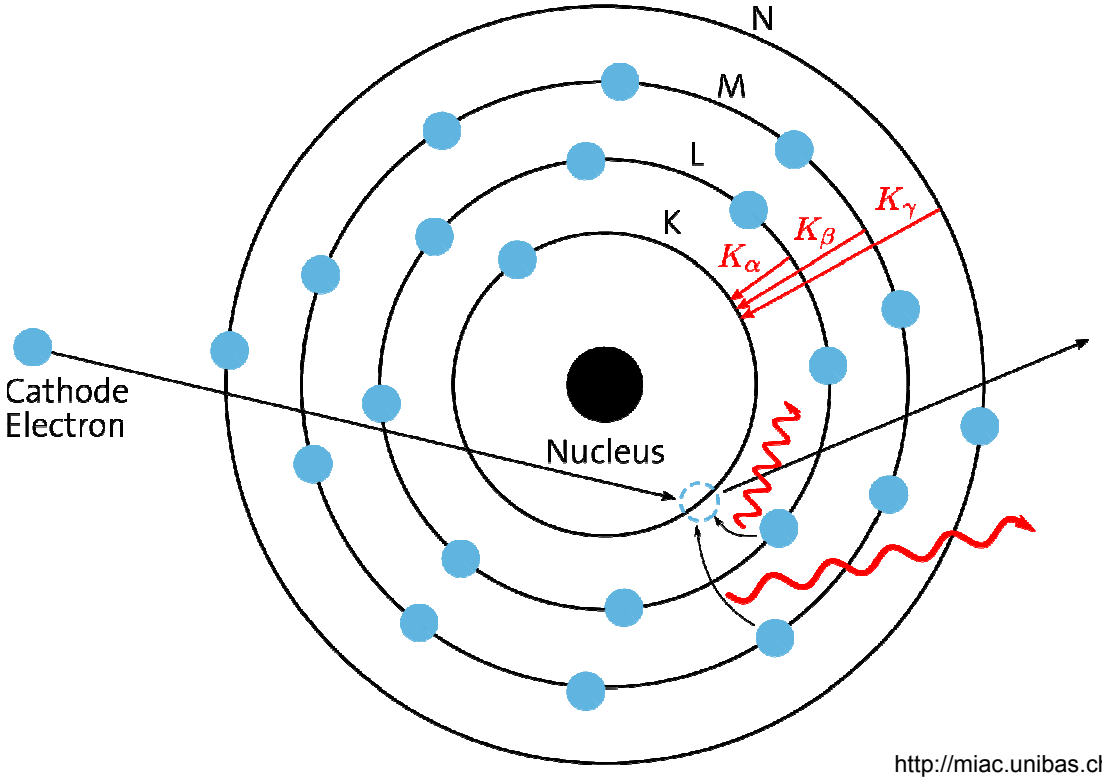




http://hyperphysics.phy-astr.gsu.edu



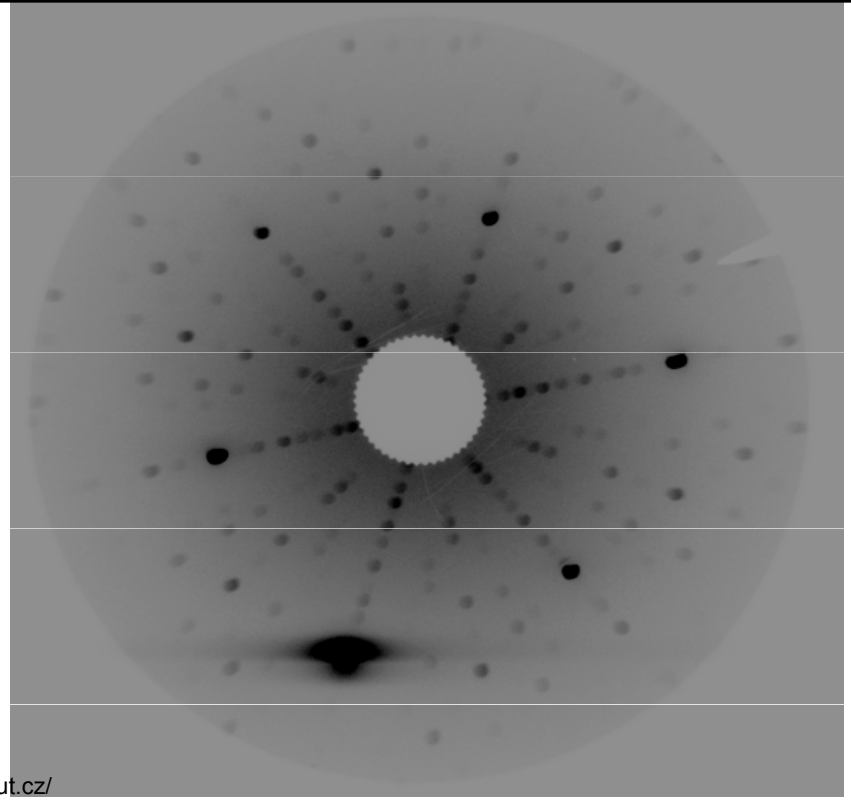
http://xdb.lbl.gov/Section1/Sec_1-2.html



http://miac.unibas.ch/

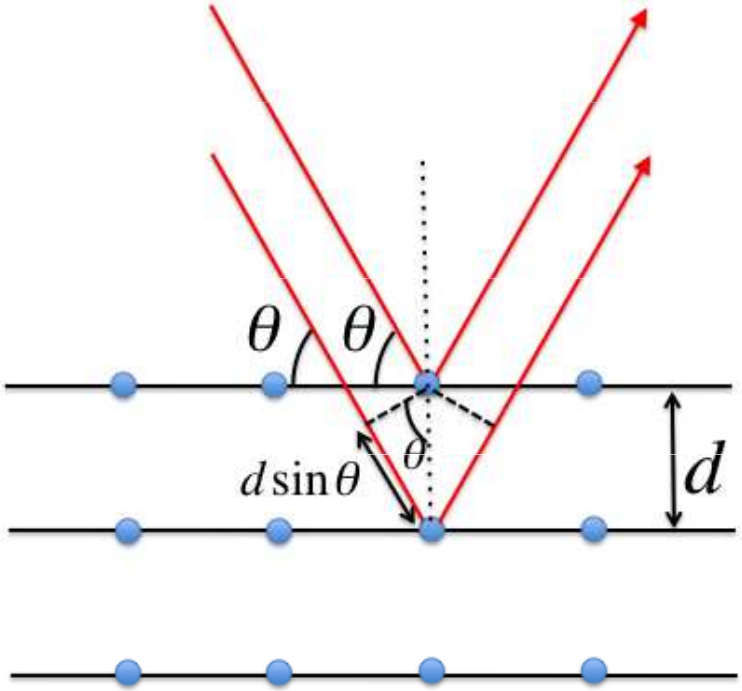
http://www.nobelprize.org/nobel_prizes/

Max von Laue (1879 – 1960),

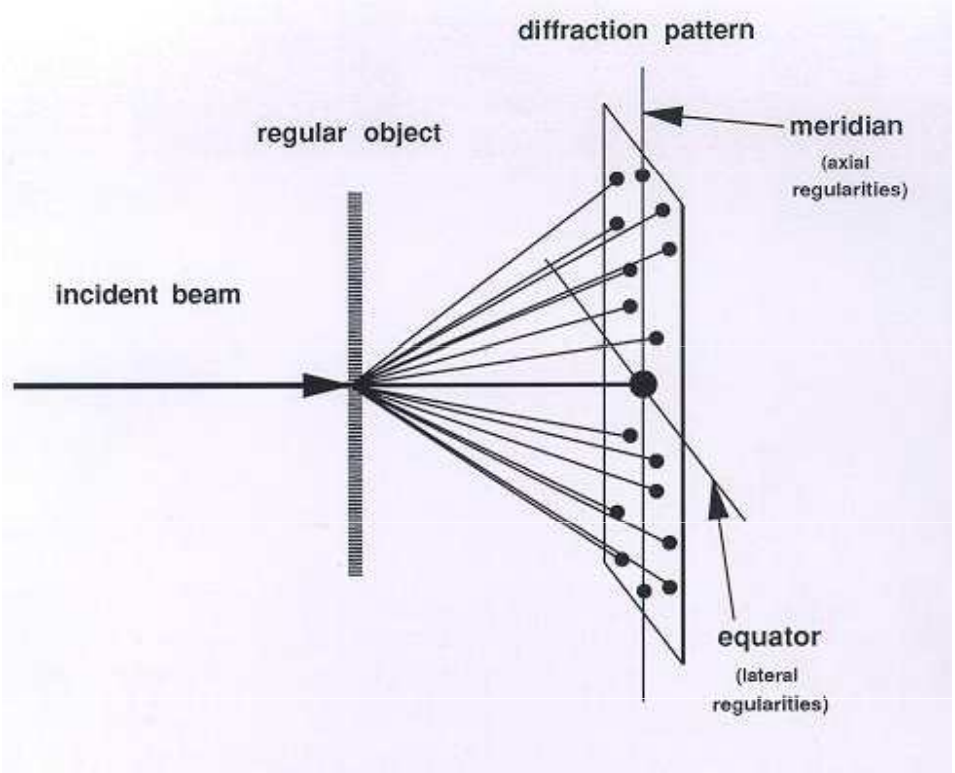


http://fyztyd.fjfi.cvut.cz/

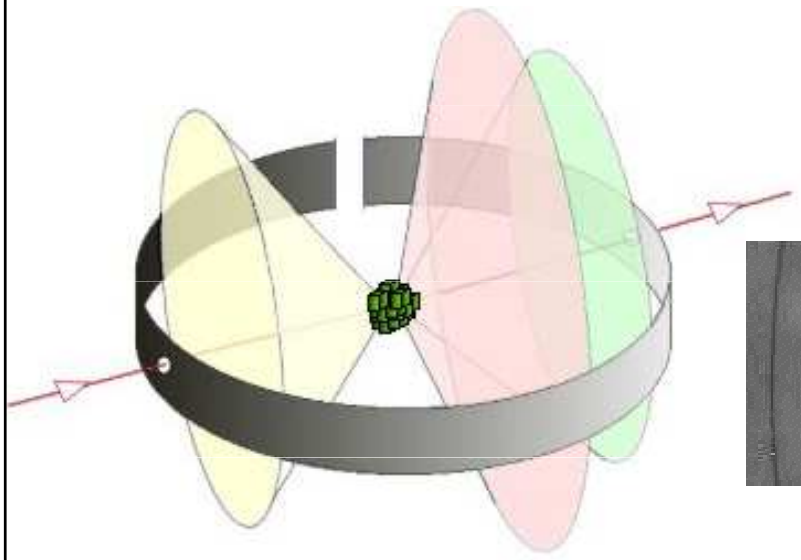
monokrystal Si



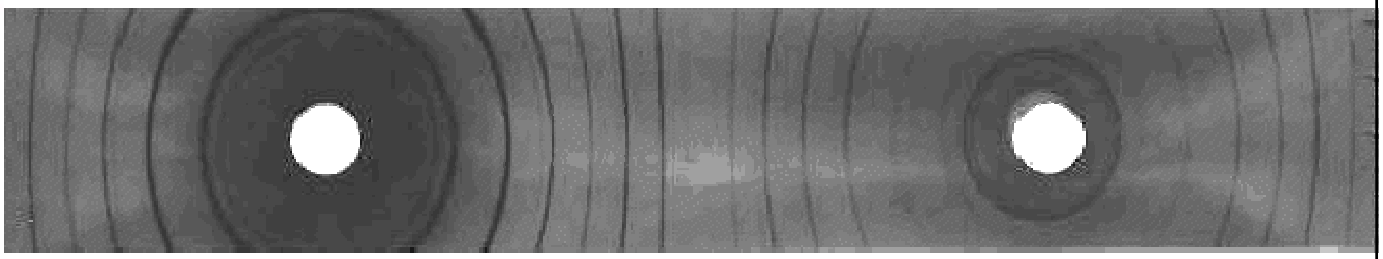
http://mini.physics.sunysb.edu/



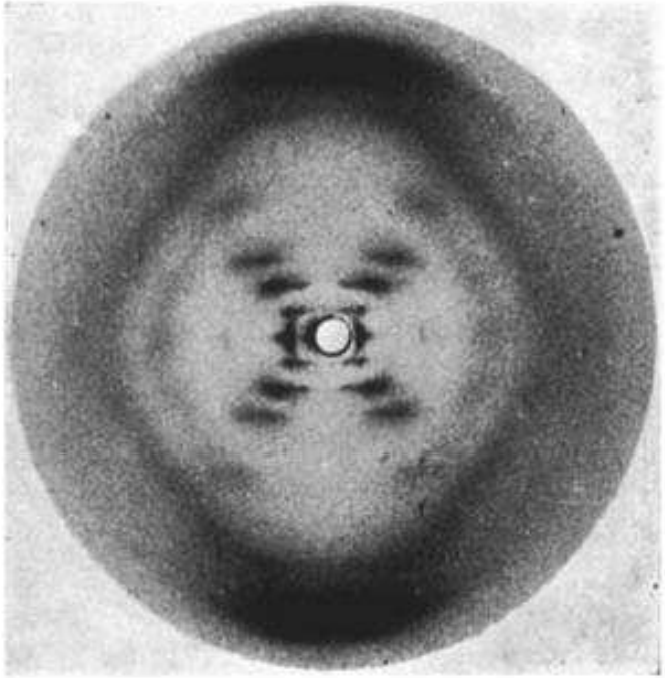
http://www.leeds.ac.uk/



http://www.matter.org.uk/diffraction/x-ray/powder

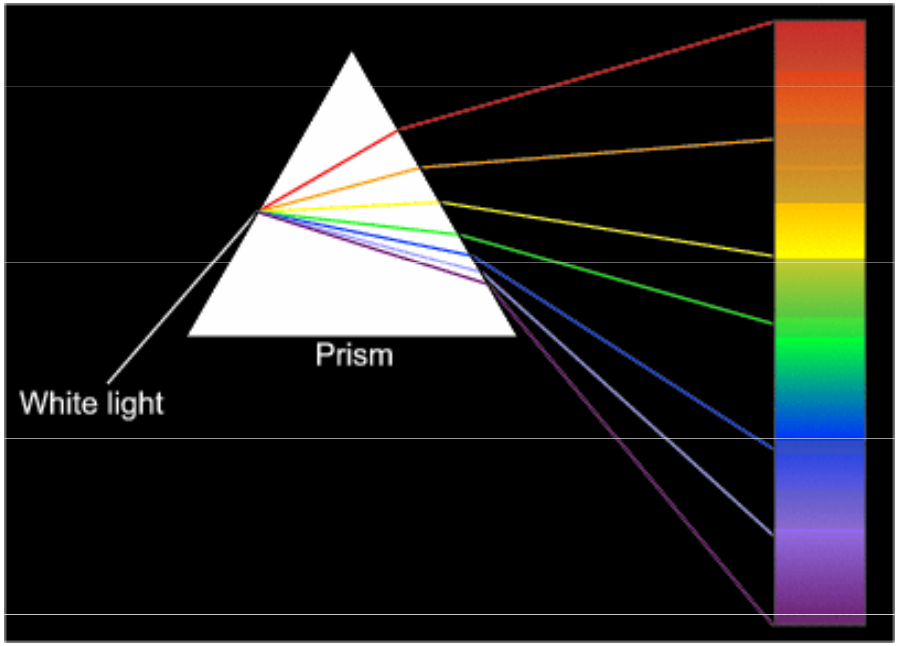


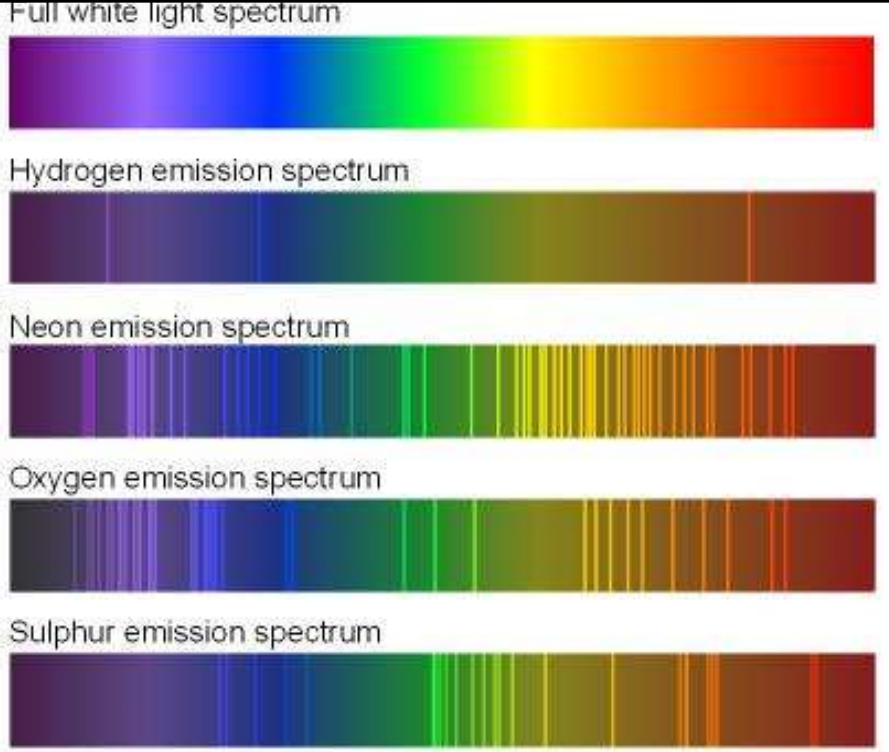
http://www.chemgapedia.de/



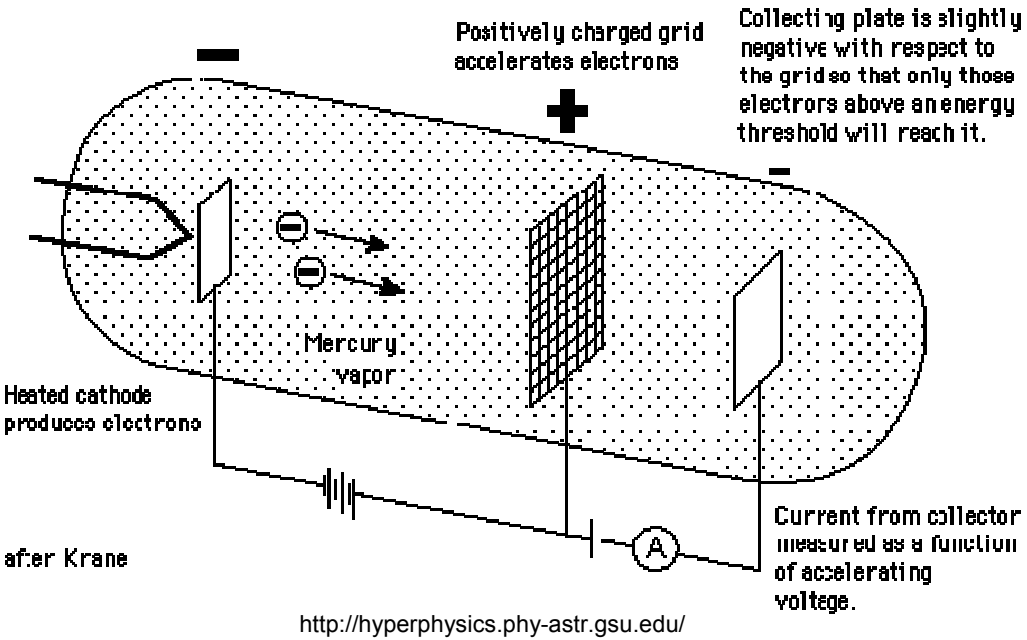
http://en.wikipedia.org/wiki/

http://www.astrochem.org/

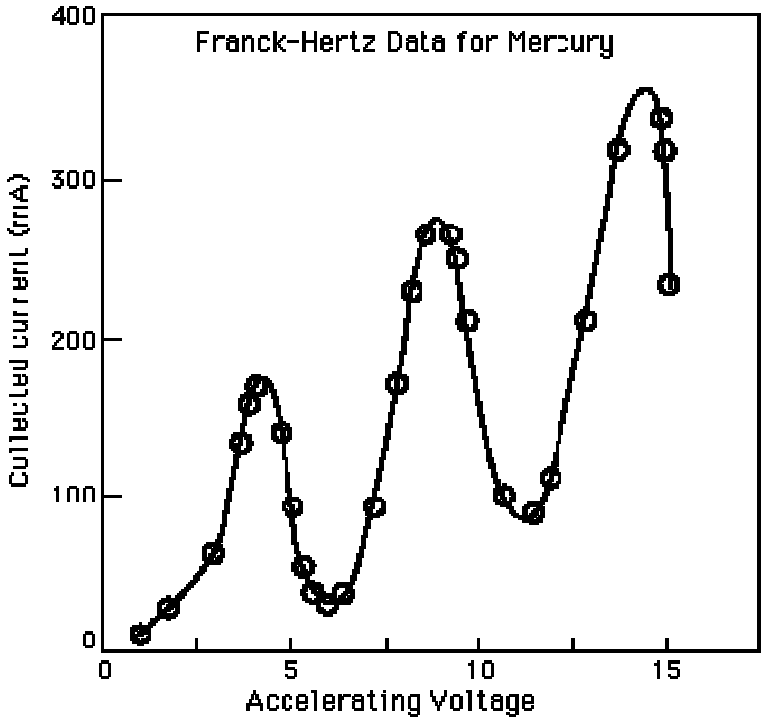


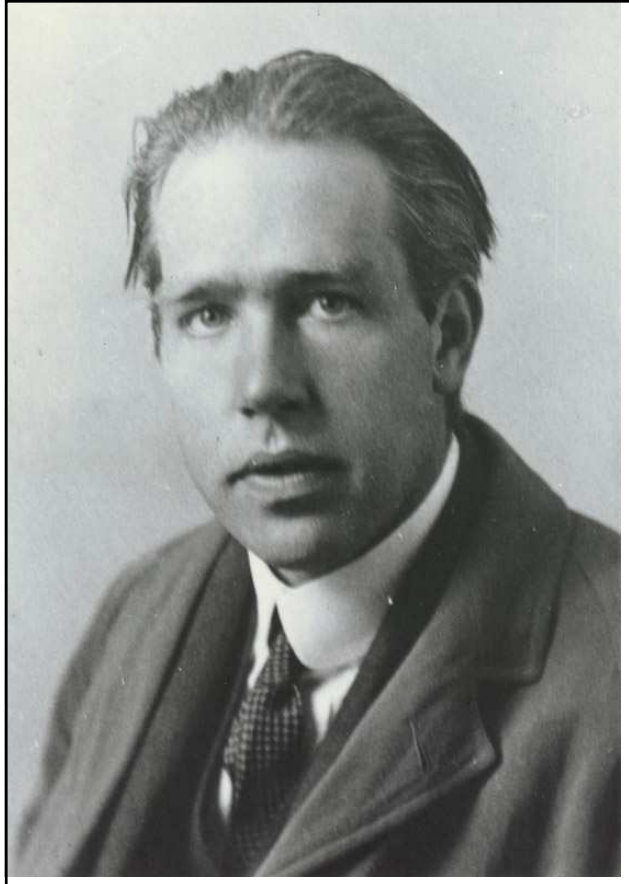


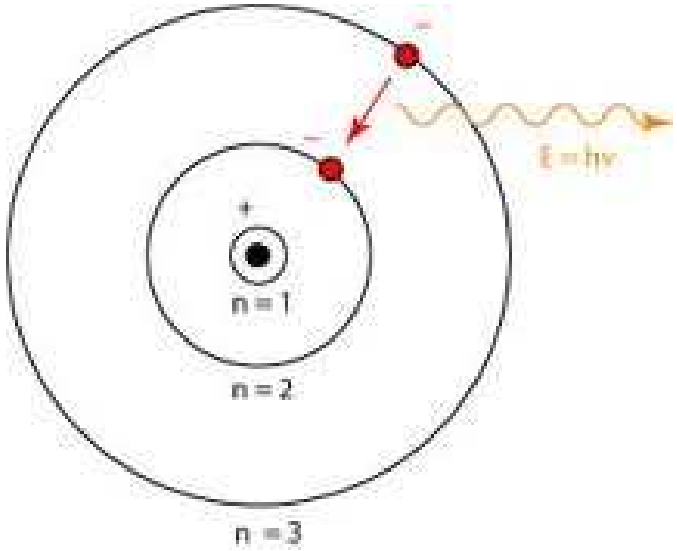
http://learning.covcollege.ac.uk



http://hyperphysics.phy-astr.gsu.edu/

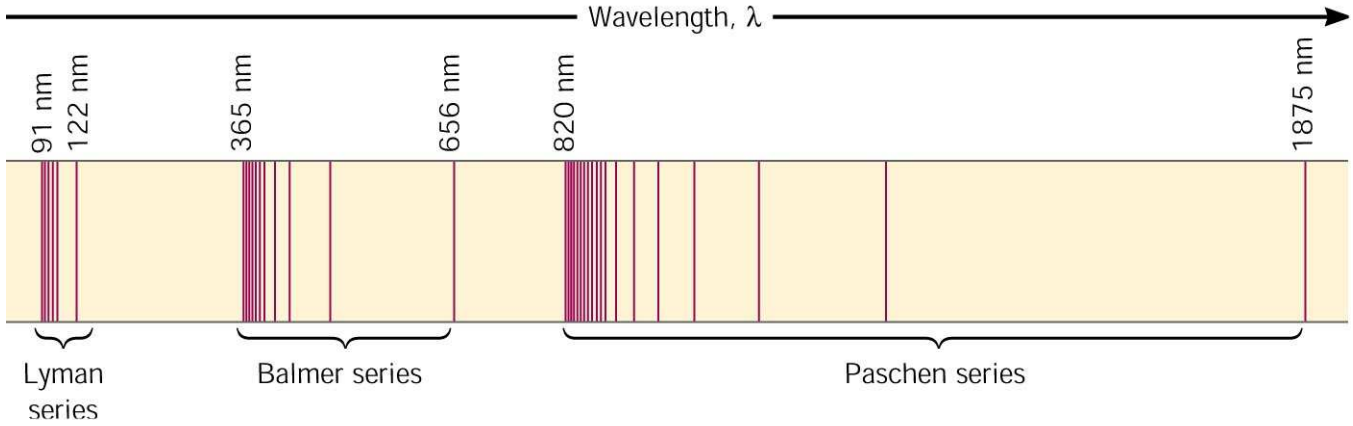






http://skullsinthestars.com/

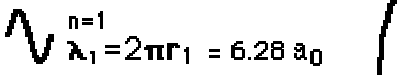
Niels Henrik Bohr (1885 - 1962)



http://mail.rdcrd.ab.ca

For a hydrogen atom:

Electron wave resonance



$\lambda_1 = 2\pi r_1 = 6.28\, a_0$

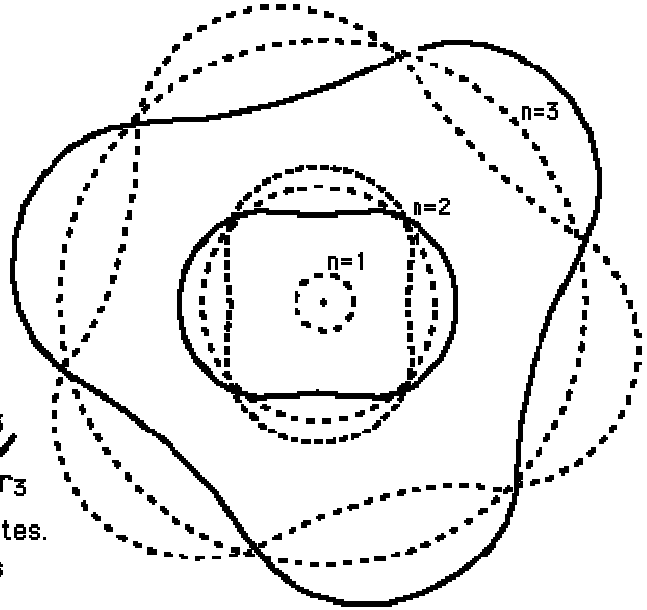
$2\lambda_2 = 2\pi r_2$

$\lambda_2 = 12.57 a_0$

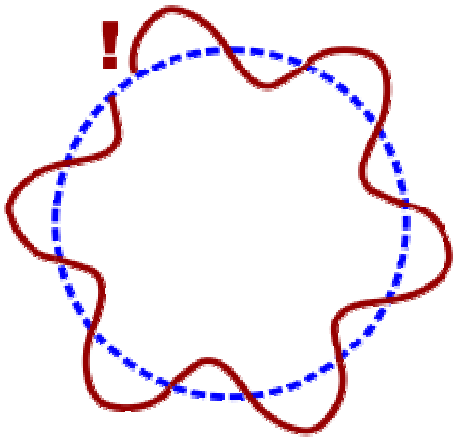
$\lambda_3 = 18.85\, a_0$ $\quad 3\lambda_3 = 2\pi r_3$

Wavelengths for hydrogen states.

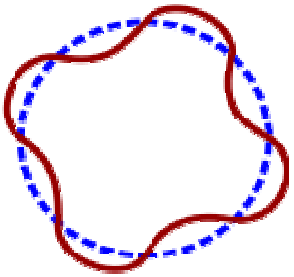
a_0 = 0.529 Å = Bohr radius



http://www2.arnes.si/~gljsentvid10/bohr.htm



Tato dráha není možná



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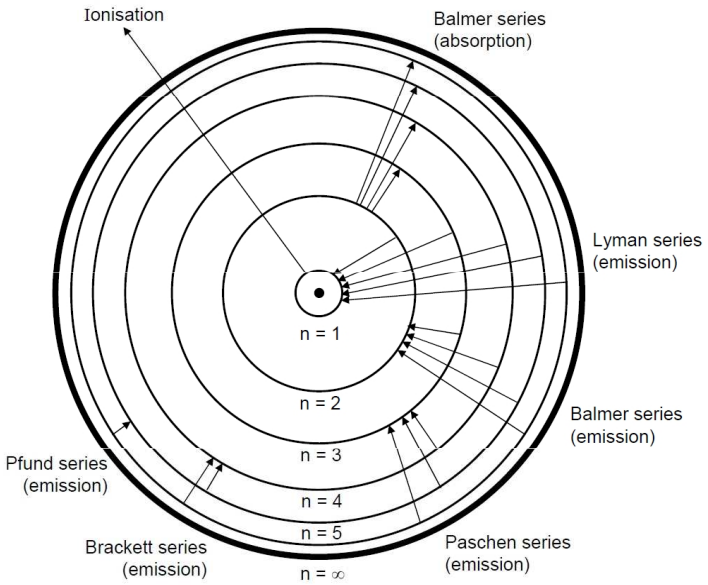
http://www.aldebaran.cz/

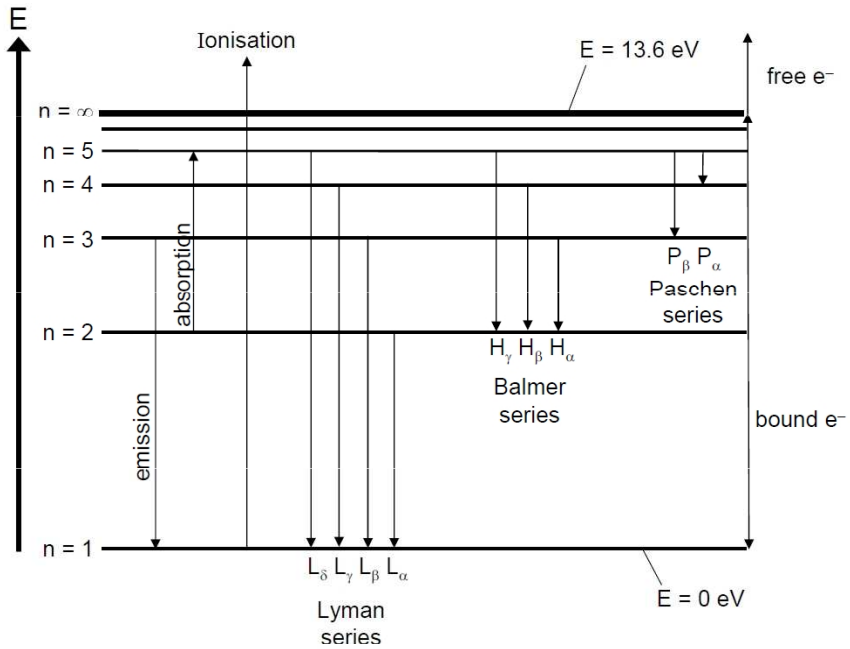
Bohr Model of the Hydrogen Atom



Spectral series	Emission	Absorption	Frequency
Lyman series	Down to n = 1	Up from n = 1	Ultraviolet
Balmer series	Down to n = 2	Up from n = 2	Visible light
Paschen series	Down to n = 3	Up from n = 3	Near infrared
Brackett series	Down to n = 4	Up from n = 4	Far infrared
Pfund series	Down to n = 5	Up from n = 5	Far infrared

http://cronodon.com/Atomic/AtomTech3.html

Hydrogen energy-level diagram

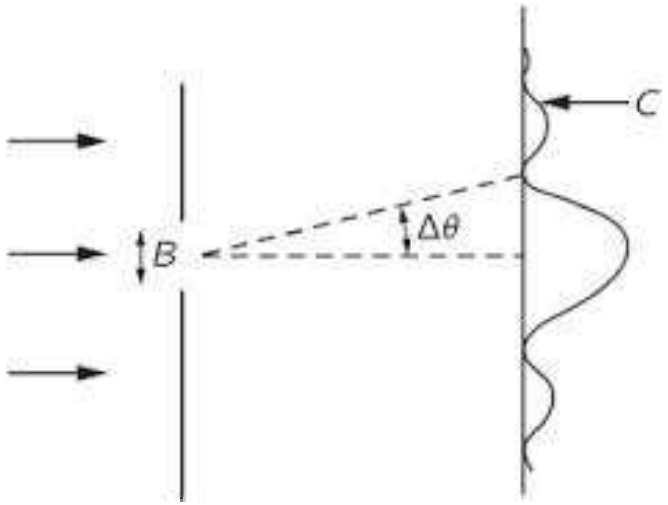


The first three spectral series (Lyman, Balmer and Paschen) are shown in emission. Note that we can talk about electron orbitals as energy levels, with th energy α n.

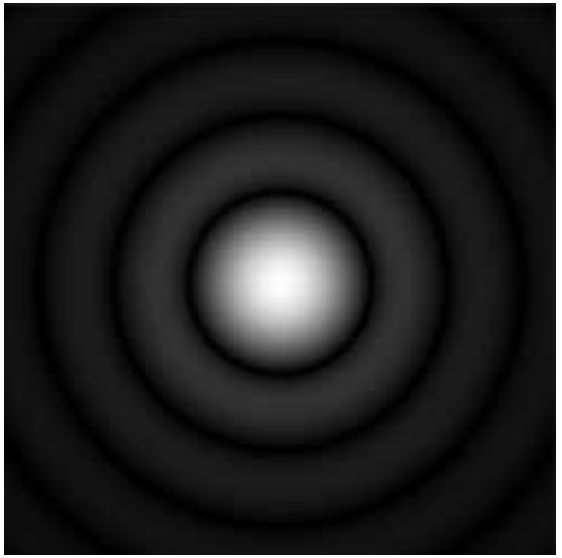
The electronvolt, eV, is a unit of energy,

$$1 \text{ eV} = 1.602 \times 10^{-19} \text{ J}$$

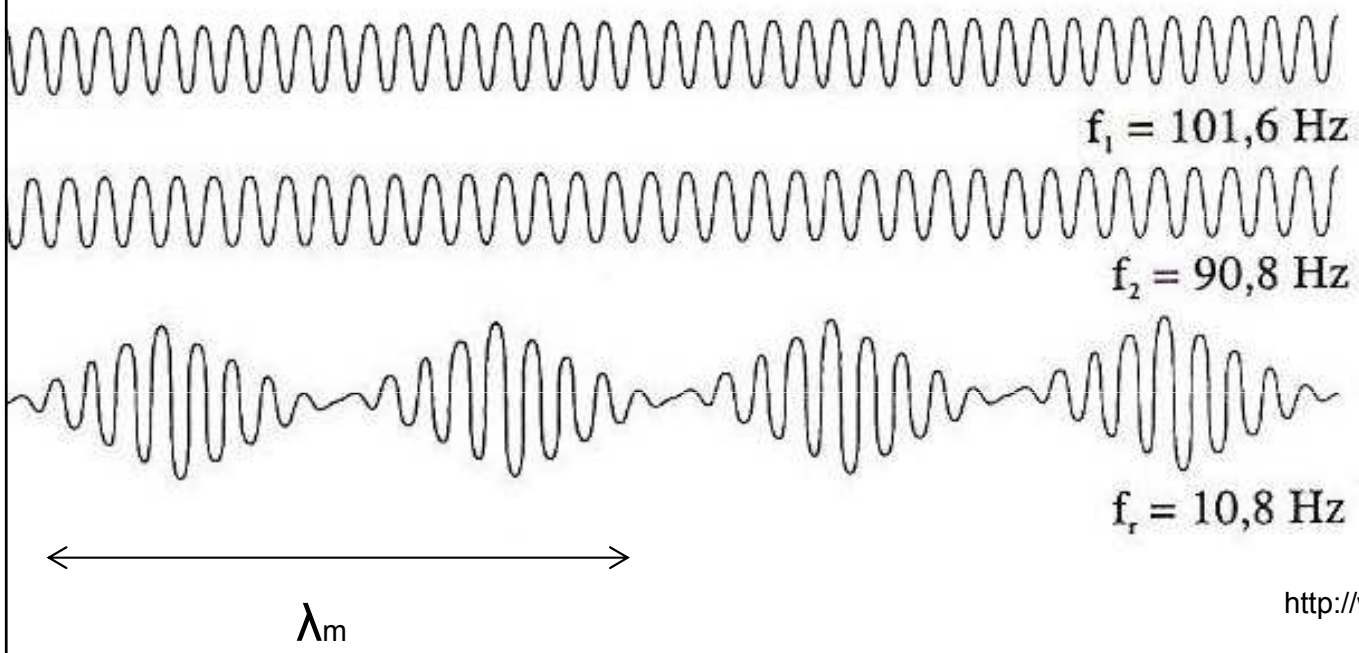
where the Joule (J) is the SI unit of energy and is the preferred unit in A-level, however, the eV is more convenient when talking about atoms! SI units now ccept the eV as a unit



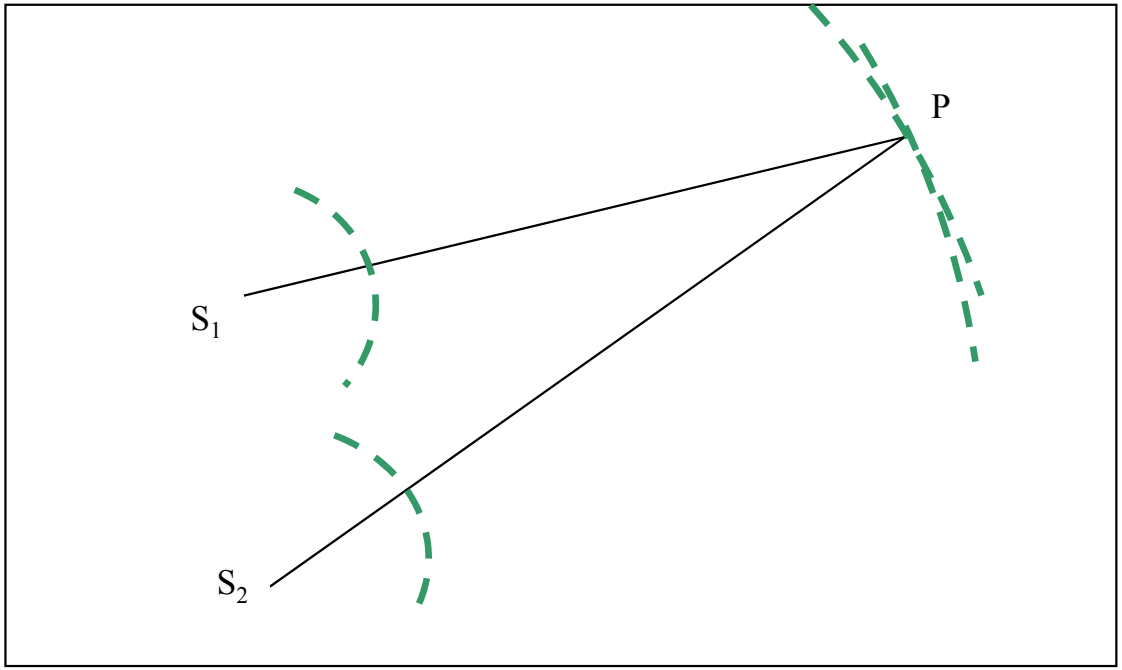
http://www.feynmanlectures.caltech.edu/



http://www.fotoroman.cz/



http://www.oskole.sk/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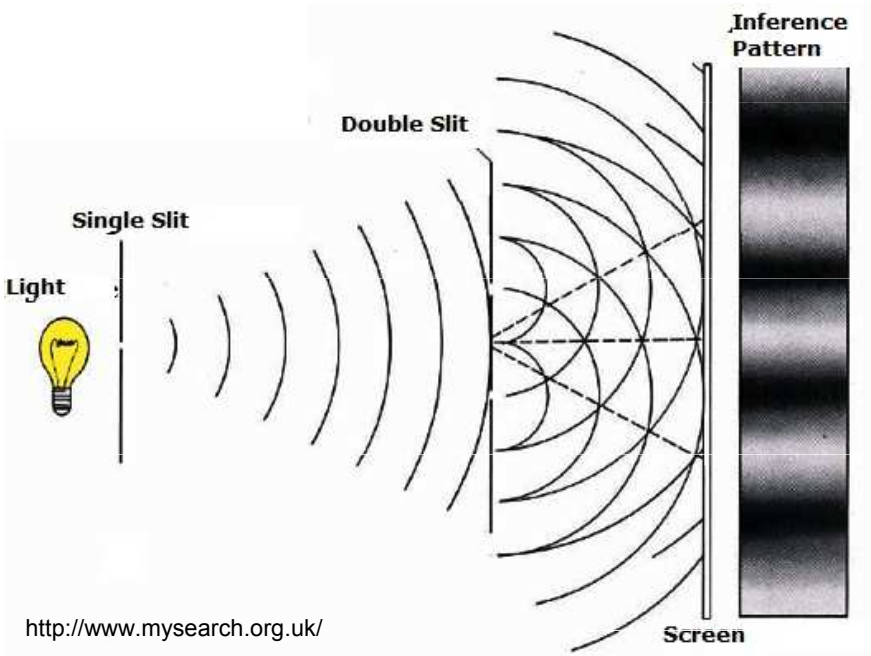
S_2


Inference Pattern
Double Slit
Single Slit
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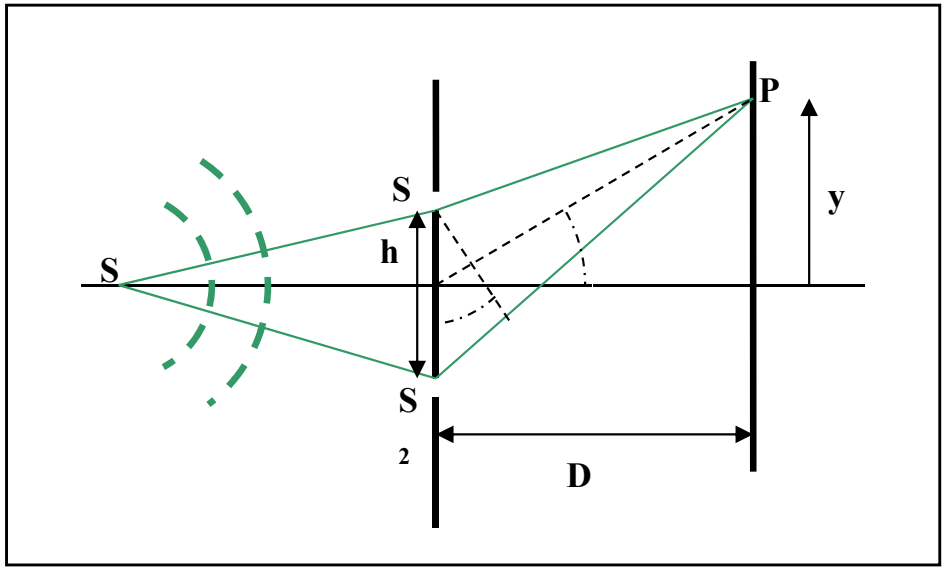
http://www.mysearch.org.uk/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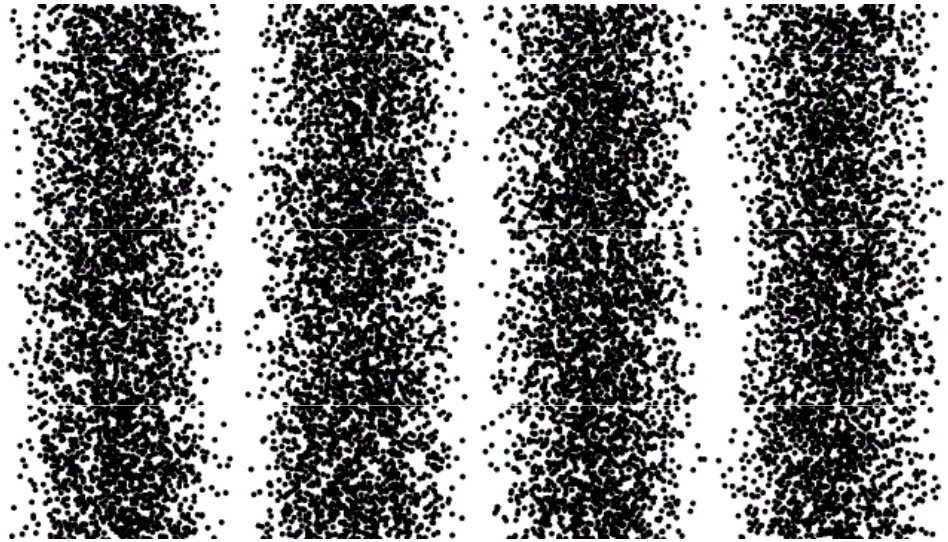
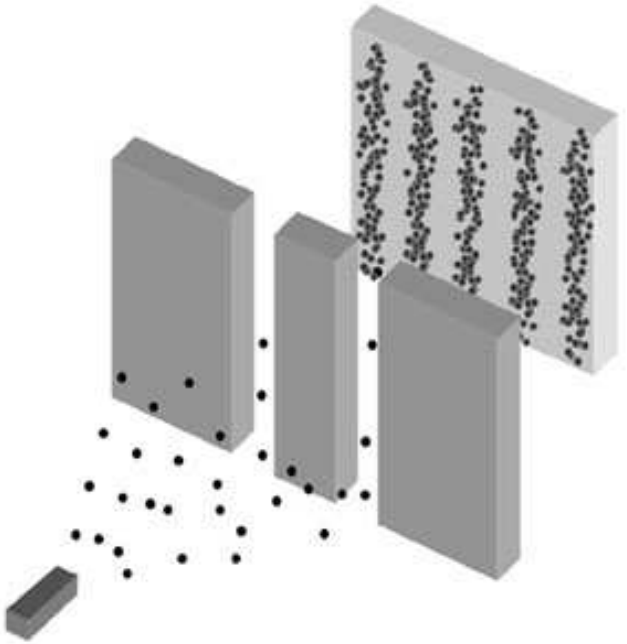
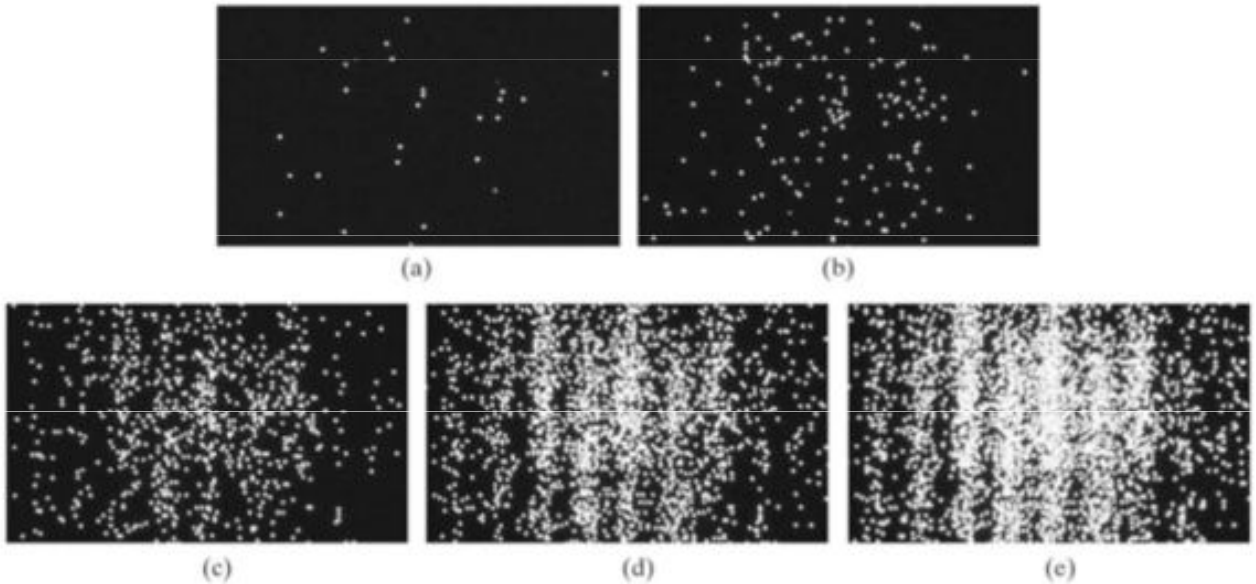


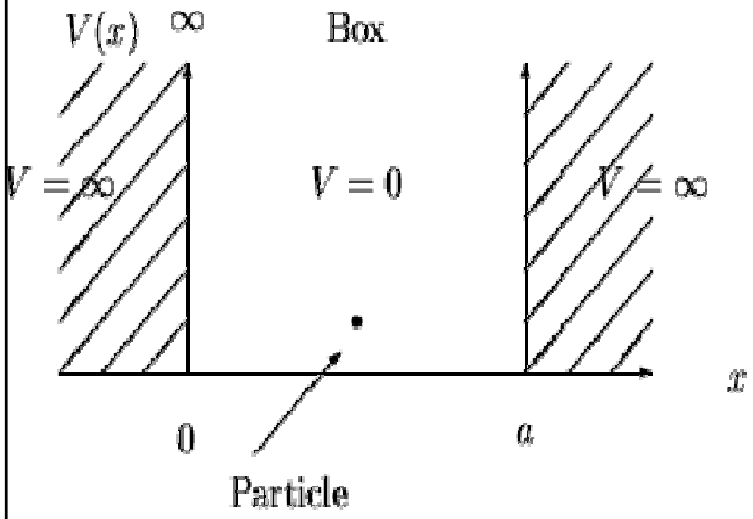
http://en.wikipedia.org/



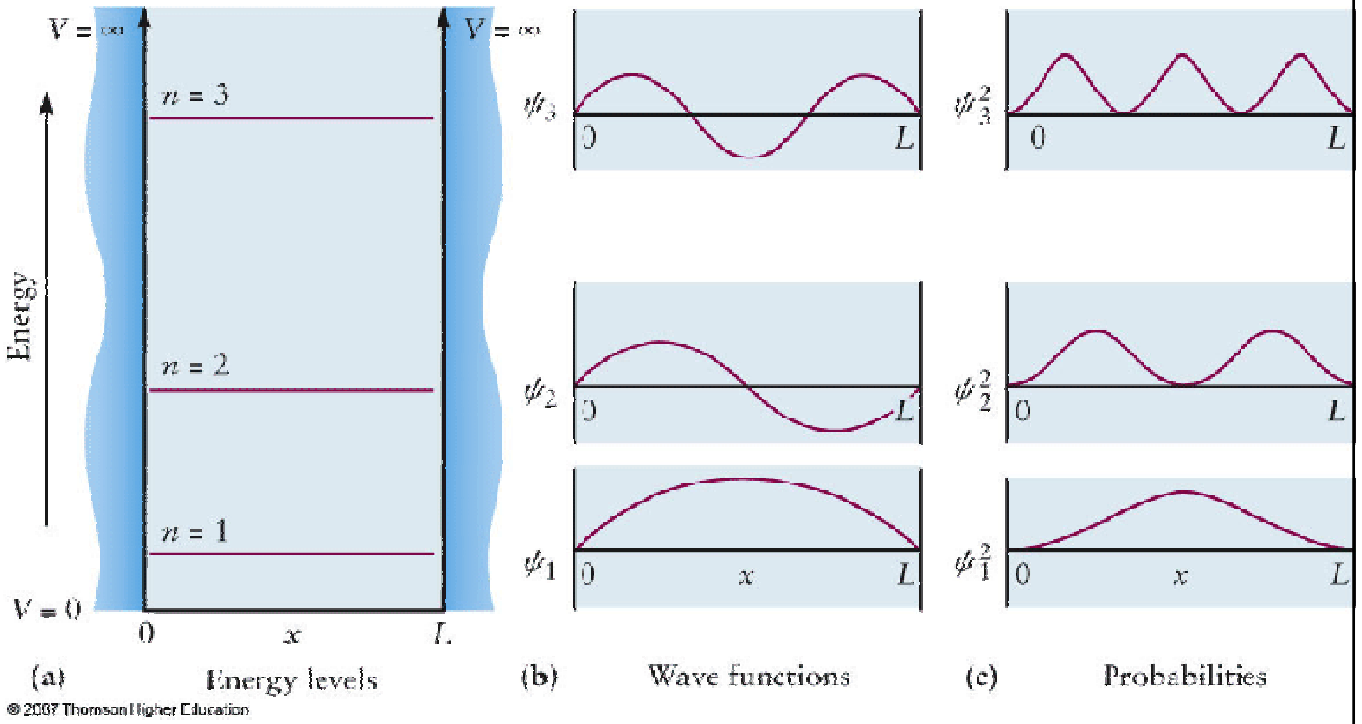
http://www.blacklightpower.com/

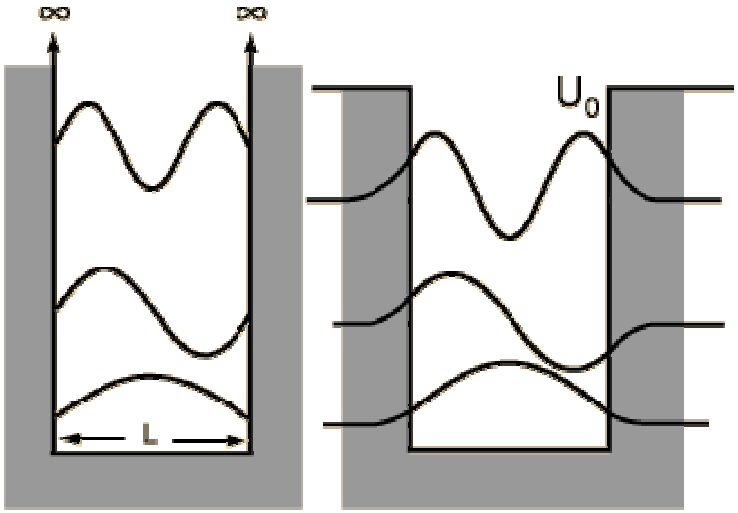


http://physicsforme.wordpress.com/



http://www.nyu.edu/classes/tuckerman/





http://hyperphysics.phy-astr.gsu.edu/hbase/quantum/pbox.html