

Introduction to my two articles Physics is easy and Physics is beautiful

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Abstract. *In the present paper we show, that accurate measurement kinetical energy in high-energy physics will use to determine the exact value of the speed of particles. The exact value of the speed of particles allows us to establish the precise momentum of particles.*

Keywords: mass, kinetic energy, potential energy. leptons. hyperons, mesons, quarks

PACS number: 14.20., 14.40., 14.60. 14.65. 14.70.

Introduction

At present, high-energy physics to measure:

the mass of used units eV/c^2 , keV/c^2 , MeV/c^2 , GeV/c^2 , TeV/c^2 ,....

the momentum of used units eV/c , keV/c , MeV/c , GeV/c , TeV/c ,....

and energy measurement units eV , keV , MeV , GeV , TeV ,....

$$1eV/c^2 = 1,7826759031885020729502594615079e-36 \text{ kg}$$

$$1keV/c^2 = 1,7826759031885020729502594615079e-33 \text{ kg}$$

$$1MeV/c^2 = 1,7826759031885020729502594615079e-30 \text{ kg}$$

$$1GeV/c^2 = 1,7826759031885020729502594615079e-27 \text{ kg}$$

$$1 \text{ kg} = 5,6095446076956307032902231521748e+35 \text{ eV}/c^2$$

$$1 \text{ g} = 5,6095446076956307032902231521748e+32 \text{ eV}/c^2$$

$$1 \text{ mg} = 5,6095446076956307032902231521748e+29 \text{ eV}/c^2$$

$$1 \mu\text{g} = 5,6095446076956307032902231521748\text{e}+26 \text{ eV}/c^2$$

$$1 \text{ ng} = 5,6095446076956307032902231521748\text{e}+23 \text{ eV}/c^2$$

$$1 \text{ pg} = 5,6095446076956307032902231521748\text{e}+20 \text{ eV}/c^2$$

$$1 \text{ fg} = 5,6095446076956307032902231521748\text{e}+17 \text{ eV}/c^2$$

$$1 \text{ ag} = 5,6095446076956307032902231521748\text{e}+14 \text{ eV}/c^2$$

$$1 \text{ zg} = 5,6095446076956307032902231521748\text{e}+11 \text{ eV}/c^2$$

$$1 \text{ yg} = 5,6095446076956307032902231521748\text{e}+8 \text{ eV}/c^2$$

$$1\text{eV}/c = 5,344327908342510737878535957032\text{e}-28 \text{ kgm}/s$$

$$1\text{keV}/c = 5,344327908342510737878535957032\text{e}-25 \text{ kgm}/s$$

$$1\text{MeV}/c = 5,344327908342510737878535957032\text{e}-22 \text{ kgm}/s$$

$$1\text{GeV}/c = 5,344327908342510737878535957032\text{e}-19 \text{ kgm}/s$$

$$1\text{kgm}/s = 1,871142671539665852197730455,3045\text{e}+27 \text{ eV}/c$$

$$1\text{kgm}/s = 1,871142671539665852197730455,3045\text{e}+27 \text{ eV}/c$$

$$1\text{kgm}/s = 1,871142671539665852197730455,3045\text{e}+24 \text{ keV}/c$$

$$1\text{kgm}/s = 1,871142671539665852197730455,3045\text{e}+21 \text{ MeV}/c$$

$$1\text{kgm}/s = 1,871142671539665852197730455,3045\text{e}+18 \text{ GeV}/c$$

$$1\text{eV} = 1,6021764874\text{e}-19 \text{ J}$$

$$1\text{keV} = 1,6021764874\text{e}-16 \text{ J}$$

$$1\text{MeV} = 1,6021764874\text{e-}13 \text{ J}$$

$$1\text{GeV} = 1,6021764874\text{e-}10 \text{ J}$$

$$1\text{TeV} = 1,6021764874\text{e-}7 \text{ J}$$

$$1 \text{ J} = 6,2415096455621596834576040851715\text{e+}18 \text{ eV}$$

$$1 \text{ aJ} = 6,2415096455621596834576040851715 \text{ eV}$$

$$1\text{keV}/c^2 = 1,7826759031885020729502594615079\text{e-}33 \text{ kg}$$

$$1\text{MeV}/c^2 = 1,7826759031885020729502594615079\text{e-}30 \text{ kg}$$

$$1\text{GeV}/c^2 = 1,7826759031885020729502594615079\text{e-}27 \text{ kg}$$

Subject and Methods

Calculation of the kinetic energy of a body moving at the velocity of v , [4] p. 51-52:

$$T_{\text{kin}} = \frac{mc^2}{\cos^2 \vartheta} \left[\ln \left| 1 - \frac{v}{c} \cos \vartheta \right| + \frac{\frac{v}{c} \cos \vartheta}{1 - \frac{v}{c} \cos \vartheta} \right] \quad (3.11)$$

while ϑ isn't $\frac{\pi}{2}, \frac{3\pi}{2}$

For $\vartheta = 0^\circ$ we have the kinetic energy in the direction of motion

$$T_{\text{kin},\vartheta} = mc^2 \left[\ln \left| 1 - \frac{v}{c} \right| + \frac{\frac{v}{c}}{1 - \frac{v}{c}} \right] \quad (3.12)$$

For $\vartheta = 180^\circ$ we have the kinetic energy against the direction of motion

$$T_{\text{kin},\vartheta} = mc^2 \left[\ln \left| 1 + \frac{v}{c} \right| - \frac{\frac{v}{c}}{1 + \frac{v}{c}} \right] \quad (3.13)$$

Modern physics knows very precise values of the kinetic energy of elementary particles

Although not able to accurately determine the speed of the particles, nor their momentum and even mean life time.

It is caused by:

1. incorrect interpretation of Heisenberg uncertainty principle,
2. symmetrical shape of the intensity of moving charge, instead of its nonsymmetrical form
3. using the relativistic formulas

Nonsymmetrical intensity form of moving charge leads to a precise relationship to calculate the kinetic energy of particles and hence to calculate the radius of force reach particles moving at speed v .

$\frac{v}{c}$	ϑ	$\left(1 - \frac{v}{c} \cos \vartheta\right)^2$	$\left[\ln \left 1 - \frac{v}{c} \cos \vartheta \right + \frac{\frac{v}{c} \cos \vartheta}{1 - \frac{v}{c} \cos \vartheta} \right]$	$\frac{\left(1 - \frac{v}{c} \cos \vartheta\right)^2 \cos^2 \vartheta}{c^2 \left[\ln \left 1 - \frac{v}{c} \cos \vartheta \right + \frac{\frac{v}{c} \cos \vartheta}{1 - \frac{v}{c} \cos \vartheta} \right]}$
1e-11	0°	0,9999999998000000000001	5,0000000006666666667416681543e-23	222530,01120330601939454831181967
	180°	1,0000000002000000000001	4,9999999993333333334083307909e-23	222530,01121814135347526322604228
1e-5	0°	0,9999800001	5,0000666674166746667500008571516e-11	2,2252259363145864188235921247326e-7
	180°	1,0000200001	4,9999333340833253334166658095326e-11	2,2253742896554018427675581293938e-7
0,0233369 (proton in neutron W,Z)	0°	0,95387081090161	2,8100659699952059430970892833714e-4	3,7768665310707900771233403029056e-14
	180°	1,04721841090161	2,6404947553600672889486553935683e-4	4,4127624992429437464982818171877e-14
0.1	0°	0,81	0,0057505954532848098836101302717983	1,5672229992958867768557580582592e-15
	180°	1,21	0,0044010888952339509530430323709091	3,0590306169067098339292573093029e-15
0.2	0°	0,64	0,026856448685790244233704909690165	2,6514899427156429718840229295676e-16
	180°	1,44	0,015654890127287959545051358487848	

				1,023460444429690261431424782922e-15
0.3	0°	0,49	0,071896484632696192515932717330244	7,5831041010082209250378340918581e-17
	180°	1,69	0,031595033698260282804726756111724	5,9515005196343703481824982011149e-16
0.4	0°	0,36	0,155841042900675983461152570363	2,5702729699684599169499411202269e-17
	180°	1,96	0,050757950906927216218879124502706	4,2964581329611301988894545783634e-16
0.5	0°	0,25	0,30685281944005469058276787854182	9,065014117223880214546269485867e-18
	180°	2,25	0,072131774774831048644679782131016	3,4706793697167909899464388084794e-16
0.6	0°	0,16	0,58370926812584493481647278823199	3,0498746326261487716129468067033e-18
	180°	2,56	0,095003629245735553650937031148342	2,9981845600126051588427054612182e-16
0.7	0°	0,09	1,1293605290073973407105871155715	8,8668323775081880070263341218428e-19
	180°	2,89	0,11886354517981745505507257495347	2,705252192445077769641876537934e-16
0.8	0°	0,04	2,3905620875658996253992406667738	1,861737976755973251180660244798e-19

	180°	3,24	0,14334222045767456374528669617442	2,5149507033611130483587166590632e-16
0.9	0°	0,01	6,6974149070059543159820085453156	1,6613127176721727837362652705961e-20
	180°	3,61	0,16816967564607898651735176667717	2,3884607536538436609198476438693e-16
0.99	0°	0,0001	94,394829814011908631964017090632	1,1787192775768502566574630137117e-23
	180°	3,9601	0,19064720155047137913293235234825	2,3111828818591121456844826336418e-16
0.999	0°	0,000001	992,09224472101786294794602563595	1,1215187518843090345079018175602e-26
	180°	3,996001	0,1928971805807942771307765797681	2,3049329820443183550806416888995e-16
0.9999	0°	0,00000001	9989,7896596280238172639280341813	1,1137872707672692539054857599486e-29
	180°	3,99960001	0,19312218055996614431315920999989	2,3043211103018486886944999779354e-16
0.99999	0°	0,0000000001	99987,487074535029771579910042727	1,1127892985491280495983883714593e-32
	180°	3,9999600001	0,19314468055994533025072170572902	2,3042600528375412809029012556114e-16

0.999999	0°	0,000000000001	999985,18448944203572589589205127	1,112666540776500800008201783458e-35
	180°	3,999996000001	0,19314693055994530943806547041602	2,3042539483867541993784900262739e-16
0.9999999	0°	0,00000000000001	9999982,8819043490416802118740598	1,1126519607018873842966670804881e-38
	180°	3,99999960000001	0,19314715555994530941725295479213	2,3042533379546304737349677770133e-16
0.99999999	0°	0,0000000000000001	99999980,579319256047634527856068	1,1126502721378755807880843098156e-41
	180°	3,9999999600000001	0,19314717805994530941723214229151	2,304253276911547649541786197633e-16
0.999999999	0°	0,000000000000000001	999999978,27673416305358884383808	1,1126500802240119083800515298461e-44
	180°	3,999999996000000001	0,1931471803099453094172321214785	2,3042532708072406626047258441206e-16
0.9999999999	0°	0,00000000000000000001	9999999975,9741490700595431598201	1,1126500587268548769901809810519e-47
	180°	3,99999999960000000001	0,19314718053494530941723212145806	2,3042532701968099768658409329029e-16
0.99999999999	0°	0,0000000000000000000001	99999999973,671563977065497475802	
	180°	3,9999999999600000000001	0,193147180557445309417232121458	

Coulomb force constant :

$$k_e = \frac{1}{4\pi\epsilon_0} = \frac{c^2 \mu_0}{4\pi} = c^2 \cdot 10^{-7} \text{ H} \cdot \text{m}^{-1}$$

$$= 8.987\ 551\ 787\ 368\ 176\ 4 \times 10^9 \text{ N} \cdot \text{m}^2/\text{C}^2$$

Coulomb force constant: $k_e = 8,987\ 551\ 787\ 368\ 176\ 4\text{e}+9$ $m_e = 9.10938215(45)\times 10^{-31} \text{ kg}$ $-1.602176487(40)\times 10^{-19} \text{ C}$

$m_e = 9,1093821545\text{e}-31 \text{ kg}$ $e = 1,6021764874\text{e}-19 \text{ C}$ $e^2 = 2,56696949677740235876\text{e}-38$

$k_e e^2 / m_e = 253,26384267987327744648929039417$

ELECTRON

v/c	ϑ	$\frac{\left(1 - \frac{v}{c} \cos \vartheta\right)^2 \cos^2 \vartheta}{c^2 \left[\ln \left 1 - \frac{v}{c} \cos \vartheta \right + \frac{\frac{v}{c} \cos \vartheta}{1 - \frac{v}{c} \cos \vartheta} \right]}$	Radius of force reach of electron $r_e = (k_e e^2 / m_e) \times$ $\frac{\left(1 - \frac{v}{c} \cos \vartheta\right)^2 \cos^2 \vartheta}{c^2 \left[\ln \left 1 - \frac{v}{c} \cos \vartheta \right + \frac{\frac{v}{c} \cos \vartheta}{1 - \frac{v}{c} \cos \vartheta} \right]} \text{ [m]}$
1e-11	0°	222530,01120330601939454831181967	56358805,748944533620585462739198
	180°	222530,01121814135347526322604228	56358805,752701787337307007225384
1e-5	0°	2,2252259363145864188235921247326e-7	5,6356927146195112745341478248751e-5
	180°	2,2253742896554018427675581293938e-7	5,6360684399912043860636272385214e-5

0.1	0°	1,5672229992958867768557580582592e-15	3,9692091913795261692429748610406e-13
	180°	3,0590306169067098339292573093029e-15	7,7474184891317665944562648987872e-13
0.2	0°	2,6514899427156429718840229295676e-16	6,7152653171920081003013395502542e-14
	180°	1,023460444429690261431424782922e-15	2,5920552498711426117136110177112e-13
0.3	0°	7,5831041010082209250378340918581e-17	1,9205260840628479434302487907522e-14
	180°	5,9515005196343703481824982011149e-16	1,5072998913138632336398806658147e-13
0.4	0°	2,5702729699684599169499411202269e-17	6,5095720911042268541432179464265e-15
	180°	4,2964581329611301988894545783634e-16	1,0881374966669297431008752447374e-13
0.5	0°	9,065014117223880214546269485867e-18	2,2958403092754191352594658014895e-15
	180°	3,4706793697167909899464388084794e-16	8,7899759388423509608008888808277e-14
0.6	0°	3,0498746326261487716129468067033e-18	7,7242296915076524984672268696567e-16
	180°		

		2,9981845600126051588427054612182e-16	7,5933174273225751416275418610272e-14
0.7	0°	8,8668323775081880070263341218428e-19	2,2456480403260404701829509458201e-16
	180°	2,7052521924450777769641876537934e-16	6,8514256567679244617970506409516e-14
0.8	0°	1,861737976755973251180660244798e-19	4,7151091405627038204692448144038e-17
	180°	2,5149507033611130483587166590632e-16	2,5149507033611130483587166590632e-16
0.9	0°	1,6613127176721727837362652705961e-20	4,2075044277059789792419591578755e-18
	180°	2,3884607536538436609198476438693e-16	6,0491074856043862427085642876938e-14
0.99	0°	1,1787192775768502566574630137117e-23	2,9852697367995728469528649797656e-21
	180°	2,3111828818591121456844826336418e-16	5,8533905779558232539269262326763e-14
0.999	0°	1,1215187518843090345079018175602e-26	2,840401487397554751560630135382e-24
	180°	2,3049329820443183550806416888995e-16	5,8375618415212342167582430481493e-14
0.9999	0°	1,1137872707672692539054857599486e-29	2,8208204412244710124730056860972e-27

	180°	2,3043211103018486886944999779354e-16	5,8360121916339832415148205320058e-14
0.99999 (electron in neutron ...W,Z)	0°	1,1127892985491280495983883714593e-32	2,8182929384359290310322993280433e-30
	180°	2,3042600528375412809029012556114e-16	5,8358575551536354084674977608795e-14
0.999999	0°	1,112666540776500800008201783458e-35	2,8179820373837850370891823292115e-33
	180°	2,3042539483867541993784900262739e-16	5,835842094786997544029465474407e-14
0.9999999	0°	1,1126519607018873842966670804881e-38	2,8179451113265535077795895303551e-36
	180°	2,3042533379546304737349677770133e-16	5,8358405487831440441062556420652e-14
0.99999999	0°	1,1126502721378755807880843098156e-41	2,8179408348044511047847731751605e-39
	180°	2,304253276911547649541786197633e-16	2,304253276911547649541786197633e-16
0.999999999	0°	1,1126500802240119083800515298461e-44	2,8179403487560253326308206162038e-42
	180°	2,3042532708072406626047258441206e-16	5,8358403787230843492041014702241e-14

0.9999999999	0°	1,1126500587268548769901809810519e-47	2,8179402943114993680062623983703e-45
	180°	2,3042532701968099768658409329029e-16	5,8358403771770841376047003464431e-14
0.999999999999	0°	1,1126500563465617904184391792971e-50	2,8179402882830776299113064044206e-48
	180°	2,3042532701357669084215006515694e-16	5,8358403770224841167728590082991e-14
0.99999999999999	0°	1,1126500560854747394245122755733e-53	2,8179402876218385318245268507968e-51
	180°	2,3042532701296626015783621055325e-16	5,835840377007024114692955862223e-14
0,9999999999999999 9999999999999999	0°	1,112650056053618432174089964926e-107	2,8179402875411580239462002254501e-105
	180°	2,3042532701289843452624723622911e-16	5,8358403770053063366841145585626e-14

Coulomb force constant: $k_e = 8,987\ 551\ 787\ 368\ 176\ 4e+9$ $m_p = 1.672621637(83) \times 10^{-27}$ kg $1.602176487(40) \times 10^{-19}$ C

$m_p = 1,67262163783e-27$ kg $e = 1,6021764874e-19$ C $e^2 = 2,56696949677740235876e-38$

$k_e e^2 / m_p = 0,13793179979910179480477042123259$

PROTON

v/c	ϑ	$\frac{\left(1 - \frac{v}{c} \cos \vartheta\right)^2 \cos^2 \vartheta}{c^2 \left[\ln \left 1 - \frac{v}{c} \cos \vartheta \right + \frac{\frac{v}{c} \cos \vartheta}{1 - \frac{v}{c} \cos \vartheta} \right]}$	Radius of force reach of proton $r_p = (k_e e^2 / m_p) \times$ $\frac{\left(1 - \frac{v}{c} \cos \vartheta\right)^2 \cos^2 \vartheta}{c^2 \left[\ln \left 1 - \frac{v}{c} \cos \vartheta \right + \frac{\frac{v}{c} \cos \vartheta}{1 - \frac{v}{c} \cos \vartheta} \right]} \quad \times \quad [m]$
1e-11	0°	222530,01120330601939454831181967	30693,964954586285353106449123719
	180°	222530,01121814135347526322604228	30693,964956632549683480410539001
1e-5	0°	2,2252259363145864188235921247326e-7	3,0692941835551237424441729516075e-8
	180°	2,2253742896554018427675581293938e-7	3,0694988099881725521686709045555e-8
0,0233369 (proton in neutron ...W,Z)	0°	3,7768665310707900771233403029056e-14	5,2094999823158429540570663364243e-15
	180°	4,4127624992429437464982818171877e-14	6,0866027360656180220252868643397e-15
0.1	0°	1,5672229992958867768557580582592e-15	2,1616988897942810802868484599855e-16
	180°	3,0590306169067098339292573093029e-15	4,2193759863049915889774961646583e-16

0.2	0°	2,6514899427156429718840229295676e-16	3,6572477994798595268453791082012e-17
	180°	1,023460444429690261431424782922e-15	1,4116774112337578482747022319377e-16
0.3	0°	7,5831041010082209250378340918581e-17	1,0459511967160137232869970309141e-17
	180°	5,9515005196343703481824982011149e-16	8,2090117817845827137841750663558e-17
0.4	0°	2,5702729699684599169499411202269e-17	3,5452237672273239304428007543138e-18
	180°	4,2964581329611301988894545783634e-16	5,9261820304081729075884236779132e-17
0.5	0°	9,065014117223880214546269485867e-18	1,2503537123929557347570571276018e-18
	180°	3,4706793697167909899464388084794e-16	4,7871705199064921528288026881435e-17
0.6	0°	3,0498746326261487716129468067033e-18	4,2067469723974908737130919224999e-19
	180°	2,9981845600126051588427054612182e-16	4,1354499249241675529787881863041e-17
0.7	0°	8,8668323775081880070263341218428e-19	1,2230181483466531761392096193456e-19
	180°		

		2,705252192445077769641876537934e-16	3,7314030381441566885399300615569e-17
0.8	0°	1,861737976755973251180660244798e-19	2,5679286988828973321312752258476e-20
	180°	2,5149507033611130483587166590632e-16	3,4689167692061529030387698981773e-17
0.9	0°	1,6613127176721727837362652705961e-20	2,2914785317765985872340512127526e-21
	180°	2,3884607536538436609198476438693e-16	3,2944469050099375448096167157544e-17
0.99	0°	1,1787192775768502566574630137117e-23	1,6258287141407200693701902275126e-24
	180°	2,3111828818591121456844826336418e-16	3,1878561455970219181268896828397e-17
0.999	0°	1,1215187518843090345079018175602e-26	1,5469309995584503253958532571062e-27
	180°	2,3049329820443183550806416888995e-16	3,1792355462968361130132017371322e-17
0.9999	0°	1,1137872707672692539054857599486e-29	1,5362668285025896560940309689659e-30
	180°	2,3043211103018486886944999779354e-16	3,1783915805899855770615198617039e-17
0.99999	0°	1,1127892985491280495983883714593e-32	1,5348903074606124747261667140307e-33

	180°	2,3042600528375412809029012556114e-16	3,1783073629305546753111587953902e-17
0.999999	0° 180°	1,112666540776500800008201783458e-35 2,3042539483867541993784900262739e-16	1,5347209854554344202378755150903e-36 3,1782989429517162033291392202101e-17
0.9999999	0° 180°	1,1126519607018873842966670804881e-38 2,3042533379546304737349677770133e-16	1,5347008748961080840136873691309e-39 3,1782981009717013966691478983463e-17
0.99999999	0° 180°	1,1126502721378755807880843098156e-41 2,304253276911547649541786197633e-16	1,534698545829375843516629284865e-42 3,1782980167738786044031148582806e-17
0.999999999	0° 180°	1,1126500802240119083800515298461e-44 2,3042532708072406626047258441206e-16	1,5346982811191296161696339655511e-45 3,1782980083540981120585058219573e-17
0.9999999999	0° 180°	1,1126500587268548769901809810519e-47 2,3042532701968099768658409329029e-16	1,5346982514677140171344231439907e-48 3,1782980075121200806928628555962e-17

0.99999999999	0°	1,1126500563465617904184391792971e-50	1,5346982481845329223324274747877e-51
	180°	2,3042532701357669084215006515694e-16	3,1782980074279222777349867363293e-17
0.9999999999999	0°	1,1126500560854747394245122755733e-53	1,5346982478244108538541054052409e-54
	180°	2,3042532701296626015783621055325e-16	3,1782980074195024974409860061742e-17

$$k_e e^2 / m_p = 0,13793179979910179480477042123259$$

PROTON

v/c	ϑ	$\frac{\left(1 - \frac{v}{c} \cos \vartheta\right)^2 \cos^2 \vartheta}{c^2 \left[\ln \left 1 - \frac{v}{c} \cos \vartheta \right + \frac{\frac{v}{c} \cos \vartheta}{1 - \frac{v}{c} \cos \vartheta} \right]}$	Radius of force reach of proton $r_p = (k_e e^2 / m_p) \times$ $\frac{\left(1 - \frac{v}{c} \cos \vartheta\right)^2 \cos^2 \vartheta}{c^2 \left[\ln \left 1 - \frac{v}{c} \cos \vartheta \right + \frac{\frac{v}{c} \cos \vartheta}{1 - \frac{v}{c} \cos \vartheta} \right]} \quad [m]$
0,0233369 (proton in neutron ...W,Z)	0°	3,7768665310707900771233403029056e-14	5,2094999823158429540570663364243e-15
	180°	4,4127624992429437464982818171877e-14	6,0866027360656180220252868643397e-15

$$k_e e^2 / m_e = 253,26384267987327744648929039417$$

ELECTRON

v/c	ϑ	$\frac{\left(1 - \frac{v}{c} \cos \vartheta\right)^2 \cos^2 \vartheta}{c^2 \left[\ln \left 1 - \frac{v}{c} \cos \vartheta \right + \frac{\frac{v}{c} \cos \vartheta}{1 - \frac{v}{c} \cos \vartheta} \right]}$	Radius of force reach of electron $r_e = (k_e e^2 / m_e) \times$ $\frac{\left(1 - \frac{v}{c} \cos \vartheta\right)^2 \cos^2 \vartheta}{c^2 \left[\ln \left 1 - \frac{v}{c} \cos \vartheta \right + \frac{\frac{v}{c} \cos \vartheta}{1 - \frac{v}{c} \cos \vartheta} \right]} \quad [m]$
0.99999 (electron in neutron ...W,Z)	0°	1,1127892985491280495983883714593e-32	2,8182929384359290310322993280433e-30
	180°	2,3042600528375412809029012556114e-16	5,8358575551536354084674977608795e-14

In neutron:

$$\text{Re orbit} = 0,999994396591c / 138538364588050870918387289,29769 = 2,1639549379096690127802754046778e-18 \text{ m/rad}$$

$$\text{Rp orbit} = \text{Re orbit} / 42,850352057551791567501064480165 = 5,0500283755038633241814022901928e-20 \text{ m/rad}$$

Calculation of radius of force reach of Earth in the gravitational field of Sun

Orbital speed of Earth around of Sun $v=29,77\text{km/s}$ $v/c = 9,9302031140489865158649187899183\text{e-5}$

$(1-v/c) = 0,9999006979688595101348413508121$ $(1-v/c)^2 = 0,99980140579861240889650161170161$

$1+v/c = 1,0000993020311404898651586491879$ $1-v/c = 0,9999006979688595101348413508121$

in direction of motion $[\ln |1-v/c| + (v/c) / (1-v/c)] = 4,931099571743949067190802725819\text{e-9}$

against direction of motion $[\ln |1+v/c| - (v/c) / (1+v/c)] = 4,9297939627386990737581874445081\text{e-9}$

$$G = (6,6742 \pm 0,0010) \cdot 10^{-11} \frac{\text{m}^3}{\text{kg s}^2}$$

G = 6,67428e-11

The gravitational constant **G = 6,67428e-11** In SI units, the CODATA recommended 2006 $M_s = 1,9891\text{e+30 kg}$

$r_{id} = \{ 6,67428\text{e-11} * M_s (1-v/c)^2 / \{c^2 * []\} = \{ 6,67428\text{e-11} * 1,9891\text{e+30} * 0,99980140579861240889650161170161\} /$

$/ \{ 89875517873681764 * 4,931099571743949067190802725819\text{e-9} \} = 132731738490461658220,69383357619 / 443185127,69717778633633910997741 =$

$= 299495019564,725563233533090519 \text{ m} = 2,99495019564,725563233533090519\text{e+11 m}$

$r_{ad} = \{ 6,67428\text{e-11} * M_s (1-v/c)^2 / \{c^2 * []\} = \{ 6,67428\text{e-11} * 1,9891\text{e+30} * 0,99980140579861240889650161170161\} /$

$/ \{ 89875517873681764 * 4,9297939627386990737581874445081\text{e-9} \} =$

$= 132731738490461658220,69383357619 / 443067785,41169040068353510738428 = 299574337969,82052980311726897379 \text{ m} =$

$= 2,9957433796982052980311726897379\text{e+11 m}$

147+152 = 299 milion km $R_{z-s} = 0,5 * 299 \text{ milion km}$ $R_{z-s} = 1,5\text{e+11m}$

Galactic period $2,26 \times 10^8$ a = 2,26e+8 a 1 a = The Julian year is, therefore, on average 365.25 days long

1 a = 31 556 925,4 s It is 20 minutes shorter than the sidereal year $20 * 60 = 1200$ s $31 556 925,4$ s + 1200 s = 31 558 125,4 s

$2,26e+8 * 31 558 125,4$ s = 7132136340400000 s $2,26e+8 * 31 556 925,4$ s = 7131865140400000 s

Orbital speed of Sun in GALAXY $v = 217$ km/s **Orbital radius of Sun in GALAXY $R_{S-G} = 2,5e+17$ km = $2,5e+20$ m**

$2 * \pi * 2,5e+17$ km = 1570796326794896619,2313216916398 km = 1,5707963267948966192313216916398e+18 km

$1,5707963267948966192313216916398e+18$ km / 7131865140400000 s = 220,25042480076908034621278039205 km/s

Calculation of radius of force reach of Sun in the gravitational field GALAXY Sun – GALAXY :

Speed of Sun around center of Galaxy $v = 217$ km/s $v/c = 7,2383408657998994757900147041057e-4$

$(1-v/c) = 0,99927616591342001005242099852959$ $(1-v/c)^2 = 0,9985528557626249151932255235164$

in direction of motion $[\ln |1-v/c| + (v/c) / (1-v/c)] = 2,6222092687501056683610098932237e-7$

$v/c = 7,2383408657998994757900147041057e-4$ $1+v/c = 1,0007238340865799899475790014704$

against direction of motion $[\ln |1+v/c| - (v/c) / (1+v/c)] = 2,6171526978337756549521716609342e-7$

GALAXY Mass $7.0 \times 10^{11} M_{\odot}$ (1.4×10^{42} kg) $7e+11 * 1,9891e+30$ kg = $1,39237e+42$ kg

The gravitational constant **$G = 6,67428e-11$** In SI units, the CODATA recommended 2006 **$M_s = 1,9891e+30$ kg**

$r_{id} = \{ 6,67428e-11 * M_s (1-v/c)^2 \} / \{ c^2 * [] \} = \{ 6,67428e-11 * 1,39237e+42 * 0,9985528557626249151932255235164 \} /$

$\{ 89875517873681764 * 2,6222092687501056683610098932237e-7 \} = 92796188348908850965353920772140 / 23567241600,208411024731870231558 =$

$= 3937507406385999412502,2966641138$ m = **$3,9375074063859994125022966641138e+21$ m**

Sun's distance to galactic center **26,400±1,600 light years** 1 light-year = 9.461×10¹² km = 9.461×10¹⁵ m 1 light-year = 9,461e+15 m

26 400*9,461e+15 m = 249770400000000000000 = 2,49770400000000000000e+20 m **R_{S-G} =2,5e+17 km =2,5e+20 m**

Diameter GALAXY = 100 000 light years =9,461e+20 m Radius GALAXY = 4,7305e+20 m

Radius of force reach of Sun **r_{id} = 3,9375074063859994125022966641138e+21 m** **r_{ad} = 3,945115019594982313836,7757809177e+21 m**

r_{ad} = { 6,67428e-11 * M_s (1-v/c)^2 / {c^2 * []} = { 6,67428e-11 * 1,39237e+42 * 0,9985528557626249151932255235164 } /

{ 89875517873681764 * 2,6171526978337756549521716609342e-7} =

= 92796188348908850965353920772140 / 23521795407,231395275161213129806 =

= 3945115019594982313836,7757809177 m = 3,945115019594982313836,7757809177e+21 m

Interaction	Relative Strength	Radius of force reach calculation [m]	ϑ	Radius of force reach formula [m]	v/c
Strong QCD	10 ³⁸	2,1616988897942810802868484599855e-16	0°	Radius of force reach of proton $r_p = (k_e e^2 / m_p) \times$ $\frac{\left(1 - \frac{v}{c} \cos \vartheta\right)^2 \cos^2 \vartheta}{c^2 \left[\ln \left 1 - \frac{v}{c} \cos \vartheta \right + \frac{\frac{v}{c} \cos \vartheta}{1 - \frac{v}{c} \cos \vartheta} \right]}$	(0,06 –) 0,1 u,d quarks
		4,2193759863049915889774961646583e-16	180°		(0,5 – 0,78) 0,7 c,s quarks
		1,2230181483466531761392096193456e-19	0°		(0,8665) 0,9 b quark
		3,7314030381441566885399300615569e-17	180°		(0,994637- -0,994766) 0,99
		2,2914785317765985872340512127526e-21	0°		
		3,2944469050099375448096167157544e-17	180°		
		1,6258287141407200693701902275126e-24	0°		
			180°		

		3,1878561455970219181268896828397e-17			t quark	
Electromagnetic QED	10 ³⁶	56358805,748944533620585462739198	0°	Radius of force reach of electron $r_e=(k_e e^2/m_e) \times$ $\frac{\left(1 - \frac{v}{c} \cos \vartheta\right)^2 \cos^2 \vartheta}{c^2 \left[\ln \left 1 - \frac{v}{c} \cos \vartheta \right + \frac{\frac{v}{c} \cos \vartheta}{1 - \frac{v}{c} \cos \vartheta} \right]}$ x	1e-11 (- 0,682) electron	
		56358805,752701787337307007225384	180°		0,6 electron	
		7,7242296915076524984672268696567e-16	0°		0,9953 muon	
		7,5933174273225751416275418610272e-14	180°		0,99971 tauon	
		2,9852697367995728469528649797656e-21	0°			
		5,8533905779558232539269262326763e-14	180°			
Weak	10 ²⁵	2,840401487397554751560630135382e-24	0°	Radius of force reach of proton $r_p=(k_e e^2/m_p) \times$ $\frac{\left(1 - \frac{v}{c} \cos \vartheta\right)^2 \cos^2 \vartheta}{c^2 \left[\ln \left 1 - \frac{v}{c} \cos \vartheta \right + \frac{\frac{v}{c} \cos \vartheta}{1 - \frac{v}{c} \cos \vartheta} \right]}$ x	0,0233369 (proton in neutron ...W,Z)	
		5,8375618415212342167582430481493e-14	180°			
		5,2094999823158429540570663364243e-15	0°			
		Rp orbit= = 5,0500283755038633241814022901928e-20 m/rad	180°			
		6,0866027360656180220252868643397e-15	180°	Radius of force reach of electron $r_e=(k_e e^2/m_e) \times$ $\frac{\left(1 - \frac{v}{c} \cos \vartheta\right)^2 \cos^2 \vartheta}{c^2 \left[\ln \left 1 - \frac{v}{c} \cos \vartheta \right + \frac{\frac{v}{c} \cos \vartheta}{1 - \frac{v}{c} \cos \vartheta} \right]}$ x	0.99999 (electron in neutron ...W,Z)	
		2,8182929384359290310322993280433e-30	0°			
Gravitation	1	Re orbit = =2,1639549379096690127802754046778e-18 m/rad	180°			
		5,8358575551536354084674977608795e-14	180°			
		Calculation of radius of force reach of Earth in the gravitational field of Sun r_{id}=2,99495019564,725563233533090519e+11 r_{ad}=2,99574337969820529803117268974e+11	0° 180°	Radius of force reach of Earth in the gravitational field of Sun r_{id}={ 6,67428e-11 * M_s (1-v/c)^2 / {c^2 * []} r_{ad}={ 6,67428e-11 * M_s (1-v/c)^2 / {c^2 * []}	9,9302031140489 86515864918789 9183e-5 (Earth around of Sun: v=29,77km/s)	
Calculation of radius of force reach of Sun in the gravitational field of GALAXY		Radius of force reach of Sun in the gravitational field of GALAXY	7,2383408657998			

		$r_{id}=3,9375074063859994125022966641138e+21$ $r_{ad}=3,945115019594982313836,775780917e+21$	$r_{id}=\{ 6,67428e-11 * M_G (1-v/c)^2 \} / \{ c^2 * [] \}$ $r_{ad}=\{ 6,67428e-11 * M_G (1-v/c)^2 \} / \{ c^2 * [] \}$	99475790014704 1057e-4 (Sun in GALAXY $v = 217 \text{ km/s}$)
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$k_e e^2 / m_p = 0,13793179979910179480477042123259$ for PROTON,

$k_e e^2 / m_e = 253,26384267987327744648929039417$ for ELECTRON

v/c	ϑ	$\frac{\left(1 - \frac{v}{c} \cos \vartheta\right)^2 \cos^2 \vartheta}{c^2 \left[\ln \left 1 - \frac{v}{c} \cos \vartheta \right + \frac{\frac{v}{c} \cos \vartheta}{1 - \frac{v}{c} \cos \vartheta} \right]}$	Radius of force reach of proton $r_p = (k_e e^2 / m_p) \times$ $\frac{\left(1 - \frac{v}{c} \cos \vartheta\right)^2 \cos^2 \vartheta}{c^2 \left[\ln \left 1 - \frac{v}{c} \cos \vartheta \right + \frac{\frac{v}{c} \cos \vartheta}{1 - \frac{v}{c} \cos \vartheta} \right]} \text{ [m]}$
0,0233369 (proton in neutron ...W,Z)	0°	3,7768665310707900771233403029056e-14	5,2094999823158429540570663364243e-15
	180°	4,4127624992429437464982818171877e-14	6,0866027360656180220252868643397e-15

$$k_e e^2 / m_e = 253,26384267987327744648929039417$$

ELECTRON

v/c	ϑ	$\frac{\left(1 - \frac{v}{c} \cos \vartheta\right)^2 \cos^2 \vartheta}{c^2 \left[\ln \left 1 - \frac{v}{c} \cos \vartheta \right + \frac{\frac{v}{c} \cos \vartheta}{1 - \frac{v}{c} \cos \vartheta} \right]}$	Radius of force reach of electron $r_e = (k_e e^2 / m_e) \times$ $\frac{\left(1 - \frac{v}{c} \cos \vartheta\right)^2 \cos^2 \vartheta}{c^2 \left[\ln \left 1 - \frac{v}{c} \cos \vartheta \right + \frac{\frac{v}{c} \cos \vartheta}{1 - \frac{v}{c} \cos \vartheta} \right]} \quad [m]$
0.99999 (electron in neutron ...W,Z)	0°	1,1127892985491280495983883714593e-32	2,8182929384359290310322993280433e-30
	180°	2,3042600528375412809029012556114e-16	5,8358575551536354084674977608795e-14
	0°		
	180°		

Subject and Methods

Calculation of the kinetic energy of a body moving at the velocity of v , [4] p. 51-52:

$$T_{\text{kin}} = \frac{mc^2}{\cos^2 \vartheta} \left[\ln \left| 1 - \frac{v}{c} \cos \vartheta \right| + \frac{\frac{v}{c} \cos \vartheta}{1 - \frac{v}{c} \cos \vartheta} \right] \quad (3.11)$$

while ϑ isn't $\frac{\pi}{2}$, $\frac{3\pi}{2}$

For $\vartheta = 0^\circ$ we have the kinetic energy in the direction of motion

$$T_{\text{kin}_d} = mc^2 \left[\ln \left| 1 - \frac{v}{c} \right| + \frac{\frac{v}{c}}{1 - \frac{v}{c}} \right] \quad (3.12)$$

For $\vartheta = 180^\circ$ we have the kinetic energy against the direction of motion

$$T_{\text{kin}_a} = mc^2 \left[\ln \left| 1 + \frac{v}{c} \right| - \frac{\frac{v}{c}}{1 + \frac{v}{c}} \right] \quad (3.13)$$

Comparing the kinetic energies of the baryon and proton we calculate the speed of proton.

Results

1. Leptons (electron, muon, tau), W + - Z bosons and neutrinos (electron neutrino , muon neutrino, tau neutrino) can be replaced with electron moving at different speeds from 0.1c up to 0.999.. c .
2. Hyperons, mesons and quarks can be replaced by proton and neutron (or alpha particle respectively) moving at different speeds from 0.1c up to 0.999.. c .

Discussion

In my two articles Physics is easy and Physics is beautiful we show:

Thus, all particles, which are currently known, can be replaced by the various fast moving electron or proton (or alpha particle respectively).

Electron and proton are the only stable fundamental elementary particles.

$$t \rightarrow b \rightarrow c \rightarrow s \rightarrow u \leftrightarrow d$$

This decay of quarks actually means a reduction of the speed of proton or alfa particle.

QUARKS = different speeds proton (or alfa particle) = proton (or alfa particle) of different speeds

A pair of quarks of one generation = one speed of proton:

u,d quarks are in the proton at speed of proton :

from $v= 0,05875c$ to $v= 0,105065c$ down – up,

c,s quarks are in the proton at speed of proton

from $v=0,5111c$ to $v=0,7805c$:

t quark is in the proton (neutron or alfa particle) at speed of proton (neutron or alfa particle):

$v=0,994637c$ for *Top quark*: 169 100MeV

$v=0,994766c$ for *Top quark*: $173\ 400\text{MeV}/c^2$

b quark is in the proton (neutron or alfa particle) at speed of proton (neutron or alfa particle):

$v=0,8665c$ pre $4,2\ \text{GeV}$ *Bottom quark*

Leptons (electron, muon, tau), W + - Z bosons and neutrinos (electron neutrino , muon neutrino, tau neutrino) can be replaced with electron moving at different speeds from $0.001c$ up to $0.999.. c$:

Electron, electron neutrino are in the electron at speed of electron :

from $v=0.001c$ to $v=0.9c$ odhad

Muon, muon neutrino are in the electron at speed of electron :

$v=0,995308032046c$

Tauon, tauon neutrino are in the electron at speed of electron : $v=0,99971316674c$

W + - boson and neutrino are in the electron at speed of electron :

$v=0,99999364465781184c$

Z boson and neutrino are in the electron at speed of electron : $v=0,999994396590953c$

Hyperons, mesons and quarks can be replaced by proton and neutron (or alpha particle respectively) moving at different speeds from $0.1c$ up to $0.999.. c$. :

Lambda hyperón $2286,46\ \text{MeV}$ and pion π^0 : $134.9766(6)\ \text{MeV}$ are in the proton at speed of proton $v=0,8022863362c$

hyperon $\text{Chí } c(2645)^+$ $2646,6\text{MeV}$ and pion π^\pm : $139.57018(35)\ \text{MeV}$ are in the proton at speed of proton $v=0,819183027c$

hyperon $6,165\ \text{GeV}$ and meson K^- $493.7\ \text{MeV}$ are in the **alpha particle at speed of **alpha particle** $v=0,7533c$**

Thus, all particles, which are currently known, can be replaced by the various fast moving electron or proton (or alpha particle respectively).

Electron , proton and alfa particle are the only stable fundamental elementary particles.

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