Calculate Universe 3 – Planck Units

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Abstract. This article is about relations between fundamental physical constants. The mass, radius and cycle of the universe are the basis for calculating Planck units.

This article is the continuation of articles [2] and [3] that show relations between fundamental physical constants. The Planck unit values are added here. Results in Table 1 are presented in such a way that all the values derive from the preceding ones.

Only two physical constants (**ά**-inverse fine structure constant**, μ**-proton-electron mass ratio) are the knowns and all the relations are calculated using them. Instead of π, $\pi'=2\pi$ is used, as it is a more natural value.

The term cycle is used in two senses: as the mathematical cycle c=exp(2π) and as cycle of universe T_u=13.7 billion years (instead "the age of the universe"). Moreover, the lower-case "c" is used twice: for the mathematical cycle (hereinafter: "cycle") and for the speed of light. From the very relations it is clear which of the values is in question. For example, the cycle is always in the exponent. Cycle of universe has dimension of time, while mathematical cycle is dimensionless.

Table 1 shows the calculation of physical constants using the known formulas. Relations marked in blue give the value of the physical quantity based only on the knowns: mass, radius and the cycle of the Universe and the constants **c=exp (π ') - mathematical cycle** and

$$p=c/2-(\mu/ά+1)/(\mu/ά+2)-1$$

.Relations in Table 1 also show the dimensions of physical quantities. For example, from the relation:

$$\text{energy } E_{pl}=M_u R_u^{2} T_u^{-2} {}^{*} 2^{-c/4-p/4}\pi'^{-3/4}$$

It is clear that the dimensions $M_u R_u^{2} T_u^{-2}$ actually $ML^{2}T^{-2}$ because the other values (p,c,π') are dimensionless. So all the blue values have been reduced to a mass-length-time.

Constants or Ratio	dimensionless	dimensionless
two pi π'=	6.28318530718	6.28318530718
Cycle c=exp(π')=	535.49165552477	535.49165552477
inverse fine structure constant $\acute{\alpha}$=	137.03599907400	137.03599907400
proton-electron mass ratio μ=	1836.15267245006	1836.15267245006
ratio $\beta=\mu/(\pi'\acute{\alpha})$=	2.13252558500	2.13252558500

Constants or Relations / System of measure	natural(Mu,Ru,Tu=1)	kg-m-sec
Mass universe M_u=	1	1.73944911962E+53
Radius universe R_u=	1	1.29165299384E+26
Cycle of universe T_u=	1	4.30849062202E+17
$p=c/2-(\mu/\acute{\alpha}+1)/(\mu/\acute{\alpha}+2)-1$	**265.81076681886**	**265.81076681886**
proton mass $m_p= M_u*2^{-p}$	9.6158131798E-81	1.67262177700E-27
electron mass $m_e=m_p/\mu$=	5.2369355359E-84	9.10938290751E-31
Classical electron radius $r_e=R_u*\beta*2^{-c/2+p/2}\pi'^{-1/2}$	2.18165431439E-41	2.81794032671E-15
speed of light $c=R_u*T_u^{-1}$=	1	2.9979245800E+08
Universal gravitational constant $G=M_u^{-1}R_u^3T_u^{-2}$	1	6.67383601081E-11
Proton Compton wavelength $\lambda_c=R_u*2^{-c/2+p/2}\pi'^{-1/2}$	1.0230378148E-41	1.32140985624E-15
Rydberg cons. $R_\infty=R_u^{-1}*2^{c/2-p/2-\ln\pi'/2\ln2-1}\beta^{-1}\acute{\alpha}^{-3}$	1.4174253234E+33	1.0973731569E+07
reduced Planck constant $\hbar=cm_p\lambda_c/\pi'$	1.5656613679E-122	1.05457172584E-34
$\hbar=M_u*R_u^2*T_u^{-1}*2^{-c/2-p/2}*\pi'^{-3/2}$	1.5656613679E-122	1.05457172584E-34

Planck units	natural(M_u,R_u,T_u=1)	kg-m-sec
mass $m_{pl}=M_u*2^{-c/4-p/4}*\pi'^{-3/4}$	1.25126390816E-61	2.17650990345E-08
length $l_{pl}=R_u*2^{-c/4-p/4}*\pi'^{-3/4}$	1.25126390816E-61	1.61619877306E-35
time $t_{pl}=T_u*2^{-c/4-p/4}*\pi'^{-3/4}$	1.25126390816E-61	5.39105881395E-44
area $A_{pl}=R_u^2\,2^{-c/2-p/2}\pi'^{-3/2}$	1.56566136785E-122	2.61209847403E-70
volume $V_{pl}=R_u^3\,2^{-3c/4-3p/4}\pi'^{-9/4}$	1.95905556199E-183	4.22167034884E-105
density $\rho_{pl}=M_u*R_u^{-3}*2^{c/2+p/2}*\pi'^{3/2}$	6.38707718369E+121	5.15556574438E+96
energy $E_{pl}=M_uR_u^2T_u^{-2}\,2^{-c/4-p/4}\pi'^{-3/4}$	1.25126390816E-61	1.95614954730E+09
force $F_{pl}=M_uR_uT_u^{-2}$	1	1.21033970568E+44
momentum $M_{pl}=M_uR_uT_u^{-1}\,2^{-c/4-p/4}*\pi'^{-3/4}$	1.25126390816E-61	6.52501253818
power $P_{pl}=M_uR_u^2T_u^{-3}$	1	3.62850715380E+52
pressure $p_{pl}=M_uR_u^{-1}T_u^{-2}\,2^{c/2+p/2}*\pi'^{3/2}$	6.3870771837E+121	4.6335914121E+113
charge $q_{pl}=M_u^{1/2}R_u^{3/2}T_u^{-1}\,2^{-c/4-p/4}*\pi'^{-3/4}$	1.25126390816E-61	1.77806819281E-13
current $I_{pl}=M_u^{1/2}R_u^{3/2}T_u^{-2}$	1	3.2981799201E+30
electric potential $U_{pl}=M_u^{1/2}R_u^{1/2}T_u^{-1}$	1	1.1001544008E+22
impedance $Z_{pl}=R_u^{-1}T_u$	1	3.3356409520E-09
capacitance $C_{pl}=R_u*2^{-c/4-p/4}*\pi'^{-3/4}$	1.25126390816E-61	1.6161987731E-35
mag. flux density $B_{pl}=M_u^{1/2}R_u^{-3/2}*2^{c/4+p/4}*\pi'^{3/4}$	7.9919191586E+60	2.2705870924E+48
magnetic flux $\Phi_{pl}=M_u^{1/2}R_u^{1/2}\,2^{-c/4-p/4}*\pi'^{-3/4}$	1.2512639082E-61	5.9309970793E-22

Table 1. Relations

Relations

The values in the third column are obtained by simple conversion, by using the three well-known values containing m, kg and sec. Of course, the same conversion can be applied to any other system of measurement units.

Using the values from Table 1, all the other physical quantities that are obtained from the table parameters can be calculated.

The Appendix 1 presents the additional formulas that show relations among Planck units. The confusion is possible due to the different definition of electromagnetic quantities. Since the author is not a specialist in that field, referring to possible errors is welcome.

The crucial innovation is the introduction of the notion of the Cycle and its connection to the proton as the basis of the material world. Related to that is the appearance of mathematical constants **π', exp(π'), ln(2)**), and also **2,1/3, 2/3, ½, ¾, 3/8** in the article.

It is possible to explore the distribution of these coefficients in the exponents of M_u, R_u, T_u and 2 and to find the deeper principles of their occurrences.

Of great importance is the view, I hope commonly accepted, that parts are dependent on the whole (the Universe), parallel to being its integral part. Results are as accurate as the accuracy of two input dimensionless values **ά, μ** taken from [1].

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References:

1. CODATA internationally recommended values of the Fundamental Physical Constants, (2010) values of the constants.

2. Branko Zivlak, Calculate Universe 1, viXra: 1303.0209

3. Branko Zivlak, Calculate Universe 2, viXra: 1304.0051

4. Wikipedia

Appendix 1

Constants or Ratio	dimensionless	dimensionless
two pi $\pi'=$	6.28318530718	6.28318530718
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speed of light $c=R_u*T_u^{-1}=$	1	2.99792458000E+08
Universal gravitational constant $G=M_u^{-1}R_u^{3}T_u^{-2}$	1	6.67383601081E-11
Proton Compton wavelength $\lambda_c=R_u*2^{-c/2+p/2}\pi'^{-1/2}$	1.0230378148E-41	1.32140985624E-15
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$\hbar=M_u*R_u^{2}*T_u^{-1}*2^{-c/2-p/2}*\pi'^{-3/2}$	1.5656613679E-122	1.05457172584E-34
square elementary charge $e^2=m_ec^2r_e$	1.1425183006E-124	2.3070773517E-28
$e^2=Gm_{pl}^{2}/\acute{\alpha}$	1.1425183006E-124	2.3070773517E-28

Planck units	natural($M_u,R_u,T_u=1$)	kg-m-sec
mass $m_{pl}=M_u*2^{-c/4-p/4}*\pi'^{-3/4}$	1.25126390816E-61	2.17650990345E-08
length $l_{pl}=R_u*2^{-c/4-p/4}*\pi'^{-3/4}$	1.25126390816E-61	1.61619877306E-35
time $t_{pl}=T_u*2^{-c/4-p/4}*\pi'^{-3/4}$	1.25126390816E-61	5.39105881395E-44
area $A_{pl}=R_u^{2}\,2^{-c/2-p/2}\pi'^{-3/2}$	1.56566136785E-122	2.61209847403E-70
area $A_{pl}=\hbar G/c^3$	1.56566136785E-122	2.61209847403E-70
volume $V_{pl}=R_u^{3}2^{-3c/4-3p/4}\pi'^{-9/4}$	1.95905556199E-183	4.22167034884E-105
$V_{pl}=(\hbar G/c^3)^{3/2}$	1.95905556199E-183	4.22167034884E-105
density $\rho_{pl}=M_u*R_u^{-3}*2^{c/2+p/2}*\pi'^{3/2}$	6.38707718369E+121	5.15556574438E+96
$\rho_{pl}=m_{pl}/l_{pl}^{3}$	6.38707718369E+121	5.15556574438E+96
$\rho_{pl}=\hbar t_{pl}/l_{pl}^{5}$	6.38707718369E+121	5.15556574438E+96
$\rho_{pl}=c^5/\hbar G^2$	6.38707718369E+121	5.15556574438E+96
energy $E_{pl}=M_uR_u^{2}T_u^{-2}\,2^{-c/4-p/4}*\pi'^{-3/4}$	1.25126390816E-61	1.95614954730E+09
$E_{pl}=c^2*m_{pl}$	1.25126390816E-61	1.95614954730E+09
$E_{pl}=\hbar/t_{pl}$	1.25126390816E-61	1.95614954730E+09
$E_{pl}=(\hbar c^5/G)^{1/2}$	1.25126390816E-61	1.95614954730E+09
force $F_{pl}=M_uR_uT_u^{-2}$	1	1.21033970568E+44
$F_{pl}=E_{pl}/l_{pl}$	1	1.21033970568E+44
$F_{pl}=\hbar/l_{pl}t_{pl}$	1	1.21033970568E+44
$F_{pl}=c^4/G$	1	1.21033970568E+44

momentum $M_{pl}=M_u R_u T_u^{-1}\ 2^{-c/4-p/4}*\pi'^{-3/4}$	1.25126390816E-61	6.52501253818
$M_{pl}=c*m_{pl}$	1.25126390816E-61	6.52501253818
$M_{pl}=\hbar/l_{pl}$	1.25126390816E-61	6.52501253818
$M_{pl}=(\hbar c^3/G)^{1/2}$	1.25126390816E-61	6.52501253818
power $P_{pl}=M_u R_u^2 T_u^{-3}$	1	3.62850715380E+52
$P_{pl}=c^5/G$	1	3.62850715380E+52
$P_{pl}=E_{pl}/t_{pl}$	1	3.62850715380E+52
$P_{pl}=\hbar/t_{pl}^2$	1	3.62850715380E+52
pressure $p_{pl}=M_u R_u^{-1} T_u^{-2}\ 2^{c/2+p/2}*\pi'^{3/2}$	6.3870771837E+121	4.6335914121E+113
$p_{pl}=c^7/\hbar G^2$	6.3870771837E+121	4.6335914121E+113
$p_{pl}=F_{pl}/l_{pl}^2$	6.3870771837E+121	4.6335914121E+113
$p_{pl}=\hbar/t_{pl}l_{pl}^3$	6.3870771837E+121	4.6335914121E+113
charge $q_{pl}=M_u^{1/2} R_u^{3/2} T_u^{-1}\ 2^{-c/4-p/4}*\pi'^{-3/4}$	1.25126390816E-61	1.77806819281E-13
$q_{pl}=\sqrt{(\hbar c)}$	1.25126390816E-61	1.77806819280E-13
$q_{pl}=\sqrt{(F_{pl})}/l_{pl}$	1.77806819280E-13	1.77806819280E-13
current $I_{pl}=M_u^{1/2} R_u^{3/2} T_u^{-2}$	1	3.2981799201E+30
$I_{pl}=m_{pl}^{1/2} l_{pl}^{3/2} t_{pl}^{-2}$	1	3.2981799201E+30
$I_{pl}=q_{pl}/t_{pl}$	1	3.2981799201E+30
$I_{pl}=(c^6/G)^{1/2}$	1	3.2981799201E+30
electric potential $U_{pl}=M_u^{1/2} R_u^{1/2} T_u^{-1}$	1	1.1001544008E+22
$U_{pl}=m_{pl}^{1/2} l_{pl}^{1/2} t_{pl}^{-1}$	1	1.1001544008E+22
$U_{pl}=E_{pl}/q_{pl}$	1	1.1001544008E+22
$U_{pl}=\hbar/t_{pl}q_{pl}$	1	1.1001544008E+22
$U_{pl}=(c^4/G)^{1/2}$	1	1.1001544008E+22
impedance $Z_{pl}=R_u^{-1} T_u$	1	3.3356409520E-09
$Zpl=l_{pl}^{-1} t_{pl}$	1	3.3356409520E-09
$Z_{pl}=\hbar/q_{pl}^2$	1	3.3356409520E-09
$Z_{pl}=U_{pl}/I_{pl}$	1	3.3356409520E-09
capacitance $C_{pl}=R_u*2^{-c/4-p/4}*\pi'^{-3/4}$	1.25126390816E-61	1.6161987731E-35
$C_{pl}=E_{pl}/U_{pl}^2$	1.2512639082E-61	1.6161987731E-35
$C_{pl}=I_{pl}t_{pl}/U_{pl}$	1.2512639082E-61	1.6161987731E-35
$C_{pl}=q_{pl}/U_{pl}=$	1.2512639082E-61	1.6161987731E-35
$C_{pl}=P_{pl}t_{pl}/U_{pl}^2$	1.2512639082E-61	1.6161987731E-35
mag. flux density $B_{pl}=M_u^{1/2} R_u^{-3/2}*2^{c/4+p/4}*\pi'^{3/4}$	7.9919191586E+60	2.2705870924E+48
$B_{pl}=m_{pl}^{1/2} l_{pl}^{-3/2}$	7.9919191586E+60	2.2705870924E+48
$B_{pl}=m_{pl}q_{pl}^{-1} t_{pl}^{-1}$	7.9919191586E+60	2.2705870924E+48
$B_{pl}=F_{pl}I_{pl}^{-1} l_{pl}^{-1}$	7.9919191586E+60	2.2705870924E+48
magnetic flux $\Phi_{pl}=M_u^{1/2} R_u^{1/2}\ 2^{-c/4-p/4}*\pi'^{-3/4}$	1.2512639082E-61	5.9309970793E-22
$\Phi_{pl}=m_{pl}^{1/2}*l_{pl}^{1/2}$	1.2512639082E-61	5.9309970793E-22
$\Phi_{pl}=U_{pl}*t_{pl}$	1.2512639082E-61	5.9309970793E-22
$\Phi_{pl}=E_{pl}/I_{pl}$	1.2512639082E-61	5.9309970793E-22
$\Phi_{pl}=B_{pl}*A_{pl}$	1.2512639082E-61	5.9309970793E-22