Physical constants

Abstract: From a logical starting point that the whole and parts are immanently depandant on each other, I calculated relations between physical constants. Also, I created a Ttable presenting the possibility of using original formulas obtained in that way for the purpose of calculating more accurate values of physical constants corresponding to the publishing years of CODATA reports.

Introduction

I am claiming that the whole and parts are immanently depandant on each other. The assumption in this article is that fundamental physical constants are immanent and therefore relations among them are constant and able to be determined in a rational way.

Table 1 presents physical constants as per years of their publishing in CODATA reports [3]. Each years includes five rows:

1. Value of physical constant from the CODATA report;
2. Uncertainty ***σ*** of the CODATA value of a physical constant (it is the value in brackets, of the CODATA reports data);
3. Value ***for***. determined through the formula, with input data as known in that time;
4. ***fσ***, the ***1σ*** uncertainty of a physical constant determined through the formula;
5. ***σ/fσ,*** the ratio between uncertainties.

The top of the Table also includes three mathematical constants and the speed of light *c* which we consider to have been same through the years. The fact that it was not the case in 1969 does not significantly affects the results.

All the formulas are presented through the relation of proton and electron mass ***μ***, inverse fine-structure constant ***ά***, speed of light *c*, proton mass m_p and Rydberg constant $\boldsymbol{R}_\infty$.

Formula (1) for the relation of neutron masses was published in [1] and formula (2) for universal gravitational constant in [2]. The other formulas can be seen in the Table and they are formulas known from the literature. Planck's values can, for example, be found in [4].

$$\gamma = \sqrt{2^{\left[e^{2\pi}+\frac{-1}{1+1/(\mu/\alpha'+1)}+3\log(2\pi,2)-1\right]\Big/\left[1+\alpha'^2\log(\mu,2)\right]}} \qquad \textbf{(1)}$$

$$G = c^2(2\mu\alpha'^2\, m_p R_\infty)^{-1}\, 2^{(-cy/4+3zp/2+t/2)} \qquad \textbf{(2)}$$

According to formula, uncertainty is approximately determined as one half of the difference between the upper and lower value based on input data and their corresponding *1σ* uncertainties. For example, if $X=a^2*b$ where σ_a is uncertainty for ***a***, i.e. σ_b for ***b***, we can say that $\boldsymbol{\sigma_X}$ is uncertainty for *X*:

$$\boldsymbol{\sigma_X \approx [(a+\sigma_a)^2 * (b+\sigma_b) - (a-\sigma_a)^2 * (b-\sigma_b)] / 2} \qquad \textbf{(3)}$$

The variable included is the average of the CODATA value interval, for example for **a=1.883574(38)** it is: $\mathbf{a^2=1.883574^2=3.5478518}$
A bit more accurate, but more advanced value for calculation can be obtained by: $\mathbf{a^2=[(1.883574+0.000038)^2+(1.883574-0.000038)^2]/2=3.5478510}$

Table 1. Physical constants – as per years of publishing in CODATA reports, values obtained through formulas

$2\pi=$	6.283185307	$cy=\exp(2\pi)=$	535.4917	$t=\log_2(2\pi)=$	2.65149613	**c (m/sec)=**	299792458	
year	μ	ά	γ=(1)	m_p	R_∞	$m_e=m_p/\mu$	$r_e=1/4\pi\acute{\alpha}^3R_\infty$	G=(2)
1969	1836.109	137.03602	1.001379	1.672614E-27	10973731.2	9.109558E-31	2.817939E-15	6.6732E-11
σ	1.1E-02	2.1E-04	1.3E-05	1.10E-32	1.1	5.4E-36	1.3E-20	3.1E-14
for.	1836.109	137.03602	1.0013784232	1.67261E-27	10973731.2	9.109557E-31	2.817939E-15	6.67401E-11
f. σ	1.1E-02	2.1E-04	3.1E-09	1.1E-32	1.1E+00	1.1E-35	1.3E-20	1.1E-15
σ/fσ	**1.00**	**1.00**	**4156.93**	**1.00**	**1.00**	**0.47**	**0.98**	**28.72**
1973	1836.15152	137.03604	1.001379	1.6726485E-27	10973731.77	9.1095340E-31	2.8179380E-15	6.6720E-11
σ	7.0E-04	1.1E-04	1.0E-05	8.6E-33	8.3E-01	4.7E-36	7.0E-21	4.1E-14
for.	1836.15152	137.036040	1.0013784185	1.67265E-27	10973731.77	9.1095342E-31	2.8179378E-15	6.673729E-11
f. σ	7.0E-04	1.1E-04	2.1E-09	8.6E-33	8.3E-01	5.0E-36	7.0E-21	4.9E-16
σ/fσ	**1.00**	**1.00**	**4663.38**	**1.00**	**1.00**	**0.93**	**1.00**	**84.47**
1986	1836.152701	137.0359895	1.001378404	1.67262310E-27	10973731.534	9.1093897E-31	2.81794092E-15	6.67259E-11
σ	3.7E-05	6.1E-06	9.0E-08	1.0E-33	1.3E-02	5.4E-37	3.8E-22	8.5E-15
for.	1836.152701	137.0359895	1.0013784194	1.67262E-27	10973731.534	9.1093900E-31	2.81794093E-15	6.6738316E-11
f. σ	3.7E-05	6.1E-06	1.2E-10	1.0E-33	1.3E-02	5.6E-37	3.8E-22	4.8E-17
σ/fσ	**1.00**	**1.00**	**755.69**	**1.00**	**1.00**	**0.96**	**1.00**	**178.87**
1998	1836.1526675	137.03599976	1.00137841887	1.672621580E-27	10973731.568549	9.10938188E-31	2.817940285E-15	6.673E-11
σ	3.9E-06	5.0E-07	5.8E-10	1.3E-34	8.3E-05	7.2E-38	3.1E-23	1.0E-13
for.	1836.152668	137.0359998	1.0013784192	1.67262E-27	10973731.568549	9.10938186E-31	2.817940284E-15	6.67383674E-11
f. σ	3.9E-06	5.0E-07	9.7E-12	1.3E-34	8.3E-05	7.3E-38	3.1E-23	5.8E-18
σ/fσ	**1.00**	**1.00**	**59.95**	**1.00**	**1.00**	**0.99**	**1.00**	**17126.33**
2002	1836.1526673	137.0359991	1.00137841870	1.67262171E-27	10973731.568525	9.10938260E-31	2.817940325E-15	6.6742E-11
σ	8.5E-08	4.6E-07	5.8E-10	2.9E-34	7.3E-05	1.6E-37	2.8E-23	1.0E-14
for.	1836.152667261	137.0359991	1.0013784192	1.67262E-27	10973731.57	9.10938257E-31	2.817940324E-15	6.67383629E-11
f. σ	8.5E-08	4.6E-07	9.3E-12	2.9E-34	7.3E-05	1.6E-37	2.8E-23	1.2E-17
σ/fσ	**1.00**	**1.00**	**62.69**	**1.00**	**1.00**	**1.01**	**0.99**	**830.84**
2006	1836.152667247	137.035999679	1.00137841918	1.672621637E-27	10973731.568527	9.10938215E-31	2.8179402894E-15	6.67428E-11
σ	8.0E-08	9.4E-08	4.6E-10	8.3E-35	7.3E-12	4.5E-38	5.8E-24	6.7E-15
for.	1836.152667	137.035999679	1.0013784192	1.67262E-27	10973731.568527	9.10938217E-31	2.8179402894E-15	6.67383653E-11
f. σ	8.0E-08	9.4E-08	1.9E-12	8.3E-35	7.3E-12	4.5E-38	5.8E-24	3.4E-18
σ/fσ	**1.00**	**1.00**	**244.13**	**1.00**	**1.00**	**0.99**	**1.00**	**1965.35**
2010	1836.1526672	137.035999074	1.00137841917	1.672621777E-27	10973731.568539	9.10938291E-31	2.8179403267E-15	6.67384E-11
σ	7.5E-08	4.4E-08	4.5E-10	7.4E-35	5.5E-05	4.0E-38	2.7E-24	8.0E-15
for.	1836.152667245	137.035999074	1.0013784192	1.67262E-27	10973731.568539	9.10938293E-31	2.8179403267E-15	6.67383603E-11
f. σ	7.5E-08	4.4E-08	8.8E-13	7.4E-35	5.5E-05	4.0E-38	2.7E-24	3.0E-18
σ/fσ	**1.00**	**1.00**	**512.35**	**1.00**	**1.00**	**0.99**	**0.99**	**2666.69**

Continuation of the Table

year	Planck constant $h=cm_p\lambda_p$	Planck mass $m_{pl}=(hc/2\pi G)^{1/2}$	Planck length $l_{pl}=(hG/c^3)^{1/2}$	Planck time $t_{pl}=(hG/c^5)^{1/2}$	Planck temp. $T_{pl}=(hc^5/G)^{1/2}/k_b$	Compton proton w. $\lambda_p=1/2\mu\acute{\alpha}^2R_\infty$	Compton elect.w. $\lambda_e=1/2\acute{\alpha}^2R_\infty$	Boltzmann c. k_B
1969	6.626196E-34	2.17663E-08	1.61614E-35	5.39085E-44	1.416942E+32	1.3214409E-15	2.4263096E-12	1.3806220E-23
σ	5.0E-39	5.1E-12	3.8E-39	1.3E-47	4.0E+28	9.0E-21	7.4E-18	5.9E-28
for.	6.626195E-34	2.1765E-08	1.61624E-35	5.391182E-44	1.416855E+32	1.3214409E-15	2.4263095794E-12	1.3806220E-23
fσ	1.0E-38	3.5E-13	2.6E-40	8.6E-49	8.3E+27	1.2E-20	7.6795779E-18	5.9E-28
σ/fσ	**0.48**	**14.80**	**14.79**	**14.79**	**4.75**	**0.74**	**0.96**	**1.00**
1973	6.626176E-34	2.17683E-08	1.61599E-35	5.39036E-44	1.417026E+32	1.3214099E-15	2.4263089E-12	1.380662E-23
σ	3.6E-39	6.7E-12	5.0E-39	1.7E-47	4.8E+28	2.2E-21	4.0E-18	4.4E-28
for.	6.626176E-34	2.17654E-08	1.61620E-35	5.391059E-44	1.416843E+32	1.3214099E-15	2.4263087E-12	1.380662E-23
fσ	4.8E-39	1.6E-13	1.2E-40	3.9E-49	5.5E+27	2.7E-21	4.1E-18	4.4E-28
σ/fσ	**0.75**	**42.83**	**42.82**	**42.82**	**8.74**	**0.81**	**0.98**	**1.00**
1986	6.6260755E-34	2.17671E-08	1.61605E-35	5.39056E-44	1.416957E+32	1.32141002E-15	2.42631058E-12	1.380658E-23
σ	4.0E-40	1.4E-12	1.0E-39	3.4E-48	1.0E+28	1.2E-22	2.2E-19	1.2E-28
for.	6.6260757E-34	2.17651E-08	1.6162E-35	5.39106E-44	1.416825E+32	1.32141002E-15	2.42631059E-12	1.380658E-23
fσ	4.7E-40	1.5E-14	1.1E-41	3.8E-50	1.3E+27	1.5E-22	2.2E-19	1.2E-28
σ/fσ	**0.85**	**90.58**	**87.13**	**88.81**	**7.73**	**0.82**	**1.01**	**1.00**
1998	6.62606876E-34	2.1767E-08	1.6160E-35	5.3906E-44	1.416921E+32	1.321409847E-15	2.426310215E-12	1.3806503E-23
σ	5.2E-41	1.6E-11	1.2E-38	4.0E-47	1.1E+29	1.0E-23	1.8E-20	2.4E-29
for.	6.62606874E-34	2.17650965E-08	1.616198761E-35	5.391058773E-44	1.41683185E+32	1.321409847E-15	2.426310215E-12	1.3806503E-23
fσ	5.8E-41	1.9E-15	1.4E-42	4.7E-51	2.6E+26	1.2E-23	1.8E-20	2.4E-29
σ/fσ	**0.90**	**8418.64**	**8502.93**	**8497.05**	**411.43**	**0.80**	**1.02**	**1.00**
2002	6.6260693E-34	2.17645E-08	1.61624E-35	5.39121E-44	1.41679E+32	1.3214098555E-15	2.426310238E-12	1.3806505E-23
σ	1.1E-40	1.6E-12	1.2E-39	4.0E-48	1.1E+28	8.8E-24	1.6E-20	2.4E-29
for.	6.6260693E-34	2.17650982E-08	1.616198777E-35	5.391058826E-44	1.4168318E+32	1.3214098593E-15	2.426310238E-12	1.3806505E-23
fσ	1.2E-40	3.9E-15	2.9E-42	9.7E-51	2.7E+26	8.9E-24	1.6E-20	2.4E-29
σ/fσ	**0.92**	**407.84**	**411.93**	**411.6403**	**40.47**	**0.98**	**0.98**	**1.00**
2006	6.62606896E-34	2.17644E-08	1.616252E-35	5.39124E-44	1.416785E+32	1.3214098446E-15	2.4263102175E-12	1.3806504E-23
σ	3.3E-41	1.1E-12	8.1E-41	2.7E-48	7.1E+27	1.9E-24	3.3E-21	2.4E-29
for.	6.62606898E-34	2.17650972E-08	1.61619876E-35	5.39105878E-44	1.4168318E+32	1.3214098483E-15	2.4263102175E-12	1.3806504E-23
fσ	3.4E-41	1.1E-15	8.3E-43	2.8E-51	2.5E+26	1.9E-24	3.3E-21	2.4E-29
σ/fσ	**0.98**	**989.82**	**98.16**	**980.8719**	**28.01**	**1.02**	**0.99**	**1.00**
2010	6.62606957E-34	2.17651E-08	1.616199E-35	5.39106E-44	1.416833E+32	1.32140985623E-15	2.4263102309E-12	1.3806488E-23
σ	2.9E-41	1.3E-12	9.7E-40	4.4E-48	8.5E+27	9.4E-25	1.6E-21	1.3E-29
for.	6.62606959E-34	2.17650990E-08	1.616198778E-35	5.391058829E-44	1.4168336E+32	1.32140985999E-15	2.4263102389E-12	1.3806488E-23
fσ	3.0E-41	9.8E-16	7.3E-43	2.4E-51	1.4E+26	9.1E-25	1.6E-21	1.3E-29
σ/fσ	**0.97**	**1329.06**	**1335.48**	**1816.10**	**60.81**	**1.03**	**1.02**	**1.00**

Results

The original theory which produced the formulas can be found in articles at viXra, for example in [1], [2], [8]. In short the theory could be called "The $\mathbf{2^n}$ Theory" or "Theory stating that the whole and parts are immanently depandant on each other" or "Theory of relations between physical constants". Whatever we might call it, the most important thing are the results it produces. Partial results are presented in physical constants in the two-page Table.

The best results are obtained for the relation between masses of neutron and proton γ, universtal gravitational constant $\boldsymbol{G}$ and Planck's values:

- For the relation between the masses of neutron and proton, the uncertainty obtained is from 60 to 4000 times smaller;
- For the Universal gravitational constant and three Planck's values that relation ($\sigma/f\sigma$) is 9–9000. These values are not featured in the CODATA reports for years 1969 and 1973, so for those years the values were calculated through the formula (underlined values), once from the CODATA input data and once from input data obtained through formulas. Values obtained in this manner are 14 to 42 times more accurate;
- Planck's temperature is not featured in the CODATA reports from 1969 to 1998, so for those years the values were both times calcuated through the formula, once from the CODATA input data and once from the input data obtained through formulas; Even the value obtained through the formula is 4 to 400 times more accurate. Compared to previous Planck's constants, the result is less accurate because here the Boltzmann constant is included, with its uncertainties. The accuracy is especially in favor of the formula approach in 1998, when the uncertainty of CODATA values of universal gravitational constant was great;
- The uncertainty of results of constants obtained by using γ and G is approximately the same as with experimental method. In the Table this refers to h, m_p, m_e, re, λ_e, $\lambda_{p.}$

  The reader can check which results would be obtained by using other constants that are in the function of here shown physical constants, according to the examples in the Table. At your request, I am willing to send you the spread sheet with formulas.

Constants such as: the Avogadro constant, electron magnetic moment anomaly, electron-muon mass ratio, g factors, etc. have not determined by this methodology. The answer to why are some constants more easy and others less easy to be determined can be found in [13]. Boscovich claimed that assembling points together in collections forms more complicated particles of the first order, connecting these first order particles together then forms particles of the second order, then the third order and so on, and further assembling forms atoms, molecules and macromolecules. So we can say that the values in the Table are connected to the points of zero order, hence they were the least difficult to be determined.

The example of a point of higher order that was determined nevertheless is the background radiation temperature [14].

If we would make a convention, just like with the speed of light, for two more exact values of constants, the mass of proton and the Rydberg constant, the formulas would give even much better results. Thus we would avoid the measurement error in these constants. This would specifically lead to a much more accurate value of the Planck constant.

When it comes to electrical phenomena, there is a large number of constants related to the zeroth-order particles [13], so they are easy to be determined. However, the problem with electrical constants are units of measurement in use. In order for electical constants to be included in the Table, they should all first be expressed in m-kg-sec units.

Problems

Just like every theory, this one also has its drawbacks:

- Formulas have been derived through only seven basic mathematical operations;
- Consequently, the theory eliminates the exclusivity of the few dedicated people who know and use the demanding and complex mathematical theories in physics;
- The theory requires essential understanding of the seventh mathematical operation - the logarithm, which does not receive enough attention in the school system;
- The theory does not feature paradoxes or anomalies, such as the millenium paradox and the Pioneer anomaly, thus it does not give room to scientific and philosophical discussions on these topics;
- The theory is in accordance with the teaching of Roger Boscovich, which very few scientists in the world are familiar with;
- Adoption of the teaching of Roger Boscovich in the wider sense would require a reinvention of the history of science;
- It would be necessary to explain in more detail the processes which Roger Boscovich anticipated and which are still unresolved, and it is a really difficult task;
- The theory requires expansion to wave and nuclear processes, which is a really demanding work;
- The theory is in accordance with Mach's principle, even though we do not know a precise definition of that principle [5];
- The theory supports Einstein's efforts to unify gravity with other forces, however, we know that "mainstream physics, largely ignored Einstein's approaches to unification" [6];
- Exotic phenomena such as black holes, expansion of the universe, the twin paradox, "warmhole", etc. are too easily explained through immanent relations ruling the universe;
- The theory leaves no room for the poet's freedom, such as that "the universe is multiverse", rather, it diligently adheres to the literal translation of Latin "unus" meaning "one", no matter how many parts "one" consists of;
- The theory is boring. Really, imagine a science fiction novel entitled "Role of mathematical constants in physics" or "Fine structure constant as a product of immanent relations in physics";
- The theory's bad ranking in the scientific community is also a problem (90^{th} position among 180 contest participants [7]). I am consoled by the fact that the comments on the work were either gratification on the contribution or absolute disagreement, there were no neutral opinions. An improved version of the article can be found in [8];
- My competence, as a meteorologist, to publish articles on the topic of the universe. Although, it can be questioned which professional field is competent or just more competent to discuss the topic;
- My shortcoming is also my lack of doctoral degree, although, the necessity of that degree is questionable if it does not feature signatures of scientists understanding the topic of the universe and belonging to the history of science (Newton, Boscovich, Planck, Einstein…);
- Lack of complete philosophical and physical explanation of the achieved results can partially be explained by my position that one formula is worth a thousand words. Although, it is a fact that a numerous of well-known and unknown authors described the universe in the manner compliant with mine. There are a number of theories more or less compliant with mine: Cyclic model [9], Relational theory [10], Theory of everything [11], Mathematical universe hypothesis [12].
- Every physical explanation would be specific in relation to the general relation of the whole and its parts which is promoted here;

- The theory greatly exploits mathematical constants 2π, e, $exp(2\pi)$, $ln(2)$, not only for spatial relations, but also for relations among masses, which many people consider as excessive mathematization;
- One can say that there are a lot of speculative formulas which can give arbitrary correct value of any physical constant. My approach is rational, bringing together mathematical constants, information (2^x) and relations among physical constants in the statement that: the whole and parts are immanently depandant on each other. Here I also did not take into account such speculative formulas used for determining μ and $\acute{\alpha}$, rather I am supporting the statement that it is possible to determine one but not both;
- A question arises: How is it possible that the others have not come to these relatively simple relations? The answer is: Because of wrong mainstream paradigms which have been ruling physics for the past century, even though they have had some good tries;
- I have not shown the step-by-step formula derivation methodology, because the conditions have not been met yet for me to publish it. That is why some formulas look as if they have come from nowhere.

Conclusion

The spreadsheet of physical constants per publishing years of CODATA reports shows that the use of proposed formulas would give significantly more accurate values than those obtained via the CODATA methods. All the published and non-published formulas (those that did not fit the Table) have the same source, described in [8]. This means that the bit (information), universe duration cycle, each specific cycle and relations among them, as well as relations among physical constants are immanent, and hence we have such accurate results for the values of physical constants in the Table. I am convinced that the next CODATA report should show closer values of physical constants here determined by a formulas.

References:

1. Branko Zivlak, *Neutron, proton and electron mass ratios*, http://viXra.org/abs/1211.0090
2. Branko Zivlak, *Universal Gravitational Constant via Rydberg Constant*, http://viXra.org/abs/1311.0081
3. *CODATA internationally recommended values of the Fundamental Physical Constants, (2010)*, http://physics.nist.gov/cuu/Constants/
4. http://en.wikipedia.org/wiki/Planck_units
5. http://en.wikipedia.org/wiki/Mach%27s_principle
6. http://en.wikipedia.org/wiki/Einstein
7. http://www.fqxi.org/community/forum/topic/1847
8. Branko Zivlak, *Bit, Cycle, Dimensionless, It* http://viXra.org/abs/1311.0008
9. *Cyclic model*, http://en.wikipedia.org/wiki/Cyclic_model
10. *Relational theory*, http://en.wikipedia.org/wiki/Relationism_%28physics%29
11. *Theory of everything*, http://en.wikipedia.org/wiki/Theory_of_everything
12. *Mathematical universe hypothesis*, http://en.wikipedia.org/wiki/Mathematical_universe_hypothesis
13. Boscovich J. R., (a) "Theoria philosophia naturalis redacta ad unicam legem virium in natura existentium", first (Wien, 1758) and second (Venetiis, 1763) edition in Latin language; (b) "A Theory of Natural Philosophy", in English, The M.I.T. Press, Massachusetts Institute of Technology, Cambridge, Massachusetts and London, England, first edition 1922, second edition 1966
14. Zivlak B., "Dozen Coincidences?! One Rule", http://viXra.org/abs/1312.0081