1.39e+24 and The Pfund Mass $M_F = \sqrt{\frac{k_e^2\ q_e^4\ T}{c\ G\ M\ L^2}} = \sqrt{\frac{c\ \hbar^2\ \alpha^2\ T}{G\ M\ L^2}}$

Copyright (CC BY-NC-SA 4.0) Roy Pfund *

March 17, 2022

I could go on about how some CFD software uses planck units to reduce computation by reducing the billions of multiplications times the boltzman constant; but I feel reducing the number constants people have to know down to the 1 we don't understand should be reason enough.

$$\frac{\hbar}{cM_F} = L_F = \frac{\hbar\ c}{E_F}; \qquad \frac{\hbar}{c^2 M_F} = T_F = \frac{\hbar}{E_F}; \qquad q_e = Q_F$$

$$k_e = \alpha\ M_F^1 L_F^3 T_F^{-2} Q_F^{-2} \qquad \hbar = 1\ M_F^1 L_F^2 T_F^{-1}$$

$$\mu_0 = \alpha\ 4\ \pi\ M_F^1 L_F^1 Q_F^{-2} \qquad c = 1\ L_F^1 T_F^{-1}$$

$$\epsilon_0 = \frac{1}{\alpha\ 4\ \pi}\ M_F^{-1} L_F^{-3} T_F^2 Q_F^2 \qquad N_A = 1^{**}$$

$$M_F\ c^2 = E_F = 1\ M_F^1 L_F^2 T_F^2$$

$$R_\infty = \frac{m_e}{M_F}\frac{\alpha^2}{4\ \pi}\ L_F^{-1} \qquad \frac{2\ \pi\ \hbar}{c\ q_e} = k_b = 2\pi\ M_F^1 L_F^1 Q_F^{-1}$$

** only way to correct N_A being based on the Dalton = $\frac{1}{12}$ the mass of Carbon isotope C^{12} is to correct the periodic table to use the Pfund Mass = M_F like the example to the right.

1 Dimensionality

Stoney-Mass $M_S = \sqrt{\frac{\hbar\ \alpha\ c}{G}}$ dimensions are correct but $M_F = M_S\sqrt{\hbar\alpha}$ gives correct arithmetic for all the equations above to work but to correct dimensions, that's where the $M^{-1/2} L^{-2/2} T^{1/2} = \frac{1}{\sqrt{\frac{M^1 L^2}{T}}}$ comes from.

$$\alpha^2\hbar = \alpha^2\frac{M_F L_F^2}{T_F} = \frac{G}{M_F^3 L_F^{-1} T_F^{-2} Q_F^0}$$

but it comes back in the solution for G. However G is wrong to begin with, because with Relativity it doesn't really exist, as it is the curvature of space time. which leads us to our next question:

$$\frac{\mu_0}{2}\frac{c\ q_e^2}{2\ \pi\ \hbar} = \frac{2\ \pi\ 10^{-7}\ 299792458\ (1.602176634\times10^{-19})^2}{6.62607015\times10^{-34}} = \alpha$$

$$\frac{\mu_0}{2} = \frac{\hbar\ \alpha}{c\ q_e^2};\quad \frac{\hbar\ \alpha}{c\ q_e^2}\frac{c^2}{2\pi} = k_e;\quad \epsilon_0 = \frac{1}{\mu_0 c^2}$$

$$\sqrt{\frac{T_F}{M_F L_F^2}\frac{G}{M_F^3 L_F^{-1} T_F^{-2} Q_F^0}} = \alpha$$

= 0.00729735257 - "It has been a mystery ever since it was discovered more than fifty years ago, and all good theoretical physicists put this number up on their wall and worry about it."[Feynman, 1985, p. 129].

*e-mail: r0ypfund@gm411.c0m

2 Speed of Sound = c_0

Given $c_0 = \sqrt{\frac{\gamma_0 N_A k_B T}{M}}$ and $39.947 g\ mol^{-1}$ = molar mass of the argon gas from the experiment measuring c_0 in a purifed isotope of argon gas at the Triple-Point of water = 273.16K [dePodesta et al., 2013] Where $U_F = \frac{E_F}{k_b}$, $T = \frac{Kelvin}{U_F}U_F$, and $\gamma_0 = 5/3$ for monotonic gases. Let's see how that matches up with the $c_0^2 = 94756.245 m^2 s^-2$ from the experiment in 2013.

$$c_0 = \sqrt{\frac{\frac{5}{3}\ 1\ k_B\ \frac{273.16 Kelvin}{U_F}\ U_F}{40.671 M_F}} = 307.701 ms^{-1} \approx \sqrt{c_0^2}$$

$$\text{**adjusted argon gas molar mass} = 40.671 M_F = \frac{39.947}{M_F\ N_A}$$

3 Time is On Our Side(& Distance)

With a Sympathetic Constant = D_C = light-second / L_F to save our wallets, watches, measuring wheels, and road signage we can still use existing definitions of distance and time.

$$\frac{1.3899982e+24 \approx \frac{c\ T_{SI}}{L_F} = D_C}{1.39e+24} = 0.999998675$$

Perhaps one day for the sake of simplicity, Bureau international des poids et mesures might redefine the second and meter such the D_C is exactly 1.39e+24 rather than approx. 5 almost 6 nines.

4 Conclusion

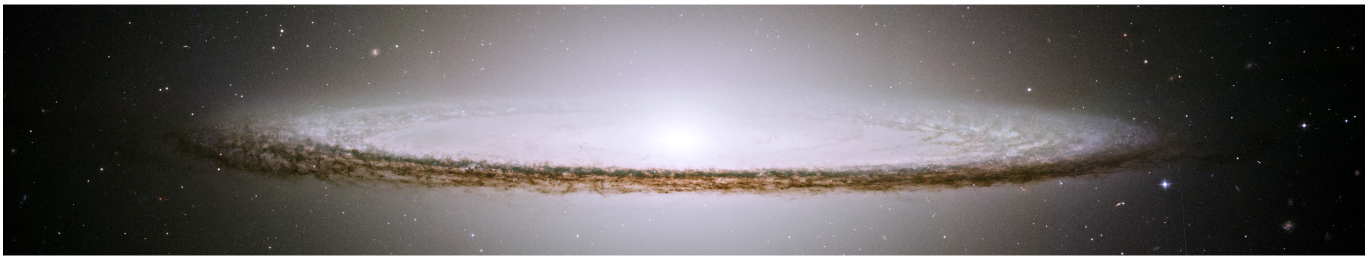
Remember all wallets, watches, measuring wheels, and road signage are already calibrated to D_C and After the dust settles and all scales and ammeter are calibrated, all that will have to be remembered besides preserving dimensionality when doing calculations is the following:

$$\frac{\hbar}{c^2 M_F}\frac{c\ T_{SI}}{L_F} = T_F\ D_C \qquad = 1\text{Second}$$

$$\frac{\hbar}{cM_F}\frac{\frac{c\ T_{SI}}{L_F}}{299792458} = L_F\ \frac{D_C}{299792458} \qquad = 1\text{Meter}$$

$$\frac{c\ T_{SI}}{L_F}\ q_e = Q_F\ D_C \qquad \approx 222702.257\text{Coulumbs}$$

$$\text{Pfund Mass}\ \frac{c\ T_{SI}}{L_F} = M_F\ D_C \qquad \approx 2.267061\text{grams}$$



5 Constants

$$
\begin{aligned}
\text{Avogadro constant } N_A &= 6.02214076 \times 10^{26} \frac{\text{atoms per kg}}{\text{molar mass}} \\
\text{Planck constant } h &= 6.62607015 \times 10^{-34} kg\ m^2\ s^{-1} \\
\text{lightspeed constant } c &= 299792458\ m\ s^{-1} \\
\text{electron charge } q_e &= 1.602176634 \times 10^{-19} \text{Coulumbs} \\
\text{gravity constant } G &= 6.67430 \times 10^{-11} kg^{-1} m^3 s^{-2}
\end{aligned}
$$

On May 20, 2019 the values of N_A, $\hbar = \frac{h}{2\pi}$, and h, were fixed to the Dalton $= \frac{1}{12}$ the mass of Carbon isotope C^{12} [Bettin]. $s =$ "duration of 9192631770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the cesium 133 atom"[SI, 1968] to finish the definition of c, An international agreement in Paris on Oct. 20 1983 defines the meter as $\frac{1}{299792458}$ the distance light travels in a vacuum in 1 second[Times, 1983],

[Tiesinga et al., 2021] gives us q_e, and G. Just don't forget Milikan's Oil Drop or the Cavendish Mitchell Device.

5.1 How the Avogadro constant was measured for the last time

N_A and h were measured using a incredibly round & pure ball of Si^{28} and a Kibble balance and the equations basically verbatim from [Bettin] and [Wood and Bettin, 2019] Where $\alpha^2\ m_e\ c\ /\ 2\ h\ =\ R_\infty$ is the Rydberg constant, $\sum_{i=28}^{30} x_i\ A_r({}^iSi)\ =\ A_r(Si)$ average molar mass of a silicon atom in the crystal is calculated using the proportions x_i of the various isotopes ${}^iSi$, V is Volume of Silicon Sphere, a Lattice parameter of the silicon crystal, 8 is the number of atoms in an elementary cell of the lattice(cube with edge length a). M Molar mass of silicon contained in sphere. m mass of sphere.

$$
\begin{aligned}
N &= \frac{8\ V}{a^3} = \text{Number of atoms in silicon sphere} \\
N_A &= \frac{M\ 8\ V}{m\ a^3} = \text{Avogadro constant} \\
m(Si) &= \frac{m}{N} = \frac{m\ a^3}{8V} = m(e)\frac{A_r(Si)}{A_r(e)} \\
m(e) &= \frac{2\ h\ R_\infty}{c\ \alpha^2} = \frac{2\ (2\pi\ \hbar)\ R_\infty}{c\ \alpha^2} \\
h &= \frac{c\ \alpha^2}{2R_\infty}\frac{m\ a^3}{8\ V}\frac{A_r(e)}{\sum_{i=28}^{30} x_i\ A_r({}^iSi)}
\end{aligned}
$$

References

Horst Bettin. How the avogadro constant was measured for the last time. URL https://q-more.chemeurope.com/q-more-articles/287/how-the-avogadro-constant-was-measured-for-the-last-t html.

Michael dePodesta, Robin Underwood, Gavin Sutton, Paul Morantz, Peter Harris, Darren F Mark, Finlay M Stuart, Gergely Vargha, and Graham Machin. A low-uncertainty measurement of the boltzmann constant. *Metrologia*, 50(4): 354–376, jul 2013. doi: 10.1088/0026-1394/50/4/354. URL https://doi.org/10.1088/0026-1394/50/4/354.

Richard Feynman. *QED : the strange theory of light and matter*. Princeton University Press, Princeton, N.J, 1985. ISBN 978-0-691-08388-9.

SI. *CGPM13 CGPM : Comptes rendus de la 13e réunion (1968)*. Bureau international des poids et mesures, F-92312 Sèvres Cedex, France, 1968. URL https://www.bipm.org/documents/20126/17314988/CGPM13.pdf/ff522dd4-7c97-9b8d-127b-4fe77f3fe2bc?version=1.2&t=1587104721230&download=true#page=103.

George Johnstone Stoney. On the physical units of nature. *The Scientific Proceedings of the Royal Dublin Society*, 3:51–60, 1883. URL https://books.google.com/books?id=R79WAAAAIAAJ&pg=PA51.

Eite Tiesinga, Peter J. Mohr, David B. Newell, and Barry N. Taylor. Codata recommended values of the fundamental physical constants: 2018. *Rev. Mod. Phys.*, 93:025010, Jun 2021. doi: 10.1103/RevModPhys.93.025010. URL https://link.aps.org/doi/10.1103/RevModPhys.93.025010.

NY Times. Science watch. *NY Time*, page 6, Nov 1983. URL https://www.nytimes.com/1983/11/01/science/science-watch-011004.html.

Barry Wood and Horst Bettin. The planck constant for the definition and realization of the kilogram. *Annalen der Physik*, 531(5):1800308, 2019. doi: https://doi.org/10.1002/andp.201800308. URL https://onlinelibrary.wiley.com/doi/abs/10.1002/andp.201800308.

Supplementary Materials

Only reason I found this was for some reason or another I had just looked at $\sqrt{\hbar\alpha}$, and I had Avogadro constant for Stoney-Mass $M_S = \sqrt{\frac{\hbar\ \alpha\ c}{G}}$ mass popping up in a script I had running with some notes to see how the Planck-Units, and the Stoney-Units[Stoney, 1883], baked out the need for certain constants. But when I had left the speed of sound calc to see how the planck units canceled out the Boltzman constant, and the Avogadro constant for M_S also popped up, not exact match but so close I had to do more tests.