# Chapter 1

# First Attempt

## 1.1 Preamble

Anyone who has taken a Physics course will remember the professor, at some point in the class, saying "If we choose a set of units such that C equals one..." or some other comments about some other constant being set to one.

These comments suggest that there is the possibility that, given the correct system of units, all of the physical constants could be reduced to one. Such a system of units could be construed to be the Universal Units of the cosmos.

The difficulty arises when one tries to construct a system of equations containing all of the "pertinent" constants in a complete set. There appear to be several ways to approach the construction of these equations, but the results of each method are markedly different, suggesting that something is missing from the mix.

In the following pages the author will outline the approaches he has taken and the implications of those results. As this is still a "work in progress" not all of the conclusions drawn are warranted, and these conclusions should be looked at closely for logical flaws.

The first decision must be made about which units to include. For each unit used, one equation will be required, and one constant must be found.

## 1.2 Units to include

The first issue to address is which units are to be discovered. The current list includes:

- Inertia, or Mass. "M" will be used to represent this unit.
- Distance, or Length. "L" will be used to represent this unit.
- Duration, or Time. "T" will be used to represent this unit.
- Charge, or Potential. "P" will be used to represent this unit.

Let's start with the mass coupling equations first, adding equations and constants as we progress. Eventually we will have enough to answer some reasonable questions.

## 1.3 Mass Coupling Equations

The coupling equation for forces between masses is usually written:

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

but for our purposes, we wish to remove the spatial form factor and reduce the constant to only that part which involves the mass coupling field. This yields the following, more useful equation:

$$F = \frac{1}{4\pi\gamma_0}\frac{m_1 m_2}{r^2}$$

With:

$$G = 6.6732x10^{-11}\ \frac{newton\ meter^2}{kilogram^2}$$

then

$$\gamma_0 = \frac{1}{4\pi G} = 1.192x10^9\ \frac{kilogram^2}{newton\ meter^2}$$

or, in the base units this becomes:

$$\gamma_0 = 1.192x10^9\ \frac{kilogram\ second^2}{meter^3}$$

Our object is to find the set of units where $\gamma_0$ is equal to unity. To accomplish this, a set of conversion factors must be found for each of the units currently being used.

## 1.4 Conversion Factors

The Kilogram is an arbitrary unit, chosen for some convenience and defined by standards, as is Meter, Second, and Coulomb. We want a somewhat less arbitrary set of units, for simplicity sake called: Mass, Length, Time, and Potential. (MLT units, for short, and that doesn't mean Mutton Lettuce and Tomato)

These units are to be chosen so that all "fudge factors", otherwise known as "multiplicative constants", become one. This removal makes the relationships in these equations more clear. This would provide a natural set of units to eliminate these constants, and may provide other insights.

So, how many Kilograms are their in a "natural" Mass unit? $M_0$ will be used to represent this number. Like Kilograms; Meters, Seconds, and Coulombs will be scaled by the values: $L_0$,$T_0$, and $P_0$. When we can solve for these 4 variables, $\gamma_0$ can be reduced to unity, along with other useful constants.

## 1.5 First Equation

If we multiply both sides of the above equation for $\gamma_0$ by:

$$\frac{L_0^3}{M_0 T_0^2}$$

the right side of the equation becomes unity, reducing the equation to:

$$\frac{L_0^3 \gamma_0}{M_0 T_0^2} = 1 \tag{1}$$

Which gives the first equation needed for the first constant.

Another way to look at this equation is:

$$\frac{M_0 T_0^2}{L_0^3} = 1.192x10^9 \frac{kilogram\ second^2}{meter^3}$$

Note: this equation has no charge components, so there is the challenge of finding a complete set of equations. One way to accomplish this is to assume that the fundamental unit of charge is some even fraction of the charge on the electron. Just as we have not seen quarks, we have not seen partially charged particles, so if the one is possible then so may be the second. In any case, if the charge on the electron is $P_e$ then:

$$P_e = nP_0 = 1.6 \times 10^{-19} \text{ coulombs}$$

There are other reasons for this choice that will become clear as we proceed. The value of **n** is yet to be determined. (Quark theory suggests 3)

## 1.6 Charge Coupling Equations

There is a symmetric equation for charge coupling that is usually presented in the following form:

$$F = K\frac{q_1 q_2}{r^2}$$

As before a slightly different form is desired:

$$F = \frac{1}{4\pi\epsilon_0}\frac{q_1 q_2}{r^2}$$

This removes the spatial component from the constant, and provides one of more innate interest. This yields equation 2:

$$\epsilon_0 = 8.85x10^{-12}\ \frac{coulomb^2\ second^2}{kilogram\ meter^3}$$

$$\frac{L_0^3 M_0 \epsilon_0}{P_0^2 T_0^2} = 1 \tag{2}$$

## 1.7 Derived vs Fundamental Constants

One of the challenges of this exercise is in the choosing of the constants which are to be used. One of the obvious constants to use is the speed of light. We all know this is a constant, and that making it equal to one is of some use, but is it a fundamental constant, or is it derived?

From Maxwell's equations we know that the permeability and permeativity of free space to the electric field is defined by the two constants: $\epsilon_0$, and $\mu_0$ and can yield the equation:

$$\frac{1}{\epsilon_0 \mu_0} = C^2 = 8.94x10^{16}\ meter^2 \tag{i}$$

This suggests that $\epsilon_0$ and $\mu_0$ are the fundamental constants and **C** is the derived one. Of course, if $\epsilon_0$ and $\mu_0$ are made one by the correct choice of units, then the value of **C** becomes unity as well. When the fundamental constants have been satisfied the derived ones will fall into place naturally.

## 1.8 Symmetry and New Constants

The mass coupling equation and the charge coupling equation are very symmetrical. This implies that $\gamma_0$ is the "permeability of free space to the gravitational field". This suggests that there is also a constant for the permeativity. If gravitational radiation also propagates at **C**, then:

$$\frac{1}{\gamma_0 \delta_0} = C^2 \qquad (ii)$$

Now there are 4 constants and 4 equations from them, although, as we will see, this is not sufficient, given that each variable does not appear in every equation. As a result, we must continue to search for completeness.

## 1.9 Deriving Three More Equations

In the same way as was done with the first two equations; $\mu_0$, $\delta_0$, and $\hbar$ can yield the following equations:

$$\mu_0 = 1.26x10^{-6} \ \frac{kilogram\ meter}{coulomb^2}$$

$$\frac{P_0^2 \mu_0}{L_0 M_0} = 1 \qquad (3)$$

$$\delta_0 = 9.38x10^{-27} \ \frac{meter}{kilogram}$$

$$\frac{M_0 \delta_0}{L_0} = 1 \qquad (4)$$

$$\hbar = 1.0546x10^{-34} \ \frac{kilogram\ meter^2}{second}$$

$$\frac{T_0 \hbar}{M_0 L_0^2} = 1 \qquad (5)$$

## 1.10 Solving the Equations

The following five constants:

$$\gamma_0 = 1.192x10^9 \; \frac{kilogram\ second^2}{meter^3}$$

$$\epsilon_0 = 8.85x10^{-12} \; \frac{coulomb^2\ second^2}{kilogram\ meter^3}$$

$$\mu_0 = 1.26x10^{-6} \; \frac{kilogram\ meter}{coulomb^2}$$

$$\delta_0 = 9.38X10^{-27} \; \frac{meter}{kilogram}$$

$$\hbar = 1.0546x10^{-34} \; \frac{kilogram\ meter^2}{second}$$

produce the following 5 equations:

$$\frac{L_0^3\gamma_0}{M_0T_0^2} = 1 = \frac{M_0T_0^2}{L_0^3\gamma_0} \tag{1}$$

$$\frac{L_0^3M_0\epsilon_0}{P_0^2T_0^2} = 1 = \frac{P_0^2T_0^2}{L_0^3M_0\epsilon_0} \tag{2}$$

$$\frac{P_0^2\mu_0}{L_0M_0} = 1 = \frac{L_0M_0}{P_0^2\mu_0} \tag{3}$$

$$\frac{M_0\delta_0}{L_0} = 1 = \frac{L_0}{M_0\delta_0} \tag{4}$$

$$\frac{T_0\hbar}{M_0L_0^2} = 1 = \frac{M_0L_0^2}{T_0\hbar} \tag{5}$$

Notice that the additional right-hand-sides are available from the unity they represent. Thus the inverse of one is still one. These additional equations provide an ease of solution that would otherwise be difficult.

### 1.10.1 Equation (2) and (3)

As with any pair for the "base" equations, we can produce two relationships. The first one looks like:

$$\frac{L_0^3 M_0 \epsilon_0}{P_0^2 T_0^2} = \frac{P_0^2 \mu_0}{L_0 M_0}$$

Solving this for $P_0^4$ gives:

$$P_0^4 = \frac{L_0^4 M_0^2}{T_0^2} \frac{\epsilon_0}{\mu_0} \qquad (a1)$$

Multiplying by one in the form of $\frac{\epsilon_0 \mu_0}{\epsilon_0 \mu_0}$ give the following, more useful form:

$$P_0^4 = \frac{L_0^4 M_0^2}{T_0^2} \frac{\epsilon_0^2}{\epsilon_0 \mu_0} \qquad (a2)$$

Until values for $M_0$, $L_0$, and $T_0$ are determined, the solution for the value of $P_0$ must wait.

Taking our previous starting point, but using the inverse on the right-hand-side yields:

$$\frac{L_0^3 M_0 \epsilon_0}{P_0^2 T_0^2} = \frac{L_0 M_0}{P_0^2 \mu_0}$$

Which can be reduced to:

$$\frac{L_0^2}{T_0^2} = \frac{1}{\epsilon_0 \mu_0} \qquad (a3)$$

or

$$\frac{L_0}{T_0} = \frac{1}{(\epsilon_0 \mu_0)^{\frac{1}{2}}} \qquad (a4)$$

This relationship between $T_0$ and $L_0$ may also be written:

$$T_0 = L_0 (\epsilon_0 \mu_0)^{\frac{1}{2}} \qquad (a5)$$

(a4) and (a5) will be useful later in solving the remaining equations.

### 1.10.2 Equation (1) and (5)

The following can be constructed from equation (1) and (5):

$$\frac{L_0^3\gamma_0}{M_0T_0^2} = \frac{M_0L_0^2}{T_0\hbar}$$

and reduces to:

$$M_0^2 = \frac{L_0}{T_0}\gamma_0\hbar \qquad (b1)$$

Plugging in equation (a4) produces the solution:

$$M_0^2 = \frac{\gamma_0\hbar}{(\epsilon_0\mu_0)^{\frac{1}{2}}} \qquad (\alpha^2)$$

Plugging in the square root of equation (i) and taking the square root of both sides gives:

$$M_0 = (\gamma_0\hbar C)^{\frac{1}{2}} = 6.13x10^{-9}\ kilograms \qquad (\alpha)$$

Instead of moving on to equation (4) it will be informative to look at the previous starting point, with the right-hand-side inverted. This gives:

$$\frac{L_0^3\gamma_0}{M_0T_0^2} = \frac{T_0\hbar}{M_0L_0^2}$$

which reduces to:

$$\frac{L_0^5}{T_0^3} = \frac{\hbar}{\gamma_0} \qquad (b2)$$

Plugging in equation (a5) yields:

$$L_0^2 = \frac{\hbar}{\gamma_0}(\epsilon_0\mu_0)^{\frac{3}{2}} \qquad (\beta^2)$$

inserting the square root of equation (i) and taking the square root of the result yields:

$$L_0 = (\frac{\hbar}{\gamma_0C^3})^{\frac{1}{2}} = 5.6x10^{-35}\ meters \qquad (\beta)$$

Plugging $\beta^2$ into (a3) gives:

$$T_0^2 = \frac{\hbar}{\gamma_0}(\epsilon_0\mu_0)^{\frac{5}{2}} \qquad (\gamma^2)$$

inserting the square root of equation (i) and taking the square root of the result yields:

$$T_0 = (\frac{\hbar}{\gamma_0 C^5})^{\frac{1}{2}} = 1.87x10^{-43}\ seconds \qquad (\gamma)$$

With values for $M_0$, $L_0$, and $T_0$, $P_0$ can now be computed. Plugging these values into equation (a1) yields:

$$P_0^2 = \hbar\epsilon_0 C \qquad (\delta^2)$$

or:

$$P_0 = (\hbar\epsilon_0 C)^{\frac{1}{2}} = 8.34x10^{-31}\ coulombs \qquad (\delta)$$

With the given values for the constants **n** comes to: $1.92x10^{11}$, which is only 4% error for the integer value: $2x10^{11}$.