Relative to the whole universe – natural coordinates

Introduction and relevance

Einstein's theories of Special and General Relativity (resp. SR and GR) are two of the great contributions to physics. However, the mathematics behind these theories is horrendous. Let us ignore the mathematics and let's use common sense instead. Let us think big, let us start with the universe and see how that works out in small details within our solar system. We will see that great results can be achieved by thinking big. The results will be amazing: total amount of energy, longest distance, and age of the universe. Plus a method of deriving the smallest theoretical particles of mass-energy and space-time, the quanta.

Relative to what?

Is everything relative? Well, funny enough everything is relative except everything, the universe. The universe is all there is, by definition. The universe is 100% of what there is, so we can express everything relative to the universe of 100%. For example, the total energy of the Milky Way galaxy is estimated to be about one 125 billionth of the total energy of the universe:

$E_{MilkyWay} = 1 / 125{,}000{,}000{,}000 = 8 \times 10^{-12} = 0.000\ 000\ 000\ 008 = 0.000\ 000\ 000\ 8\%$

Note that we separate very large numbers by commas every three digits and very small number by a space every three digits. Also note that the energy is not expressed in units like Joules, but as a number or percentage of the total universal energy. It represents the share of the object relative to the universe of 100%, which is mathematically the number 1.0. To get rid of all these zero's, we could also use the names for these small numbers, milli, micro, nano, pico, femto, atto, zepto, yocto etc. In other words, the energy of the Milky Way is 8 pico or 800 pico%

What we have done here is bypass the cumbersome job of defining the unit Joule and then figure out how may Joules there are in the Milky Way. Instead of the unit Joule we have the unit "all energy there is". The energy of the universe is thus **1.0** or **100%**. The authors have called this way of expressing quantities "natural coordinates", written in **bold** letter type to express its relativity to the universe. We should have written the above natural energy of the Milky Way in bold letter type. The natural energy of the universe equals **1.0**. That triggers the question, so what's the use of it?

Natural coordinates or naturals and its use

Einstein used this method of natural coordinates, making calculations less complicated. He computed the loss of power of objects in the universe due to radiation of gravitational waves and ended up with a number only, *natural* power. You cannot deduce the power of gravitational waves without the use of naturals! To get back to the standardized unit of power that we are used to (Watt), you need to translate natural power back into power in the units Watt.
Here comes the formula:

$P = c^5.\mathbf{P} / G$ [W] Conversion of natural power **P** into power P in Watt

In this formula is "P" the power in Watt, "c" the speed of light, "**P**" the natural power, and "G" the Newton or gravitational constant.

Relative to the whole universe – natural coordinates

The authors extend the use of "c" and "G" with the Hubble constant "H", allowing all quantities related to space-time and mass-energy to be converted into naturals. Einstein could not have used "H" in 1916, this constant of nature was discovered in 1931.

Einstein's GR uses the unit meter as well as naturals. For example, mass is expressed in meters, the so-called "Schwarzschild radius" (For the experts: $Rs = 2G.M / c^2$) The mass of the sun equals 2,952 meter. The Schwarzschild radius is not a physical quantity, it is mass expressed in units meter! But naturals make this easier to understand, the *natural* mass of the sun equals **14 yocto**, not confusing physical mass with physical distance.

The use of naturals is not restricted to Einstein's GR, it has much wider applications, it determines minimal and maximum values of many quantities. For example, the maximum speed (the speed of light) equals **1.0** or **100%**, summarizing Einstein's SR in one statement! Naturals can be translated into SI unit quantities and vice versa. In other words, Einstein's GR can be rewritten in naturals only, simplifying its solutions, see our book "Repairing Robertson-Walker Solution". Finally, natural coordinates help to establish the quanta of space-time and mass-energy, see the paraph after next. Let us first establish the properties of the universe, its major application.

Properties of the universe

The properties of the universe are the easy ones, when expressed in naturals: its energy is **1.0**, its mass is **1.0**, its maximum distance is **1.0**, and its age is **1.0**. This can be translated back into values in SI units by using the constants of nature. Einstein used the constants: the speed of light "c" and the Newton constant "G", see the earlier formula of power. The authors have used the Hubble constant "H" to complete naturals to all mechanical quantities. The formula of time translation is:

$t = \mathbf{t} / H$ [s] Conversion of natural time **t** into time t in seconds

The age of the universe is thus **1.0** in naturals, or 1 / H in seconds (the Hubble time), which comes depending on the Hubble constant "H" to an order of 11 to 14 billion years. Note that the Hubble constant needs to be established more accurately, see our book "Repairing Robertson-Walker's Solution". The formula of distance translation is:

$D = c.\mathbf{D} / H$ [m] Conversion of natural distance **D** into distance D in meters

The largest distance in the universe is thus **1.0** in naturals, or c / H (the Hubble distance) in our current units meter, which comes depending on the Hubble constant "H" to an order of 11 to 14 billion light-years. The formula of mass translation is:

$M = c^3.\mathbf{M} / G.H$ [kg] Conversion of natural mass M into mass M in kilograms

The total mass of the universe is thus **1.0** in naturals, or $c^3 / G.H$ (the Hubble mass) in our units kilogram. And finally the energy translation:

$E = c^5.\mathbf{E} / G.H$ [J] Conversion of natural energy **E** into energy E in Joules

The total energy of the universe is thus **1.0** in naturals, or $c^5 / G.H$ (the Hubble energy) in our units Joules.

Note that $E = m.c^2$ and **E** = **M** in naturals, since **c** = **1** in naturals, just like **G** = **1** and **H** = **1**. The total amount of energy of the universe in Joules comes to more than 10^{70} [J], in line with current estimates!

Quanta of space-time and mass-energy

When you get to the very, very small things like quanta, one simple statement enhances the quantum theory greatly. We introduce our "natural quantum postulate":

The quanta of space, time, momentum, mass, energy, and spin are all equal to natural **½ħ**, in which **ħ** is the natural reduced Planck constant ($\hbar = h / 2\pi$ and $\boldsymbol{\hbar} = \mathbf{h} / 2\,\pi$).

This is an extension to the "Fredkin hypothesis", the hypothesis that all physical quantities come in quanta. The quantum of spin is proven experimentally, but the quantum of the other properties, based on Heisenberg's uncertainty principle and our natural quantum postulate. The quantum of time means that everything in nature proceeds in small steps of time. For example, an electron around a nucleus falls back to a lower orbit and emits one photon of light in one quantum of time. The photon does not accelerate, its speed is in one quantum of time changed from start to the speed of light. The underlying principle is Fredkin's hypothesis that everything in nature comes in quanta.

Based on our "natural quantum postulate", we get to the quantum of time of just 4×10^{-105} [s]. The quanta are deduced based on the "uncertainty principle", making one quantum the uncertainty physicists are looking for.

Summary and our books and articles

The use of Einstein's naturals, extended by the Hubble constant, allows us to compute everything relative to the universe of 100% and allows us to compute the properties of the universe in SI units too. Based on the uncertainty principle, we can even determine the smallest quanta, which till today is only proven for spin. The use of the total universe as the essential unit of measurements of time, space, mass, and energy is a step forward in the essence of physics.

Our books and articles, see www.loop-doctor.nl describe the repair of Einstein's Relativity for Noether's theorem[1] in full detail. We hope you get as many "aha" experiences as we did,

Rob Roodenburg (MSc. author)
Frans de Winter (MSc. coauthor)
Oscar van Duijn (MSc. coauthor)
Maarten Palthe (MSc. editor of this article)

Schiedam, November 2019

[1] Noether E. "Invariant variation problems" translated by Tavel M. TTSP 1971 p. 186-207