From Atom To Universe In a 1+0 -Dimensional World *

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Abstract

Lorentz-transforming the inverse of the 1:st spatial component of four-velocity at two discrete time coordinates defines one observer at origo, who measures time and another one at the periphery, who measures one-dimensional radial length, $\bar{q}$, also comprising line increments, $\overline{\Delta q}$, related through $\bar{q}\ \overline{\Delta q} = -1$. The latter observer, who's time axis does not reach beyond the unit interval, performs measurements that are relevant to the Bohr atom and to some cosmological observations, which is evaluated quantitatively. A line increment, $7.714 \times 10^{-27} m^{-1}$, is factorized out of the atom's ground state. The geometry yields the radius of the universe as the inverse of this line increment. In general, rearranging terms in known processes provides a method to evaluate them in terms of this geometry, as shown by additional examples. The geometry inherently relates the non-local and immense to the (oscillating) minute through the inverse whereby the dynamics is generated by the geometrical state of the entire system irrespective of photon signaling.

1 Theory and Results

The instant of observation has a special significance in the quantum world since it accommodates the processes that cause the quantum observer to change from the ignorant state to the observed state. One approach to characterizing the instant of observation is to perform a Lorentz transformation of the inverse of the number-flux vector at discrete local time coordinates $\overline{t_0}$ =−1 and $\overline{t_r}$ =0 defining an interval of observation:

$$(q_0, t_0) = \left(\frac{\sqrt{1-\frac{v^2}{c^2}}}{v}\frac{m^2}{s}, 0\right); \qquad (\bar{q}_0, \bar{t}_0) = \left(\frac{1}{v}\frac{m^2}{s}, -s\right) \tag{1}$$

$$(q_r, t_r) = \left(\frac{\sqrt{1-\frac{v^2}{c^2}}}{v}\frac{m^2}{s}, s\sqrt{1-\frac{v^2}{c^2}}\right); \qquad (\bar{q}_r, \bar{t}_r) = \left(\frac{1}{v}\frac{m^2}{s} - vs, 0\right) \tag{2}$$

$$\overline{\Delta q} = -vs\ , \qquad \overline{\Delta t} = \bar{t}_r - \bar{t}_0 = s \quad \Rightarrow \frac{\overline{\Delta q}}{\overline{\Delta t}} = v \tag{3}$$

$$\Delta q = 0\ , \qquad \Delta t = t_r - t_0 = s\sqrt{1-\frac{v^2}{c^2}}\ \ . \tag{4}$$

 Published on the Internet on May 10, 2016. Citation: From atom to universe.... Proceedings of www.scienceandresearchdevelopmentinstitute.com, Quantum Physics & Cosmology # 20 (2016). Email: cerven@scienceandresearchdevelopmentinstitute.com . In this edited version corrections of printing errors, consistency, etc. are indicated by green and amendments by blue text. Amendments in the main text are only made in order to facilitate reading the manuscript and following the original logic. The derivation of Eq. 12 is presented in an Appendix while some later developments are briefly indicated in a 'Comments' section. The original unedited manuscript can be found here

Here, m is the unit of length and s the *geometrized* unit of time [1]. This system of equations defines two observers located at origo (un-barred) and at radius distance from origo (barred observer). The latter observer is capable of observations along the momentum axis, $\overline{\Delta q}$, and of measuring the unit of time while the observer at origo only is aware of time and recognizes an angular velocity v. The two observers are space-like separated.

The directions of the axes is defined by analogy with the unit circle, $(\cos x)^2 + (\sin y)^2 = 1$, as

$$q_r{}^2 + \frac{1}{c^2}\frac{m^4}{s^2} = \frac{1}{v^2}\frac{m^4}{s^2} = \overline{q}_r{}^2 \tag{5}$$

or

$$(\frac{\Delta t}{s})^2 + (\frac{\overline{\Delta q}}{m})^2 = 1 \tag{6}$$

so that line increment and time interval are perpendicular. The time interval measured by the momentum observer is also perpendicular to the momentum frame where it defines the tangential velocity as shown in eq. 3c.

The sign of the line increment (cf. eq. (3) shows that the radius of the observed object decreases. This corresponds to the observer at origo computing a contracted radius $\overline{q}_0$ similarly to the Fitzgerald case, $q_0 = \overline{q}_0\sqrt{1 - v^2/c^2}$. Hence, the geometry can be understood as a circle space-like separated from a peripheral observer who detects it in the form of a line increment in the direction of observation (equivalent of a contraction of its radius) after the passage of one unit of time. Furthermore, the axis of linear momentum may also be thought to harbor axial vectors. In physics, line increments in the direction of observation are known from the Bohr atom and the cosmological expansion.

For observations towards origo along the radius, the magnitude of the line increment is amplified from $\overline{\Delta q}$ per unit length to the unit length, m per radius (this may also be seen from eq. (1b) and (3a)),

$$\frac{-\overline{\Delta q}}{m} = \frac{m}{\overline{q}_0} \quad , \tag{7}$$

which yields

$$\overline{q}_0\ \overline{\Delta q} = -m^2 \approx \overline{q_r}\ \overline{\Delta q} \quad , \tag{8}$$

whereby the velocity of light, m/s, limits the radial extension of the geometry to $|\overline{q}_0|$ ($v \leq c$ as required by $\sqrt{1 - v^2/c^2}$). Because of eq. (3) and (4), observations can only be made from the laboratory frame at the periphery towards the origin of space and time coordinates. The observer at origo is non-local in the sense of performing all observations solely on the time axis (eq. (4b)) and can only access the observation *via* eq. 6.

The geometry described above appears to have some inherent features reminiscent of Bohr signaling and the apparent cosmological expansion, notably the line increment in the momentum frame along the axis of observation as opposed to non-locality in a yonder frame. A quantitative evaluation of the geometrical construct will therefore be performed as follows. A physical process that fits into the geometry should be possible to express in the form 'momentum frame = yonder frame' ,

$$- = | \tag{9}$$

simply by factorizing and rearranging terms, whereby quantitative agreement with previously established theory also is a requirement.

[1] using non-standard (not SI) notation for the purpose of distinguishing the two units

First, the Bohr atom in the ground state will be examined. The advanced Bohr theory reached its zenith in the first quarter of the 20:th century [1]. As is well known, the radius, a_0 of the first electron orbit in the ground state of the hydrogen atom is given by

$$a_0 = \frac{4\pi\epsilon_0}{e^2}\frac{\hbar^2}{M_e} \tag{10}$$

where ϵ_0 is the permittivity of vacuum, e is the elementary charge, $\hbar$ is the reduced Planck's constant and M_e is the mass of the electron. The entire radius encircled by the electron can be regarded as an oscillating line increment. This radius, a_0, is factorized out together with its inverse, $\alpha M_e/\hbar$,

$$\left[a_0\ \alpha M_e\right]\left(\frac{e^2}{4\pi\epsilon_0\alpha}\right) = \left[\hbar\right]\ \ \hbar \tag{11}$$

The left and right terms in square brackets, which are equal, are removed (cf. eq. 9).
Terms are rearranged once more while adhering to the geometry described above and a line increment, $\overline{\Delta q} = 1/\overline{q}$, is factorized out (see appendix),

$$4\ \frac{e\ c}{2\alpha}\ \frac{1}{\overline{q}} = \sqrt{\hbar}\ 2\pi\ Ampere\ \ s, \tag{12}$$

which is calculated to be $\Delta q = 7.714 \times 10^{-27} m^{-1}$ whereby $\overline{q}$ is the radius of the one-dimensional universe given by eq. 8 and c is an invariant proportionality constant relating magnetic to electric charge, which has the same numerical value as the velocity of light in SI units. The left hand side expresses the magnetic charge which generates the one-dimensional Dirac string (herein as seen by the barred observer) whereas the right hand side expresses the curl (herein as inferred by the space-like separated velocity perpendicular to the barred observer's direction of observation. Therefore, eq. 12 conforms to eq. 9. The original theory of monopoles can be found in [2] and [3]. Hence, a unit curl of current (right hand side, 2π) gives rise to 4 particles of quantized magnetic charge (left hand side). In principle, the four particles may be equivalent of one atom if half of the unit circle generates antimatter and the other half generates 2 particles of opposite charge, which is required to make a neutral atom. Tracing half the unit circle generates half the number of particles. Either way, eq. 12 is consistent with the geometry of the Lorentz construct above since the Dirac string is one-dimensional.

The numerical value of the line increment thus obtained from the Bohr atom in the ground state can be evaluated by reference to standard cosmology (cf. [4]). The line increment is interpreted as the apparent cosmological expansion in the current epoch, H_0. The value $7.714 \times 10^{-27} m^{-1}$, corresponds to 71.36 km/sec/Mparsec, which is within acceptable limits of current astronomical observations. In fact, it is almost precisely the average of 8 different observational approaches to H_0 (Fig. 16 in [4]). The radius of the universe given by $\overline{q}_0 = -m^2/\Delta\overline{q}$ is $r_u = 1.296 \times 10^{26}\ m$ whereas the Standard Model gives $1.37 \times 10^{26}\ m$ for the Hubble length [5]. The age of our universe is defined by the time it takes for a light signal to go from origo (the origin of space and time coordinates) to the laboratory frame, $1/(c\ \overline{\Delta q}\ m^{-2}) = 13.7 \times 10^9\ years$ whereas the Standard ΛCDM Model gives $13.8 \times 10^9\ years$ (Table 2 in [4]). In the present geometrical model the radius and the age of the universe are limited by the velocity of light, $v \leq c$ in the sense that a line increment added to each unit length can not exceed c at origo but reaches exactly c there, which defines the non-local relativistic cosmological horizon as seen by the momentum observer in the laboratory frame. Very similar numerical values have thus been obtained in the much more advanced current standard cosmological models. These recently focus on tiny variations of polarization and temperature in the cosmic microwave background radiation, the source of which is set to this side of the relativistic horizon. In the present geometry, any radiation originating at the universe's non-local relativistic horizon where no rest frame exists is expected to be largely isotropic and isothermal by definition, like in the case of the CMBR. Eq. 12 is further evaluated with the help of the Schrödinger equation in the addendum below.

Thermal radiation (blackbody radiation) as originally described by Planck constitutes another example of a process that may help consolidate the physicality of the 1-dimensional geometry comprising a non-local dimension as described above. The fundamental mechanism of thermal radiation is still not known as reflected by the fact that its frequency distribution has been obtained in so many contexts, including thermodynamics, electron energy band excitation-relaxation, plain statistics, and black hole radiation. Here, the frequency distribution of thermal radiation, [6] [7] (and references therein)

$$U(\nu) = \frac{h\nu^3}{c^3\ exp\left(\frac{h\nu}{kT} - 1\right)} \tag{13}$$

may be obtained by equating factors that by establishing the field, contribute to absorption,

$$U(\nu)\ c^3\ \nu^{-2}\Big(1 - exp(\frac{-h\nu}{kT})\Big), \tag{14}$$

with those that contribute to the instability of the excited state in the matter,

$$h\nu\ exp(\frac{-h\nu}{kT}). \tag{15}$$

Hence, if τ is the inverse of the radiation frequency, then like in the left and right sides of eq. 9,

$$\left[\frac{h\nu}{U(\nu)\ c^3}\right] exp(\frac{-h\nu}{kT}) = \left[\tau^2\right]\Big(1 - exp(\frac{-h\nu}{kT})\Big), \tag{16}$$

the 1D-momentum-containing photon emitted from the solid state normalized to the unit radiation density of its frequency (left side) is proportional to an event that generates radiation once per cycle in two perpendicular dimensions[2] of the non-local frame (right side). Irrespective of physical interpretation, the time τ belongs to the non-local frame as shown by eqs. 3, 4, and 6. The exponential terms are regarded as probabilities. Thermal radiation expressed in the form of eq. 16 conforms to eq. 9 and may be interpreted as evidence that the geometry is relevant to these ambiguously understood physical processes.

2 Discussion

Besides providing a framework for several known physical processes with good numerical and conceptual agreement as shown above the geometry has some interesting general properties that require further theoretical evaluation. 1) The non-local frame may be regarded as the physical home of non-local processes that do not require signaling, like superpositions, permutations, path integrals, vector potential, etc. In the present 1+0 geometry such mathematical representations may correspond to actual physical processes that instantaneously affect both frames of observation through their common geometry rather than *via* photon signaling. 2) Any geometrical state of the momentum frame e.g. eq. 1b and 2b has a counterpart in the yonder, non-local frame, e.g. eq. 1a resp. 2a regardless of signaling. The dynamics of the Bohr atom in the ground state and the apparent cosmological expansion corroborate that this is an ongoing process. 3) The quantum observer (and the human observer alike) is only capable of making observations at present time; a time interval around zero that defines the observation. This limits the conceivable mathematical representations of the observation. 4) Large distances, such as the radius of the universe, are inherent by reference to the inverse (eq. 7) and can be understood indirectly from the geometry as long as one intuitively accepts the notion of a

[2] see 'Comments' section

quantum fluctuation. Furthermore, the inverse gives the local observer access to remote and non-local information. 5) Eq. 9 constitutes a unique representation of several known physical processes in the framework of this geometry. Factorizing and rearranging terms so as to identify the local and non-local observers is a workable path to identifying physical processes that otherwise would be quantified rather arbitrarily.

3 Addendum

The linear Schrödinger equation for a free particle is rearranged guided by eq. 9

$$\frac{p^2}{2M_e}\Psi = -i\hbar\frac{\partial}{\partial t}\Psi \tag{17}$$

$$\frac{\hbar^2\nabla^2}{2M_e}\Psi = -i\hbar\frac{\partial}{\partial t}\Psi \ , \tag{18}$$

$$\frac{\hbar}{2}\left(\frac{\partial}{\partial x}\right)^2\Psi = -iM_e\frac{\partial}{\partial t}\Psi \ , \tag{19}$$

where the last equation has the form of eq. 9 since the wave-mass of the electron is non-local. Further substituting $\hbar$ using eq. 12 yields

$$(\overline{\Delta q})^2\left(\frac{ec}{2\alpha}\right)^2\left(\frac{\partial}{\partial x}\right)^2\Psi = -i\ M_e\ \frac{\partial}{\partial t}\ \Psi\ (2\pi\ Ampere)^2\ s^2 \tag{20}$$

revealing the right (non-local) side to contain a circular electrical current while the left side has the signature of angular momentum, $(\overline{\Delta q})^2$, multiplied by magnetic charge squared which is also assigned to the momentum frame as discussed in connection with eq. 12. The angular momentum acts to promote from a fraction of two magnetic monopoles of opposite charge a latent magnetic pole, which would appear together with the circular electric current were the latter not non-local. This interpretation is consistent with the phenomenology of solenoidal currents[3]. Hence, substituting $\hbar$ using eq. 12 shows literally that the Schrödinger wave function involves matter and charge (M_e $Ampere$) circulating (2π) around a 'particle'. These features not surprisingly define the hydrogen atom in the ground state whereby the constant $\overline{\Delta q}$ has replaced the Planck's length. Eq. 19 and eq. 20 relate three still unsolved problems in physics, the apparent cosmological expansion, the origin of the ubiquitous Planck's constant and the cause of ground state electron dynamics[4]. In the present context eq. 20 serves the purpose to demonstrate once more that physical processes can be decomposed into perpendicular events such as to support the 'physicality' of the present 1+ 0 dimensional geometry with a non-local dimension. It is also noteworthy that in eq. 20 the imaginary part originating from the Schrödinger equation settles in a manner consistent with eq. 9.

References

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[3] see 'Comments' section for another interpretation

[4] see 'Comments' section for more evidence

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4 Appendix (Derivation of Eq. 12)

Using the arc-bracketed terms in Eq. 11,

$$\frac{e^2}{4\pi\epsilon_0\alpha} = \hbar \ ; \quad \epsilon_0 = \frac{1}{\mu_0 c^2} \quad \rightarrow$$

$$\frac{e^2}{4\pi}\mu_0 c^2 \frac{1}{\alpha} = \hbar \ ; \quad \mu_0 = 4\pi \ 10^{-7}\left[\frac{H}{m}\right]$$

$$\frac{e^2}{4\pi} 4\pi \ 10^{-7}\left[\frac{H}{m}\right] c^2 \frac{1}{\alpha} = 4\frac{e^2 c^2}{4\alpha^2} \ \alpha \ 10^{-7}\left[\frac{H}{m}\right] \ ; \quad \left[H = \frac{m^2 kg}{sec^2 \ Amp^2} = \frac{m^2 kg \ sec^2}{sec^2 \ C^2}\right]$$

$$\rightarrow \quad 4\frac{e^2 c^2}{4\alpha^2} \ \alpha \ 10^{-7}\left[\frac{m^2 kg}{C^2}\right] \ ; \quad kg = 7.425 \times 10^{-28} \ m \quad \rightarrow$$

$$2^2\left[\left(\frac{ec}{2\alpha}\right)^2 \frac{1}{(C/s)^2}\right] \underbrace{\alpha \ 10^{-7} \ kg}_{5.418\times 10^{-37}} = \hbar \ ; \quad \sqrt{} \quad \Rightarrow$$

$$2\frac{e \ [c]}{2\alpha} \frac{1}{AMP^2} \underbrace{\left[\frac{\pi}{[c]}\right] 7.361 \times 10^{-19}}_{7.714\times 10^{-27}} = \sqrt{\hbar}\pi$$

$[c]$ is a numerical amplification of electric charge in order to get magnetic charge which is compensated in the denominator of the braced terms as a concession to having used geometrical units in the derivation. Adding π on both sides of the equation may have some geometrical interpretation, like e.g. forming an arc out of a line or may be related to some physical process in that the number may be derived using various iterative mathematical procedures. It is not necessary to decide on where π comes from here as long as the numbers are right and seem to support the theory.

5 Comments

Eq. 16: Interpreting τ as two perpendicular processes in the non-local frame is known from the (invisible) nodes of electromagnetic radiation where the perpendicular magnetic and electric fields change most rapidly (surrounded by curls). This leads to the notions that absorption starts in the non-local frame of observation, in the non-local wavefront, that the emitter is local and the receiver of the signal is non-local but turns local upon absorption. (#26 in this series of papers, 'Some fascinting consequences of....' and #28, 'What is a photon and....')

Eq. 20: An alternative interpretation of the squared line increment is that of 'action', $E \ t$. (#35 in this series of papers, 'The remarkable apparent stoichiometry....')

Eq. 20: The ground state electron dynamics in terms of electron velocity can be solved quantitatively. (#35 in this series of papers and #31, 'Exploring the nuclear physics....')