RS2-107: Mass and Gravity

Bruce Peret

Background

As discussed in "RS2-106: Dimensions and Displacements," Larson refers to *units of motion* that comprise the two aspects of a scalar dimension, *speed* (s/t, 0 → 1) and *energy* (t/s, 1 → ∞). Three dimensions with two aspects resulted in six units of motion, which he then splits in half to create the three speed ranges for the material and cosmic sectors, designated as 1-x (low speed), 2-x (intermediate speed) and 3-x (ultra-high speed). The range number defines the maximum unit of motion and the "-x" some fraction, thereof.

Speed ranges are discussed in more detail in *The Universe of Motion*, as an explanation of the inverse density gradient of white dwarfs (intermediate speeds) and the anti-gravity motion of quasars and pulsars (ultra-high speeds), with both motions taking place in *equivalent space* instead of the normal space of our reference system. (The reason being that only a single, scalar dimension can be completely expressed in the reference system with the other two dimensions modifying the expression of that coordinate information via equivalent space.)

This is at variance with the equivalent space concept used at the particle and chemical levels, discussed in *Nothing But Motion*, where equivalent space is treated as the *spatial expression of temporal motion*. Granted, this does work for the second unit of motion (energy), but does not work for the third (speed in a 2nd dimension) because the third unit of motion is already "space," and therefore cannot also be in "equivalent space" at the same time.

In Gustave LeBon's book, *The Evolution of Forces* (1908), he discusses the difference between *mass* and *weight*, as they were interpreted by the 19th century researchers. Conventional science treats mass as *force* divided by *acceleration*, typically the acceleration of gravity. The older approach is to treat mass as *weight* divided by *velocity*:

$$mass = \frac{force}{acceleration} = \frac{\frac{t}{s^2}}{\frac{s}{t^2}} = \frac{t^3}{s^3}$$

Equation 1: Modern Definition of Mass

$$mass = \frac{weight}{velocity} = \frac{\frac{t^2}{s^2}}{\frac{s}{t}} = \frac{t^3}{s^3}$$

Equation 2: Older Definition of Mass

The older definition is actually closer to the Reciprocal System atomic model because particles and atoms are defined by magnetic and electric *rotations*, an *angular velocity*. In Larson's A-B-C displacement notation, the A-B magnetic "double rotation" has the dimensions of t/s × t/s = t^2/s^2; the

same units LeBon refers to as *weight*. The electric rotation is an inverse *spatial* angular velocity, s/t, matching the velocity component. The older definition of mass precisely matches the A-B-C displacement structure of particles and atoms used by Larson:

$$mass = \frac{magnetic\ rotation}{electric\ rotation} = \frac{AB}{C} = \frac{\left(\frac{t}{s}\right)^2}{\frac{s}{t}} = \frac{t^3}{s^3}$$

Equation 3: RS Definition of Mass (from Atomic Structure)

In the Reciprocal System, the concept of "mass" is mathematically determined by the net temporal displacement of the atom—its angular velocity *in time*. The magnetic rotation therefore accounts for the primary mass of any particle or atom, which is then slightly modified by the electric rotation in *equivalent time*—the "time equivalent of space"—being the reciprocal concept of *equivalent space*.

Gravity of the Situation

As we know, space and time are reciprocals of each other. In the Reciprocal System, *everything* has its reciprocal, which also includes direction, velocity and geometry. Inward and outward motion are reciprocals, as are linear and angular velocities, and points and volumes.[1]

So, we have mass defined as an *outward, angular velocity in time*, defining a *volume*. Let's take a complete reciprocal of mass and see what we have as a natural consequence:

- The aspect of *time* becomes *space*.
- *Outward* motion becomes *inward* motion.
- *Angular* (circumferential) velocity becomes *linear* (radial) velocity.
- *Volume* becomes a *point* location.

The reciprocal of *mass* is therefore an *inward, linear velocity in space* that can be expressed through a *single point*. That is the definition of *gravity*, where the "point" is the "center of gravity." Mass and gravity are the *same thing*, from inverse perspectives.

Massless Particles

All material motions have a rotation in time and therefore *all* material motions (particles and atoms) *must have mass*. The problem with "massless" particles lies in the way we indirectly measure mass through the *measurable* gravitational pull in space, not *unmeasurable* angular velocity in time. And that brings up another reciprocal relation, that of the inverse relationship between "step measure," how we measure things in a straight line, and "growth measure," how we measure angles.

Step measure is the conventional method of measuring finite quantities, just like pacing off steps to measure distance. This is associated with the first unit of motion, *speed*, with the range[2] of 0→1. Coordinate time can also be "step measured," but unfortunately our mechanics and technology only allow us to measure *space*, not time, so temporal measurements must be made by their projection into equivalent space as an angular change, *growth measure*.

1 Larson only considered the inverse relationship between space/time and inward/outward. Being unfamiliar with projective geometry, he never considered the linear/angular or point/volume inverses. These are a feature of RS2.

2 Since the datum of measurement in the RS is *unity*, the speed of light, speed is measured by a fractional amount.

Growth measure is associated with the second unit of motion, *energy*, with the range of $1 \rightarrow \infty$. Since we cannot do a finite count to infinity, growth measure is done with the Calculus concept of *infinitesimals*, the *integral*. To transform this growth measure in equivalent space to a step measure in linear space, the natural logarithm must be used: $\Delta s = \ln(\Delta t)$.[3] The consequence of this is that the magnitude of gravity appears as a *logarithmic curve*, whereas the magnitude of mass is *linear*. The Reciprocal System works with *discrete units*, quanta, so until the magnitude of a temporal rotation, *mass*, becomes high enough to produce a single unit of inward, spatial magnitude, gravity does not exist in space. And that occurs with a net temporal speed of 3 displacement units, since $\ln(3) = 1.1$.[4]

So any rotating system that has a net displacement of 0, 1 or 2 will have no net effect as gravity in space, giving them the *appearance* of being "massless." Specifically, the "massless" particles are photons, positrons, electrons and neutrinos. The proton is the first particle with mass, having a temporal displacement of 3 units (2 for the proton, plus the 1 in the rotational base omitted from the notation).

The "electron volt" masses that are associated with these massless particles are an attempt to determine the actual, rotational speeds of the particles, rather than inferring it from their gravitational influence.

Particles Moving at the Speed of Light

Just because a particle is "massless" does not mean it is carried by the progression of the natural reference system at the speed of light (unit speed, in natural units), as photons are. In order for a particle to be carried, there needs to be a *free dimension*, a dimension at unit speed in one of the *three* scalar dimensions of motion for the progression to have effect.

Uncharged electrons and positrons only use a single scalar dimension, leaving two free to be carried by the progression. Photons, as a birotation, use two scalar dimensions (basically a positron+electron combination) with the third available to be carried by the progression. Uncharged electron neutrinos use a single magnetic and electric dimension, leaving one free to be carried. Muon neutrinos are a single, magnetic dimension (analogous to a *magnetic monopole*), leaving two free dimensions to be carried by the progression.

Charge, the vibration created by a photon captured in a rotation, occupies two dimensions. Any charged particle will use all three dimensions, so it cannot be carried at the speed of light and behaves more particle-like, such as the charged electrons of static electricity. Starting with the proton, all three dimensions are occupied so atoms are never carried by the progression.

Direction Reversals and The Rotational Base

Larson considered only *linear velocity* to be primary, because he was thinking in spatial terms where the concept of rotation required *two* dimensions. But consider the case of an astronaut with a baseball, out in the vacuum of space where no other forces are present. He can do two things with that baseball: throw it, where it will continue to move at a linear velocity forever in a straight line, or spin it and it will rotate (angular velocity) forever. In Eastern philosophy, linear motion is *yang* and angular motion is *yin*—"spin is yin." A primary, angular velocity is every bit as probable as a primary, linear velocity.

Larson, in order to get rotation with a "yang only" approach, he needed *something to rotate*, which

3 Larson, Dewey B., *Basic Properties of Matter*, ISUS, Inc., Salt Lake City, UT, 1988, page 7 on "Solid Cohesion" and Equation 1-1.

4 If you are a computer/math person, gravity = floor(ln(Δt)). When Δt = 0, 1 or 2, gravity = 0 = massless.

gave rise to two devices, that of the *direction reversal* and *rotational base*. The direction reversal is simply a diameter on which to create rotation as an angular velocity, resulting in the rotational base. This rotational base supplied the missing component on which to build atomic rotations that was not present in a purely linear system.

In RS2, the reevaluation of the Reciprocal System, we assume that the yin, angular velocity is a primary motion along with the yang, linear speed, completing the "tao of motion."

Taking this geometry into account, the progression of the natural reference system is still "outward at unit speed," but with one aspect being a linear, outward speed (a translation) and the other aspect being an angular, outward speed (a rotation). Therefore, every location is potentially a "rotational base" and the concept of a "direction reversal" is unnecessary, because rotation is primary and RS2 does not require "something to rotate."

This infers that the concept of *vibration*, which Larson associates with his direction reversal, is *not* a primary motion but only arises as *shear strain* from oppositely directed motions, such as the counter-rotations of a birotation as expressed in Euler's formula, $e^{ix} + e^{-ix} = 2\cos(x)$.

Rotational Dimensions

Our physical senses are designed to interpret the world around us in simple, 1-dimensional relationships, such as moving in a straight line (mph, kph), or spinning with a constant angular velocity (rpm).[5] This creates a conceptual challenge with the Reciprocal System, because the RS is a 3-dimensional system that cannot be directly expressed in a single length or angular measurement. These visualizations can assist in understanding the concepts:

- *2-dimensional magnetic rotation*: a cone with the wide end expanding across the surface of a sphere. This is known as a *solid rotation* that takes 720 degrees, or 4π radians to complete. In physics, this is measured as a particle with spin-½, because it appears to take two, 360-degree rotations to complete (they assume it is going at half speed).
- *1-dimensional electric rotation*: a common, spinning disc that takes 360 degrees or 2π radians to complete. In physics, these are the "integer spin" particles, the spin-1 on which they base relative measurements.
- *1-dimensional vibration*: two, opposing electric rotations. The second rotation "undoes" the first rotation, resulting in a cosine waveform. Take a rod with a flexible elbow. Rotate one end of the rod one way, then rotate the pivot of the rod in the opposite direction. The far end will trace a sine wave in one dimension.
- *Rotational vibration*: combine a vibration with a rotation. In one dimension, you get the "washing machine agitator" motion where the rotational direction is constantly changing. In two dimensions, you get a similar effect, except the washing machine is flipping itself upside down and back at the same time.
    - *1-dimensional rotational vibration* is electric charge (electric field).
    - *2-dimensional rotational vibration* is magnetic charge (magnetism).

And that's all you need to construct a Universe of Motion.

5 "mph" = Miles per Hour; "kph" = Kilometers per Hour; "rpm" = Revolutions per Minute.