Theory Without Practice is Sterile

There is a kind of thought that is more or less a representation of what is there, like a map. However, thought has a creative function as well, to create what is there. In fact, almost everything we see around us in the world was created from thought, including all the cities, all the buildings, all the science, all the technology, and almost everything we call nature. Farmland was produced by thought, by people thinking what they’re going to do with the land and then doing it.

What prevents us from stopping our present unintelligent sort of growth is ultimately the thought that the continuation of such growth is absolutely necessary and that we can’t live without it. But we can live without it, as long as we don’t make these material products the main point of life. For example, we have to reorganize life fundamentally so that we don’t flood our roads with cars. We have to have other ways of getting around, or perhaps we may not even get around so much.

David Bohm & Mark Edwards, "Changing Consciousness"

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Detailed Steps for the Design and Performance of the Proposed Crucial Experiment

by

Ronald W. Satz, Ph.D.

In previous papers [1], [2], [3], [4], I've proposed a new twist on Rutherford scattering: neutralize the alpha particles before they impact on the gold (or other metal) foil. In this paper I present the necessary physical steps to accomplish the experiment.

I. Design Steps

1. Decide whether the detector should be moveable (Fig. 1, from [5]) or the chamber should be moveable (Fig. 2, from [6]). The chamber (a cylindrical vessel) must have a glass window and cover, a knob to rotate the detector relative to the source or a means to rotate the chamber relative to the source, a 360° dial (so angles can be measured precisely), a microdot feed through, a source holder, a source holder stand, two beam collimators, a bottom mounting plate, a target holder (or frame), a detector mount, and a vacuum pump connection. In my modification of the experiment, an opening (vacuum-sealed) in the chamber behind the source is necessary to accomodate the electron gun, which will inject electrons to neutralize the alpha particles from the source. Purchase the appropriate chamber from an instrument supply house (such as Oxford Instruments in Tennessee). Make alterations to it as necessary.

2. Decide the radioactive source of alpha particles. Choose, for example, Po²¹⁰ or Am²⁴¹, as convenient. The primary alpha energy from Po²¹⁰ is 5.2 MeV, whereas from Am²⁴¹ it is 5.586 MeV. Note: gloves must always be worn when handling the source. Choose the amount of the source: 250 μCi to 1 mCi. For example, choose .5 mCi. (1 Ci = 3.7 x 10¹⁰ disintegrations/sec.)

3. Decide the target metal and size. For example, choose gold foil of thickness .00025 cm. The foil should be as thin as possible but self-supporting within its holder.

4. Choose the target metal. For example, choose a thin slab of scintillon B (Pilot B from Pilot Chemicals of Massachusetts), of width .565 cm, height 1.55 cm, and thickness .15 cm. This may be mounted to a photomultiplier tube (such as 6192 DuMont), which is then connected to the electronics (Fig. 2); or it may be connected via microdot vacuum to the PRE-AMP (Fig. 1).

5. Choose the electronics for the experiment. Fig. 1 shows a PRE-AMP (with BIAS and PULSER), an AMP, and an MCA. Fig. 2 shows an HV supply, a PM, HV divider, HV meter, Preamplifier, RCL discriminator, Oscilloscope, and Scaler. Purchase the items from an electronics supply house or a company such as Oxford Instruments.

6. Choose the vacuum pump. During the experiment, the chamber should have a pressure in the range of 1e-11 torr to 1 e-4 torr. (1 torr = 1 mm mercury, or 133.322 pascals [N/m²], or .001316 atm).

7. Choose the electron gun. For example, choose Kimball Physics EFG-7/EGPS-7 Electron Flood Gun and Power Supply (Fig. 3). This unit provides controls for beam energy, beam current, beam focus, and cathode heating voltage. It is commonly used in vacuum physics experiments and charge neutralization. Calculate the required electron energy and current, as follows. Electron velocity should match alpha particle velocity. Alpha particles have a mass of 6.62*10⁻²⁷ kg and so their energy is 5.2 MeV (5.327 J), their velocity is 15,860,990 m/sec. At this same velocity, electrons (which have a mass of 9.109*10⁻³¹ kg) have an energy of 1.14578*10⁻¹⁶ J, or 715.196 eV. There must be a minimum of 2 electrons injected for each alpha particle. The number of alpha particles in the incident beam is given as 1.1*10⁵ counts/min ([2]). So this amounts to needing 2.2*10⁵ electrons/min, or 3666.66 electrons/sec. This represents a current of 5.870*10⁻¹⁵ amperes. The specs for the above gun indicate a range in beam energy of 50 eV to 1500 eV and a range in beam current of 1 nA to 100 μA, so the gun is more than adequate for the job. (Perhaps it could be customized to have a current closer to what is needed, so as to avoid excess electrons.) It should be mounted behind the source so that the electrons go around the source and converge on the alpha particle beam. Perhaps a tube should be placed around the tip of the
II. Performance Steps

1. Assemble all the components selected in the design steps.

2. Remove the source (if it is in the chamber), place the target foil in its holder, turn the electron gun off, evacuate the chamber, and measure the background counting rate, denoted $R''$, at the angles shown on Table I (although this should be largely independent of angle). $R''$ is due to contamination of the chamber with bits of the source that have broken away, contamination of the foil, and to noise in the detector or electronics. Clean the chamber thoroughly to minimize this background count. If the target is contaminated, replace it.

3. Place the source in the chamber, but remove the target foil (it is in in the chamber), turn the electron gun off, evacuate the chamber and measure the counting rate at the same angles as above. This counting rate, denoted $R'$, is due to the source, but not produced by scattering in the target foil itself. $R'$ is mainly due to poor beam collimation, slit scattering, and scattering off residual air molecules. It should contain $R''$. Angular dependence may be expected.

4. Repeat step 3, but with the electron gun turned on. Gun controls should be adjusted so that nearly all of the alpha particles are neutralized, with few excess electrons. This background count, denoted $R'''$, should not be appreciably greater than $R'$. If it is, the gun controls will have to be adjusted until $R'''$ approaches $R'$.

The true counting rate, when the experiment is run with the electron gun off, is

$$R_{\text{true}} (\theta) = R (\theta) - R' (\theta) \tag{1}$$

where $R$ is the counting rate with both source and target in place. When the experiment is run with the electron gun on, the true counting rate is

$$R_{\text{true}} (\theta) = R (\theta) - R''' (\theta) \tag{2}$$

5. Take the target foil out, evacuate the chamber, and move the detector (or the chamber) to $0^\circ$. Measure the counts from the source, at this angle and at small angles on either side. Note where the peak number of counts occur. This indicates the true position of the beam axis. For instance if the axis is located at $\theta_0 = -0.25^\circ$, then all scattering angles must be corrected accordingly. The angle beyond which counts will be due to scattered alpha particles is the angle where counts from the source are zero. This could, for instance, be $\theta \geq 6^\circ$.

6. If, in the vertical direction, the beam size is larger than the dimension of the detector, then only a fraction $F$ of the incident beam reaches the detector. Let $h$ = detector height, $s$ = beam slit height (last collimator), $r$ = distance from source to last collimator, and $I$ = distance from last collimator to detector. Then, by geometry,

$$F = \left( \frac{\frac{h}{s}}{\frac{r}{r+I}} \right) \tag{3}$$

If $h = 1.55$ cm, $s = 1$ cm, $r = 5$ cm, and $I = 6.66$ cm, then $F = .665$. If $I_\theta$ is the peak counting rate obtained from the beam profile, then the total incident beam $I_0$ is given by

$$I_0 = \frac{I_\theta}{F} \tag{4}$$

If $I_\theta$ is 74000 counts/min, then $I_0$ is 110000 counts/min. It would be better to have $F = 1$.

7. Now measure $I_\theta$ (in counts/min) as a function of angle, for the angles in the table. Make one set with the electron gun turned off, and one set with the electron gun turned on. Subtract the appropriate background counts.

8. For the observed yields of scattered particles, obtain the differential cross-section of the target, from the expression

$$\frac{d\sigma}{d\Omega} = \frac{I_\theta}{\Delta\Omega I_0 N} \tag{5}$$

where $N$ is the number of gold atoms/cm$^2$ and $\Delta\Omega$ is the solid angle of the beam, approximated by

$$\Delta\Omega =$$

(6)
If \( h \), the height of the detector, is 1.55 cm, and \( w \), the width of the detector, is .565 cm, and \( l \), the distance to the target, is 6.66 cm, then \( \Delta \theta \) is .0197 sr (steradian). \( N \) is computed to be 1.4744 \( \times 10^{23} \) (from [1] or [6]). Place the values of the differential cross-section in the proper columns of the table (one column with the electron gun turned off and one with the electron gun turned on).

9. For each value of \( \theta_{\text{corr.}} \), compute the factor

\[
\frac{1}{\sin^4 \left( \frac{\theta_{\text{corr.}}}{2} \right)}
\]

and place in the proper column of the table. Both the conventional theory and the Reciprocal System make use of this factor.

10. The observed scattering factor, \( k \), is then the ratio of the differential cross-section of the factor computed in step 9. Record \( k \) in the table for each angle, for the situation with the electron gun turned off and with it turned on.

11. By least squares, obtain the best fitting value of \( k \), for both situations. (Use a computer program (such as [7]) with which one can specify no intercept in the regression equation. The \( Y \) values are the differential cross-sections, and the \( x \) values are the factors computed in step 9. The computed slope, \( m \), is the value of \( k \).) Compare with the theoretical values computed from the conventional theory and from the Reciprocal System (see [1], [3], [4]).

12. From [3], it will be necessary to repeat steps 1-11 201 times with the alpha particles charged and 251 times with the alpha particles neutralized, in order to have at least 99% assurance that the results will disconfirm one of the two theories. The actual repetitions can begin only when we are confident that the electron gun is working properly to neutralize the alpha particles.

13. Equations 17-24 of [3] should then be evaluated. (I will write a program to do the calculations automatically.) The difference in the sample means (Values of scattering constant \( k \)) of all the trials is then compared with the criterion. If the difference in sample means turns out to be less than the criterion, then the null hypothesis, my proposal, based on the Reciprocal System, will have to be accepted.

References


APPENDIX: Estimated Prices for the Hardware Items of the Experiment from Oxford Instruments, I received the following quotation:

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ion-Implanted Silicon Detector</td>
<td>$375.00</td>
</tr>
<tr>
<td>FET Spectroscopy Preamp</td>
<td>795.00</td>
</tr>
<tr>
<td>Detector Power Supply</td>
<td>995.00</td>
</tr>
<tr>
<td>Fast Pulser</td>
<td>1095.00</td>
</tr>
<tr>
<td>Spectroscopy Amplifier</td>
<td>1295.00</td>
</tr>
<tr>
<td>NIM Bin and Power Supply</td>
<td>1340.00</td>
</tr>
<tr>
<td>PC Multiport, Multichannel Analyzer for PC</td>
<td>3750.00</td>
</tr>
<tr>
<td>PC Interface Card</td>
<td>495.00</td>
</tr>
<tr>
<td>Vacuum Pump</td>
<td>1250.00</td>
</tr>
<tr>
<td>Rutherford Scattering Chamber</td>
<td>3550.00</td>
</tr>
</tbody>
</table>

**TOTAL** $14,940.00

A spare PC can be used for the experiment. If one is not available, then approximately another $2000.00 will be needed to purchase one.

From Kimball Physics, I received the following quote:

1. One EFG-7 / EGPS-7 Electron Flood Gun and Power Supply $7500.00
2. Customizing the Gun for the Necessary Current 7500.00
TOTAL $15000.00
TOTAL HARDWARE $29940.00

I expect to contract with Arthur C. Lucas of Victoreen, Inc. to carry out the experiment. He will be quoting me a labor charge shortly, after which we will seek funding.

* Will have to be modified to detect neutral particles

**Figure 1**

**Figure 2**

D 22.2-4
Reciprocity, Vol. XXII, No. 2 (Autumn 1993)

Figure 3.

EFG-7/EGPS-7F
ELECTRON FLOOD GUN/POWER SUPPLY

50 eV to 1500 eV Standard
100 eV to 5 keV Optional
UNIFORM WIDE-ANGLE LOW ENERGY ELECTRON BEAMS

FOR USE IN:
SURFACE PHYSICS STUDIES
VACUUM PHYSICS EXPERIMENTS
CHARGE NEUTRALIZATION
ELECTRON DESORPTION
SURFACE SCRUBBING
PHOSPHOR TESTING
IONIZATION EXPERIMENTS
SEMICONDUCTOR PROCESSING

FEATURING:
WIDELY CONTROLLABLE PARAMETERS
FLOOD BEAMS OR
NARROW ANGLE BEAMS
COMPUTER CONTROL /
REMOTE CONTROL

The Kimball Physics EFG-7 Flood Electron Gun, with its matching EGPS-7F Power Supply, is intended for use in a variety of UHV, Surface Physics, and Processing applications. It is a complete subsystem ready to attach and turn on. Both beam energy and beam current are adjustable over wide ranges. Beam divergence is also directly controllable. The gun uses a space charge limited refractory metal cathode to generate a uniform flood beam, and the design allows generation of this beam down to medium low energies, and very low currents. An energy range of up to 5 keV is an option. An external connector allows control of all gun power supplies, including the floating supplies, via 0 to 10 V analog inputs at ground potential (optional deflection supplies use +10 V to +10 V analog inputs). All common interface bus types can be accommodated, by use of appropriate D to A converters. A pulse grid option allows slow beam pulsing using a pulse generator.

UHV technology is used throughout. The cathodes are not damaged by repeated exposure to atmospheric gases or water vapor when cold. The gun can be run in vacuums from 1 E-11 torr to 1 E-4 torr. It is bakeable up to 350° C with cables removed. Firing units (containing cathode, control grid, triode structure with ceramic insulators, and electrical connections) are user-replaceable; spare firing units may be returned to the factory for rebuild. The electron gun itself may also be sent back to the factory for complete disassembly, cleaning, and/or installation of a new cathode.
**EFG-7F ELECTRON GUN SPECIFICATIONS**

- **BEAM ENERGY**: 50 eV to 1500 eV
  - Optional: 100 eV to 5 keV

- **BEAM CURRENT**: 1 nA to 100 µA

- **ENERGY SPREAD**: Approximately 0.4 eV plus Space Charge Well

- **SPOT SIZE**: Variable 1 mm to 70 mm

- **WORKING DISTANCE**: 25 mm to 200 mm

- **BEAM DEFORMATION**: Optional: +/− 5° at 1500 eV

- **PULSE CAPABILITY**: Optional: Down to 100 µsec

- **BEAM UNIFORMITY**: +/− 20% with appropriate Drive Potentials and Clean System

- **CATHODE**: Replaceable Refractory Metal; not harmed by repeated exposure to atmospheric gases while cold

- **MOUNTING**: 70 mm Flange

- **MECH BEAM ALIGN**: +/− 2° with Optional Port Aligner

- **GUN LENGTH**: 120-180 mm Range (Set at 160 mm if no preference indicated)

- **GUN DIAMETER**: 25.4 mm Flange; Necks down to 16.1 mm at 100 mm from flange

- **FEEDTHROUGH CONNECTOR**: Metal to Metal Shell, Matting Connector and Cable Furnished

- **CABLE**: Multi-conductor Triaxial High Voltage
  - 3 m Cable to connect Gun to Power Supply; Optional Length: 6 m

- **BAKEOUT TEMP**: 350°C Maximum (cable removed)

---

**EGPS-7F ELECTRON GUN POWER SUPPLY SPECIFICATIONS**

- **OUTPUTS**: All Necessary Voltages, to drive
  - EFG-7F Electron Gun Including: Cathode Heating and Control Grid, which float at Beam Energy, and Beam Focus

- **ENERGY STABILITY**: 0.1% at Full Output

- **CURRENT STABILITY**: 10% Drift per hour after Warmup

- **DEFLECTION**: Optional: Centering Deflection
  - Optional: Raster Capability
  - Deflection Voltages: +/− 100 V

- **CONTROLS**: Controls provided for Beam Energy, Beam Current, Beam Focus, and Cathode Heating Voltage

- **COMPUTER REMOTE CONTROL**: 0 to 10 V Analog Programming at Ground Potential; Optional Deflection Supplies use +/− 10 V

- **METERING**: Digital Meter monitors Beam Energy, Focus, Deflection/Raster Voltages; Analog Meters monitor Cathode Voltage, Cathode Current, Grid Voltage, and Beam Current

- **INPUT**: 105 to 125 VAC, 47 to 63 Hz, 150 W; 210 to 240 VAC available

- **DIMENSIONS**: 432 mm Wide, 178 mm High, 483 mm Deep, Rack Mount Kit Included

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**KIMBALL PHYSICS INC.**

**KIMBALL HILL ROAD WILTON NEW HAMPSHIRE 03086-9742**

PHONE: (603) 875-1616 FAX: (603) 875-3700

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Kimball Physics manufactures a variety of electron and ion sources for many applications. For further information contact Sales.

It is not necessarily possible to achieve all maximum specifications simultaneously. Specifications Subject to Change Without Notice.

Typical operating performance is indicated by graphs shown; data should be used for guidance only.
**ALPHA PARTICLE SCATTERING EXPERIMENT RESULTS**

Date: _______  Start Time: _______  End Time: _______

Source: ________________
Energy (J): ________________
Amount (curies): _______

Electron Gun Energy, when on (ev): _______
Electron Gun Current, when on (A): _______

Peak Counting rate (counts/min), \( I_{0 \rightarrow 0} \): _______
Fraction, \( F \), Reaching Detector: _______
Total Incident Beam, \( I_o \) (counts/min): _______
Target Material: _______
\( N \) (no. atoms/cm\(^2\)): _______
Solid Angle of Beam, \( \Delta \Omega \) (sr): _______

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Best fitting \( k_{e.g. \text{off}} \): _______
Best fitting \( k_{e.g. \text{on}} \): _______

Conventional theoretical value of \( k_{e.g. \text{off}} \): _______
Conventional theoretical value of \( k_{e.g. \text{on}} \): 0.00
Reciprocal System theoretical value of \( k_{e.g. \text{off}} \): _______
Reciprocal System theoretical value of \( k_{e.g. \text{on}} \): _______
The Wave Mechanics in the Light of the Reciprocal System

K.V.K. Nehru

One of the large areas to which the Reciprocal System is yet to be applied in detail is spectroscopy. The need is all the more urgent as vast wealth of empirical data is available here in great detail and a general theory must explain all the aspects. To be sure, this was one of the earlier areas which Larson explored.[1] But he soon found out, he writes, that there were complications too many and too involved that he decided to postpone the investigation until more basic ground was developed by studying other areas.

Coupled with this is also the fact that the calculation of the properties of elements like the lanthanides is still beyond the scope of the Reciprocal System as developed to date.[2] The question of the appropriateness of the Periodic Table as given by Larson is still open.[2-5]

Under these circumstances it is certain that there is lot more to be done toward enlarging the application of the Reciprocal System to the intrinsic structure of the atom. Perhaps it is time to break new ground in the exploration of the mechanics of the time region, the region inside unit space. Breaking new ground involves some fresh thinking and leaving no stone unturned. In this context, it may be desirable to examine, once again, such a successful theory as the Wave Mechanics in the light of our existing knowledge of the Reciprocal System.

The Fallacies of the Wave Mechanics

The fundamental starting point of the Wave Mechanics is the correlation, which Louie de Broglie advanced originally, of a wave with a moving particle. Like every wave has a corpuscular aspect, as shown by Planck's analysis of the blackbody radiation, the photoelectric effect and the Compton effect (the scattering of photons by particles), it is hypothesized that every particle has a wave aspect. Since the characteristics of waves and particles are mutually exclusive in many ways, this concept of associating a wave with a particle had been beset from its inception with a contradiction that had been euphemized by stating that the two are 'complementary' aspects. This led to many an epistemological difficulty; the quantum theorists concluded that the phenomena (particles) inside the atom are not localized in physical space, that the electron in the atom does not exist in an objectively real manner, that it is but a mathematical symbol, and that the world is not intrinsically reasonable or understandable in the realm of the very little. One may refer to The Case Against the Nuclear Atom[6] by Larson for a critical appraisal.

While this is so, it must be noted that the Wave Mechanics was succesful in explaining the vast wealth of the spectroscopic data. The several quantum numbers, n, l, m, etc. come out in a natural way in the theory. Even the 'selection rules' that govern the transitions from one energy state to another could be derived. The fine and hyperfine structures of the spectra, the breadth and intensity of the lines, the effects of electric and magnetic forces on the spectra could all be derived with great accuracy. In addition, it predicts many non-classical phenomena, such as the tunnelling through potential barriers or the phenomena connected with the phase, that found experimental verification. Thus we can see that the mathematical success of the Wave Mechanics is accompanied by a gross misinterpretation of the physical concepts involved. It is the latter which Larson points out and condemns in his criticism of the conventional atomic theory.[6]

It might be worthwhile to examine if the Wave Mechanics could be purged of its conceptual errors, drawing from our knowledge of the Reciprocal System, and to see if the transformed version could be integrated into the Reciprocal System scheme with advantage. After all we have seen this happen in the case of the Special Theory of Relativity. Some of its mathematical aspects—like Lorentz transformations or the mass-energy equivalence—could be adopted by the Reciprocal System after purging the theory of the wrong interpretations.

Reinterpretation of the Physical Concepts of the Wave Mechanics

Let us take a look at the original points linking the concept of the wave with that of the moving particle. The frequency \( \nu \) and the wavelength \( \lambda \) of the wave are respectively given by

\[
\nu = \frac{E}{\hbar} = \frac{M \cdot c^2}{\hbar}
\]  

(1)
\( \lambda = h/p = h/(M.v) \) \hspace{1cm} (2)

where \( E \) is the energy, \( p \) the particle momentum, \( M \) the mass, \( v \) the particle speed, \( c \) the speed of light and \( h \) Planck's constant. Now the product of \( v \) and \( \lambda \) gives the wave velocity

\[ u = v\lambda = c^2/v \] \hspace{1cm} (3)

That is, measured in the natural units, the propagation speed of the wave associated with the particle is the inverse of the particle speed:

\[ u_{nat} = u/c = 1/(v/c) = 1/v_{nat} \] \hspace{1cm} (4)

As the speed of the particle increases from zero upwards, the corresponding speed of the associated wave decreases from infinity downwards.

It is at this juncture that our knowledge of the Reciprocal System helps clarify the physical situation. In particular, we recall that while speed is reckoned from the standpoint of a three-dimensional spatial reference system, inverse speed is reckoned from the standpoint of a three-dimensional temporal reference system. While the speed of the origin of the three-dimensional spatial reference system is zero in that system, the inverse speed of the origin of the three-dimensional temporal reference system is zero in the latter system, or the speed of the temporal zero would be infinite in the spatial reference system. It can easily be seen that a particular speed \( v_{nat} \) reckoned from the spatial reference system is identical to the inverse speed \( 1/v_{nat} \) reckoned from the temporal reference system. Therefore it follows that the switching from the particle speed \( v_{nat} \) to the associated wave speed \( u_{nat} = 1/v_{nat} \) tantamount to the shifting of the reckoning from the three-dimensional spatial reference system to the three-dimensional temporal reference system.

This is exactly what needs to be done at the juncture where the phenomena (motion) under consideration enter the time region (see Appendix I). In the time region there could be only motion in time, and the relevant reference frame to represent the motion would have to be the three-dimensional spatial reference frame. Since changing from the corpuscular view to the wave view has the significance of shifting from the three-dimensional spatial reference frame to the three-dimensional temporal reference frame, the theorists have unknowingly adopted the right procedure in connection with the calculations relevant to atomic dimensions. But it is no longer necessary to maintain, as the theorists do, that an entity is a particle as well as a wave at the same time, since these two views are irreconcilable. The truth is that the particle viewed from the three-dimensional spatial reference frame is the wave viewed from the three-dimensional temporal reference frame. While the particle has a definite location in the former reference frame, the associated wave, being monochromatic has infinite extent. In the temporal reference frame it appears as infinite repetition.

We often come across situations where a change of the coordinate frame, say, from the rectangular to the polar, facilitates the mathematical treatment. In such cases, the same geometrical form---or more generally, the space-time configuration, namely, motion---takes on different mathematical forms in the different coordinate frames. In the present context we have the converse situation, wherein different coordinate frames engender different space-time configurations from the same underlying reality (see Appendix II). In other words, a change of coordinate frames transforms one physical object (space-time configuration) into an apparently different physical object.

Time and again we find the theorists being compelled to resort to similar transformations (without, of course, the benefit of the insight given by the Reciprocal System). Consider, for example, the phenomenon of diffraction of particles/waves by crystal lattices. Here they customarily work out the interaction in terms of the wave vector \( k \) and the reciprocal lattice, instead of the wavelength \( \lambda \) and the direct lattices respectively.

The quantity \( k = 2\pi/\lambda \) is called the wavenumber. The vector with modulus \( k \) and an imputed direction is the wave vector \( k \). From Eq.(2) it can be seen that the wave vector represents momentum. If \( a_1, a_2 \) and \( a_3 \) are the sides of the unit cell sides \( b_1 = 2\pi/a_1, b_2 = 2\pi/a_2 \) and \( b_3 = 2\pi/a_3 \) is called the reciprocal lattice. Without genuine insight, it is regarded as an invariant geometrical object whose properties are fundamental in the theory of solids. However, from the Reciprocal System we know that in solids the motion equilibrium is in the time region, where space is replaced by equivalent (reciprocal) space. Therefore we can readily see the rationale in adopting the
wave vector (reciprocal wavelength) and the reciprocal lattice in place of the wavelength and the direct lattice respectively.

The Uncertainty Principle

The quantum theorists, being uninformed about the existence of the time region, naturally thought that these waves, associated with the particles, exist in the space of the conventional reference system, while the truth is that they exist in the equivalent space of the time region. Now a particle is localized whereas its associated wave is spread out infinitely. Since the theorists have been mistaking that both the particle and the associated wave exist in the space of the conventional reference frame, they thought if \( \Delta x \) is the region in which the particle is located then it is reasonable for the wave too to be limited in the same extent \( \Delta x \), equal to the 'size' of the particle. They then identify the wave packet, rather than the original monochromatic wave, with the particle. The so-called uncertainty principle stems from this procedure, because the range of size \( \Delta x \), and the range of wave numbers \( \Delta k \), of the waves composing the wave packet, are inversely related as could be seen from Fourier analysis.

\[
\Delta x = \frac{1}{\Delta k} \quad (5)
\]

Using Eq.(2) we have

\[
\Delta x \cdot \Delta p = \frac{\hbar}{2\pi} \quad (6)
\]

which is the conventional statement of the uncertainty principle.

But now, one realizes that while the particle is localized in space, it does not entail that the associated wave is also to be somehow localized in space, since the latter is to be reckoned from the point of view of the three dimensional temporal reference frame and not the spatial reference frame.

It may be a practical difficulty to measure both the location and the momentum of a system of atomic dimensions with unlimited accuracy simultaneously. But the conclusion drawn by the theorists from the uncertainty principle that a system of atomic dimensions does not possess these properties of precise location and precise momentum simultaneously can be seen to be invalid. As Larson rightly points out, conclusions such as these are applicable only to the theorists' model, not to the actual system. The uncertainty principle is merely the statement of the fact that the characteristic length belonging to space, namely \( \Delta x \) cm, and the characteristic length belonging to equivalent space, namely \( \Delta k \) cm\(^{-1}\) are reciprocally related (Eq. 5).

The Probability Interpretation

The second point to be recognized is that the wave information is not to be visualized as mapped out on the space of the conventional spatial reference system. The reference frame for the wave is a temporal manifold. As creatures of the material sector we have no direct access to the three-dimensional temporal reference frame: we are rather anchored to the three-dimensional spatial reference frame. But fortunately, we can accomplish the equivalent of the transformation from the spatial to the temporal frame by the contrivance of adopting the wave picture in place of that of the particle. It must continually be borne in mind that the three-dimensional spatial manifold being used in this context is so used as a temporal analogue. This is why the wave function (specifically, the square of the amplitude) takes on the probability interpretation. The action itself is unambiguous and precise, but since it takes place in the temporal reference frame, the outcome in the three-dimensional spatial reference frame is governed by chance and therefore statistical.

The randomness of the radioactive disintegration is another example to the point. When the total mass (rotational + vibrational) of the atom builds up to the upper zero point for rotation, the time-zero as we might call, the (excess) motion reverts to the linear status and is jettisoned as radiation or other particles. Since it is the result of reaching the time-zero point the action is in time instead of in space. The radioactive disintegration proceeds continuously and contiguously in three-dimensional time. But since locations in the three-dimensional spatial frame, the apparent disintegration of the atoms (as observed from the conventional spatial standpoint) seems utterly random.

Again the interference of light is another example. The crests and troughs of the resultant wave in the two-slit experiment coincide respectively with the regions where the maximum and the minimum number of photons reach. But if the beam intensity is very low, say only a few photons are passing the slits, then all that we can say is that a photon
has a greater likelihood of arriving at the location indicated by the wave crest rather than at any other place. In other words, the wave (square of the amplitude) takes on probability interpretation.

This is also precisely the reason why the theorists find some of these forces to be non-local in nature—a totally non-classical phenomenon—namely, that they originate in the time region and the connection between the locations in three-dimensional time and the locations in three-dimensional space is random. We have discussed this point in connection with the phenomena of ferromagnetism and superconductivity.

Wave Mechanics Without the Nucleus

In The Case Against the Nuclear Atom Larson advances arguments to establish that the concept of the nucleus of the atom is untenable. He points out that, in fact, the 'size' of the nucleus obtained by the scattering experiments is rather the size of the atom itself. Our calculations in the next section corroborate this. While Larson's confusion of the nuclear concept proceeds from his original arguments, his criticism of the Quantum Theory, given in the same work, was based entirely on citations from other experts in the field, including those of the pioneers of the Theory. Larson himself does not directly analyze or comment upon any part of the Quantum Theory or the Wave Mechanics. And all those criticisms he quotes deal with the epistemological difficulties only—such as the 'lack of rationality,' etc. which we mentioned at the outset—none deal with the mathematical aspects.

Now since we realize that the entire confusion in the area arises from the fact that the theorists do not distinguish between the space of the conventional reference system and the equivalent space of the time region (of which they do not know), if we set this right by explicitly recognizing that the associated wave is reckoned from the three-dimensional temporal reference frame, we would have achieved much progress.

Since according to the Reciprocal System there is no nucleus, we need to give new interpretation to the energy term occurring in the Schrödinger equation for the wave. It cannot be regarded as the energy level of an orbiting electron. But as we shall see below, this can be treated as the energy level of the atom itself.

The Size of the Atom

Larson has pointed out that as the three-dimensional motion that constitutes the atom extends in the time region, its measured size in the time-space region (namely, the conventional three-dimensional spatial frame) would be much smaller than one natural unit of space, \( s_{nat} \). It is reduced by the inter-regional ratio, 156.44, which was calculated earlier as the number of degrees of freedom in the time region, and 8, which is the number of degrees of freedom in the time-space region. Since the atomic rotation is three-dimensional, the cube of 156.44 is the applicable value. So the measured atomic radius would be the following

\[
s_{nat}/(8 \times 156.44^3) = 14883 \times 10^{-13} \text{ cm}
\]

(adopting \( s_{nat} = 4.558816 \times 10^{-6} \text{ cm} \) from Larson). Since actually it is the volume with which the equation is concerned, rather than the length (radius), there is an additional geometrical factor, \( f \), relating the volume of a cube (of side \( f^* x \)) with that of a sphere (of diameter \( x \)) given by

\[
(f^* x)^3 = x \times x^3/6
\]

which gives \( f = 0.806 \). Adopting this, the measured radius, based on the natural unit of volume concerned, would be

\[
f \times 1.4883 \times 10^{-13} \text{ cm} = 1.1995 \times 10^{-13} \text{ cm}
\]

But this is specifically the measured radius of an atom of unit atomic weight. If the atomic weight of the atom is \( A \) units, then the measured radius of the atom turns out to be

\[
r_A = 1.2 \times A^{1/3} \text{ fm}
\]

As can be seen, this agrees well with the results obtained from the scattering experiments for the so-called nuclear radius. This therefore confirms Larson's view that the experimenters are confusing the atom with the nucleus.

The Region of One-dimensional Motion

We recall that the atom is constituted of three rotations a-b-c. 'a' and 'b' are two-dimensional rotations (three-dimensional motion) in two of
the scalar dimensions, and 'c' is a one-dimensional reverse rotation in the third scalar dimension. Since this one-dimensional rotation is not the basic rotation of the atom, the inter-regional ratio applicable to this is the purely rotational factor 128. As the degrees of freedom in the time-space region is 8 as already pointed out, the range of sizes associated with the one-dimensional rotation in the time region is

\[ \frac{\text{s}_{\text{nat}}}{(8 \times 128)} = 4.45 \times 10^{-9} \text{ cm} \]  \( (8) \)

Hence we can expect the discrete speeds which exist within this spatial range, as far as the one-dimensional type of rotation is concerned, to be part of the atomic structure and the origin of the energy levels that explain the line spectra. Our preliminary study suggests that further prospects for the understanding of the spectroscopic data lie in this zone of one-dimensional rotation of the time region.

Conclusion

It is shown that while the Wave Mechanics has been very successful and accurate mathematically, it is fraught with some fundamental errors. A review of the latter in the light of the Reciprocal System of theory shows that the principal stumbling block was the ignorance of the existence of the time region and its peculiar characteristics.

Knowledge of the Reciprocal System enables us to recognize two crucial points: (i) that the wave associated with a moving particle, in systems of atomic dimensions, exists in the equivalent space of the time region; and (ii) that the switching from the particle view to the wave view is equal in significance to shifting from the standpoint of the three-dimensional spatial reference frame to that of the three-dimensional temporal reference frame. This recognition not only throws new light on the intriguing wave-particle duality, but also corrects the conceptual error that eventually led the theorists to the wrong conclusion that the world of the very small does not conform to the rational laws that are applicable to the macroscopic world.

It is shown that the uncertainty principle does not stem from the intrinsic nature of the atomic phenomena, as the theorists would have us believe, but is rather the result of gratuitously assuming that the wave associated with a moving particle is spatially extensive with the particle. The probability connotation of the wave function is shown to arise from the two facts that the wave is existent in the three-dimensional temporal manifold, and that locations in the three-dimensional temporal manifold and the three-dimensional spatial manifold are randomly connected. The non-local nature of the forces in the time region also follows from the above.

Calculations based on the inter-regional ratios applicable confirm Larson's assertion that the measured size of the atom is in the femtometer range and hence the actual atom is being confused with the non-existent nucleus.

It is suggested that investigation of the one-dimensional motion zone of the time region, in conjunction with the adoption of the Wave Mechanics corrected of its conceptual errors, will lead to greater understanding of the atomic structure and thereby pave the way for the complete explanation by the Reciprocal System, of the spectroscopic data, as well as the other recalcitrant problems connected with the properties of rare-earths etc.

References


4. Robert V. Tucek, "New Periodic Table," Reciprocity, XXI (1), Spring 1992, p. 20


7. K. V. K. Nehru, "Is Ferromagnetism a Co-magnetic Phenomenon?" Reciprocity, XIX (1), Spring 1990, pp. 6-8

Appendix I

According to the Reciprocal System space and time occur in discrete units only. If two atoms approach each other in space, they cannot come any nearer than one natural unit of space, $s_{nat}$. Within one natural unit of space no decrease in space is possible since one natural unit is the minimum that can exist. However, since the basic constituents of the physical universe are units of motion or speed in which space and time are reciprocally related, an increase of time $(t)$ with space constant is equivalent to a decrease of space $(1/t)$. This is referred to as the equivalent space in the Reciprocal System. Therefore, though the atoms cannot approach each other nearer than one natural unit of space, they can do so in the equivalent space by moving outward in time. As all changes in this region inside unit space are in time only, it is referred to as the time region.

Appendix II

Consider, for instance, a wave motion in the three-dimensional temporal reference frame, of amplitude given by

$$\sigma = A + B \cdot \cos \nu$$

(i)

with $A$ and $B$ as constants, and $\nu$ as the time coordinate. In order to return to the spatial reference frame, we (i) transform the time coordinate $\nu$ into $\phi$, a rotational space coordinate—rotational because all our time measurements are based on cyclical processes; and (ii) transform $\sigma$ into $1/r$, since equivalent space and actual space are reciprocally related. We then find that the above equation (of the wave configuration) becomes the equation of an ellipse (or hyperbola) that represents the locus of a planetary mass point revolving around a central force.

$$1/r = A + B \cdot \cos \phi$$

(ii)

where $A/(A^2 - B^2)$ is the semimajor axis and $B/A$ the eccentricity. (It must be cautioned that though the above example illustrates the point in question, it is not a complete analogy.)

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Minkowski vs. Einstein on Space Translation

Frank H. Meyer

Space at Rest or in Uniform Translation?

The four-dimensional space-time theory of H. Minkowski\(^1\), mathematician, is usually considered equivalent to or even identical with the space-time continuum theory of A. Einstein\(^2\), physicist. However, a physical difference in the space-time conceptions of these two men probably will prove more significant than their previously noted mathematical similarity. The theories differ in an important physical respect, namely in the different view each offers about the probable relation of space-time to motion. The one affirms that uniformly translating space is compatible with Newtonian mechanics; the other denies that space progresses with time progression.

Einstein\(^3\) expresses the conventional attitude toward space when he writes that "the idea of motion may not be applied to it." The context of this statement makes clear that he intends "it" to refer to physical space, as viewed in the light of his general relativity theory. Einstein thus agrees with Newton\(^4\) that space is immovable. Einstein says that space cannot and does not translate with time progression.

Compared with that of Newton and Einstein, the attitude of Minkowski toward the probable relation of space to motion is unconventional. He expresses a novel probability, which he considers valid, however, in the light of Newtonian mechanics. This is the probability which both Newton and Einstein ignore in the development of their theories about the nature of space and motion. In Minkowski's opinion\(^1\) three-dimensional physical space can be and is just as likely to be "in a state of uniform translation" or constant scalar progression as to be "stationary" in time. Minkowski\(^1\) declares clearly that there is no way he knows "to decide" between these two alternatives, whose truth he considers to be equally probable.

Time at Rest or in Uniform Translation?

The stationary character of space, presumed by both Einstein and Newton, implies a stationary time and the representation of motion as static\(^5\).

In Newton's physics the stationary character of time, though less evident, is no less intended. Unlike Einstein, Newton assumes that space and time exist quite independently of one another. Newton explicitly postulates the stationary("space is immovable") character of space, but not of time. Newton's opinion that "time flows equably without any relation to anything external" appears analogous to Minkowski's paradigm that space may be in uniform translation. If river flow is motion, then are not equable time flow and uniform space translation likewise motion? No, neither to Newton nor to Einstein. Strange as this may appear to subsequent thinkers, flowing time to Newton and Einstein is compatible with assigning to time a stationary or static character.

The telling evidence that time flowing implies no motion of time for Newton is the declared position of Isaac Barrow, Newton's teacher. Newton essentially accepted and adopted Barrow's theory of time. In his Geometrical Lectures Barrow\(^6\) rejects the proposition of Aristotle\(^7\) that time "is an aspect of movement":

"But does time not imply Motion? Not at all, I reply, as far as its absolute intrinsic nature is concerned; no more than rest; the quality of time depends on neither essentially; whether things run or stand still, whether we sleep or wake, time flows in its own tenor. Imagine all the stars to have remained fixed from their birth; nothing would have been lost to time; as long would that stillness have endured as has continued the flow of this motion."

Does motion include or exclude space-time?

Barrow's claim that time does not imply motion and the claims of Newton and Einstein that space does not imply motion are grounded on a further unproved claim that motion is impossible unless something is moving and neither space nor time is any thing. On this baseless ground uniform scalar outward quantized space progression with uniform quantized time progression has been excluded from most conventional physics for centuries by the physics profession.

Einstein delimits the finite speed of absolute uniform quantized space progression with absolute uniform quantized time progression.
from unit speed to zero speed. With his theory of relativity he substitutes for the absolute unit speed of uniform scalar three-dimensional space-time progression, the absolute speed of light in vacuo in a stationary or static four-dimensional space-time continuum.

Since he postulates the speed of equable time progression to be zero, this dimension is equated with the dimensions of the conventional three-dimensional zero speed of absolute space progression as a fourth dimension of space. This serves for all practical purposes of measuring the motion of moving things with rigid rods and clocks. In this way the relativity theory has masterfully obscured the physical fact that the speed of light is the absolute uniform unit speed of three-dimensional outward scalar space-time progression or the speed of the physical locations of photons and other massless particles, as viewed in the above contrived stationary “four-dimensional” space-time reference frame.

Though predicated on the untruth that space and time are immovable, the static space-time continuum of relativity theory has several pragmatic advantages. The theory proposes that space and time are related in having the same zero rate of passage and corrects Newton’s mistaken scholia that they are unrelated.

This relativistic space-time continuum model introduces one new and one old economy into science. By proposing to treat time as a fourth dimension of space, relativity theory eliminates any further consideration of time and motion in time in favor of space and motion in space. This has the effect of ruling the speed of light not only the only absolute speed, but also the maximum speed allowed to the physical universe.

By proposing without further examination that space-time and motion, unlike light and matter, are infinitely divisible, which is the meaning of continuum, the model leaves out of account the question whether space, time and motion may not be, like light and matter, quantized?

The creator of the static four-dimensional space-time continuum model initially was quite pleased with his solution of the problem, which Einstein characterized thus:

“Our only way out seems to be to take for granted the fact that space has the physical property of transmitting electromagnetic waves, and not to bother too much about the meaning of this statement.”

Taking for granted that it is a fact that space (and time) have the physical property of transmitting electromagnetic waves, does it follow that our only way out is to agree that this space must be the motionless or stationary continuum of Einstein’s relativity theory?

Another way out worth trying is the Minkowski1 and Larson8 proposal that space uniformly translates with time progression at the speed of light and that space, time and motion are quantized rather than infinitely divisible. What can be retained of Einstein’s relativity theory is his commendable hunch that Newton is mistaken in supposing that space and time are quite unrelated.

While Einstein did a great public service during the twentieth century calling attention to the fact that space and time are somehow naturally and essentially related and inseparably united, he did not discover to the time of his death the physical character of this relationship and unity in the uniform outward unit speed of one discrete unit of space per discrete unit of time, the translating speed of physical locations, whether or not occupied by photons or other massless particles. This was rather the discovery of Dewey B. Larson8, first published in 1959.

**How Space Translates with Time Progression**

A flaw of the theory of relativity is its space-time continuum postulate. It is no wonder that Einstein9, who was an uncommitted investigator, in his later years came to question his and Minkowski’s continuum postulate:

“I am tending to the belief that it is impossible to continue further with the continuum theory.”

To examine the proposal of Larson that space translates with time progression calls at the start for discarding this arbitrary continuum postulate that space and time are infinitely divisible in favor of adopting instead the contrary postulate that space and time are quantized or finitely divisible.

Einstein and his followers of the relativity theory have taught uncritically that there is no other way or at least nobody has found any other way to account for and measure the absolute constancy of the speed of light in
vacuo than the unquantized, motionless or stationary, four-dimensional space-time continuum reference frame system. Here are some examples of this relativity teaching:  

"...we shall assume without examination... the unidirectional, one-valued, one-dimensional character of the time-continuum."\textsuperscript{10}  

"Both space and time are assumed to have to be infinitely divisible to have no ultimate structure."\textsuperscript{11}  

"While fields and particles come and go, space and time lie inert, providing the stage upon which the actors play their roles."\textsuperscript{12}  

"From the quantum phenomenon it appears to follow with certainty that a finite energy can be completely described by a finite set of numbers (quantum numbers). This does not seem to be in accord with a continuum theory and must lead to an attempt to find a purely algebraic theory for the description of reality. \textit{But nobody knows how to obtain the theory.}"\textsuperscript{13} (italics mine)  

It cannot be denied that as early as 1959 Larson\textsuperscript{14} explained the existence of light, electricity, magnetism, matter, etc. in quantized (infinitely divisible) form as caused by the quantized existence of motion, space and time. In this theory, the reciprocal system of physical theory, the absolute constancy of light speed is accounted for as the unit speed, one natural space unit per one natural time unit, the uniform rate of outward scalar progression with time progression of the physical locations of all photons and other massless particles.  

**New Definition Excludes Absolute Rest**  

Hitherto scientists have always supposed that some stationary body must somewhere exist and can be found as the basis of building a most suitable reference frame for examining, thinking about and understanding motion. Thus, Aristotle and Ptolemy chose the stationary Earth; Copernicus and Kepler, the stationary Sun; Newton and Maxwell, Immovable Space or a Stationary Ether; Einstein and Minkowski, an Inert Space-Time. Larson finds rather that the most natural reference system for understanding motion is the three-dimensional outward scalar uniform space-progression with time progression of physical locations at unit speed. In this reference system photons and other massless particles remain stationary, each in the physical location in which it originates. Most physical locations are unoccupied, whether unoccupied or occupied, each location progresses at the same unit speed.  

Among others Aristotle and Leonardo da Vinci counsel that to understand Nature, try to understand Motion. Previously, however, scientists have ignored motion as the primary, fundamental term of physics.  

The modern conjecture about an, inert, stationary space-time is a corollary of the postulate that the physical universe is a universe of matter, of things and energy, and that motion, space and time are functions of matter. According to this conjecture, matter is primary to motion, space and time. Space is not considered as an aspect of motion, but of matter by Einstein: "Now as regards the concept of space: this seems to presuppose the concept of the solid body." Also, "According to the general theory of relativity, the geometrical properties of space are not independent, but are determined by matter."\textsuperscript{2a}  

The reciprocal system of Larson introduces a new postulate about the universe, a new definition of motion, unit of motion and physical location:  

The universe is composed entirely of one component, motion, existing in three dimensions and discrete units.  

Motion is the relation between two uniformly progressing reciprocal quantities, space and time.  

By reason of the postulated reciprocal relation between space and time, each individual unit of motion is a relation of one unit of space and one unit of time, motion at unit speed. The magnitude of unit speed is identified with the speed of light.  

According to our definition, motion involves a uniform progression of both space and time. A physical location in space is a point or segment of the line of space progression at a given time. A physical location in time is a point or segment of the line of time progression at a given place.  

The future will reveal whether the reciprocal system of physical theory is the way to the revaluation of physics for achieving unification of our science.  

The past as early as 1881 already has brought in its verdict concerning both the special and
general relativity theory to the extent that it is irrecoverably committed to the immovable four-dimensional space-time, also known as the stationary ether.

In an Address delivered on May 5th, 1920, in the University of Leyden, Dr. Einstein summarized his theory of relativity:

"Recapitulating, we may say that according to the general theory of relativity space is endowed with physical qualities; in this sense, therefore, there exists an ether. According to the general theory of relativity space without ether is unthinkable; for in such space there not only would be no propagation of light, but also no possibility of existence for standards of space and time (measuring-rods and clocks),..... But this ether may not be thought of as endowed with the quality characteristic of ponderable media, as consisting of parts which may be tracked through time. The idea of motion may not be applied to it."

In 1881 Michelson conducted a famous experiment at Potsdam, Germany. He explained the unexpected outcome of this experiment:

"The interpretation of these results is that there is no displacement of the interference bands. The result of the hypothesis of a stationary ether is thus shown to be incorrect, and the necessary conclusion follows that the hypothesis is erroneous." (my italics)

References

15. A. Michelson. American Journal of Science. 3d ser. 22: 100-129 (August) 1881

Excerpt from Dewey B. Larson's book, Nothing But Motion, pages 15-16:

The simple concept of a universe of motion, without additions or modifications—the concept utilized in this present work—is that of a universe which is composed entirely of motion.

The significant difference between these two viewpoints lies in the role that they assign to space and time. In a universe of matter it is necessary to have a background or setting in which the matter exists and undergoes physical processes, and it is assumed that space and time provide the necessary setting for physical action. Many differences of opinion have arisen with respect to the details, particularly with respect to space—whether space is absolute and immovable, whether such a thing as empty space is possible, whether or not space and time are interconnected and so on—but throughout all of the development of thought on the subject the basic concept of space as a setting for the action of the universe has remained intact. As summarized by J. D. North:

Most people would accept the following: Space is that in which material objects are situated and through which they move. It is a background for objects of which it is independent. Any measure of the distance between objects within it may be regarded as a measure of the distance between its corresponding parts.

Einstein is generally credited with having accomplished a profound alteration of the scientific viewpoint with respect to space, but what he actually did was merely introduce some new ideas as to the kind of setting that exists. His "space" is still a setting, not only for matter but also for the various "fields" that he envisions. A field, he says, is "something physically real in the space around it". Physical events still take place in Einstein's space just as they did in Newton's space or in Democritus' space.