A test of Aetherometry vs Relativity, Special and Larmor-Lorentz: the 1938 Ives-Stilwell experiment

Running Title: Test of Aetherometry vs Relativity

Paulo N. Correa,[1] Alexandra N. Correa,[1] Malgosia Askanas,[1] Gene Gryziecki,[1] Jordi Sola-Soler[2]

[1] *Aurora Biophysics Research Institute, Vaughan, Ontario, Canada*, [2] *Biomedical Engineering Research Center, Universitat Politècnica de Catalunya, Barcelona, Spain*

Reprint Requests to: Dr. P.N. Correa

Aurora Biophysics Research Institute,

42 Rockview Gardens

Vaughan, Ontario, Canada, L4K 2J6

Tel. 905-660-1040

Fax. 905-738-8427

Email: pcorrea@aetherenergy.com

Abstract. Alternative physical theory ("Aetherometry", AToS) not employing LF-transformations is proposed to predict charged particle velocities and transverse Dopplers in the 1938 Ives and Stilwell experiment. Predictions nearly match observed results, precluding time-dilation. For particle velocity: AToS within 3.9% of observed; SR/LLR within 9.7%. For transverse Doppler: AToS within 4% of observed; SR/LLR within 8.4%.

PACS Category 10: The Physics of Elementary Particles and Fields

PACS Category 30: Atomic and Molecular Physics

PACS Category 50: Physics of Gases, Plasmas, and Electric Discharges;

Keywords: Aetherometry, Larmor-Lorentz Relativity, Special Relativity, transverse Doppler shift, Balmer line, hydrogen emission

1. Introduction

In 1938, Ives and Stilwell published the results of an experiment designed to test whether a transverse, second-order Doppler effect applied to the linear 'transmission' of light, by measuring the light emitted forward and backward (direct and reflected Doppler lines) from canal-rays accelerated through a potential drop of 8-43 kV [1]. The experiment was billed as a test of time-dilation, and its results variously interpreted as either confirmatory of Special Relativity (SR), or confirmatory instead of Larmor-Lorentz Relativity (LLR). What is particularly elegant and simple about the design of the Ives and Stilwell experiment is that it avoided the difficulties introduced by trying to observe light emitted transversely to the direction of motion of the atoms, and focused solely on the light emitted forward or backward with respect to the direction of motion of the canal-rays. For a schematic of the experiment see Fig. 1.

Hydrogen gas was used in a diode tube as a source of canal-rays thought to be composed of single-charge molecular hydrogen ions, H_2^+ and H_3^+. Free protons did not appear to form a significant fraction of the canal rays. The somewhat obscure physics of the process is described by French in the following manner: "These ions, after acceleration through an accurately defined voltage, could (by neutralization plus dissociation) produce neutral but still excited hydrogen atoms. (...) These atoms then emitted the characteristic Balmer lines of atomic hydrogen" [2]. Specifically, the photon emission line studied was the second line of the Balmer series, H_b, with conventional frequency of $6.167 * 10^{14}$ sec^{-1}. Ives and Stilwell produced photographic plates of this line emitted from *resting* atoms, together with the blue and red Doppler shifts for light emitted in diametrically opposite directions. The observed results were then compared to the predictions from both SR and LLR.

In the present paper we introduce a novel nonrelativistic approach (Aetherometry, AToS), physical and analytical, to the determination of both the velocity of the charged particles in the canal rays of the 1938 Ives and Stilwell experiment, and the magnitude of the observed transverse Doppler shift for the main Balmer emission of hydrogen. Based upon a novel description of the collisional particle dynamics involved, we report that the "aetherometric" predictions nearly match the results reported by Ives and Stilwell for both particle velocity and second order Doppler effects, without taking recourse to Lorentz-Fitzgerald transformations. The aetherometric predictions are also substantially closer to the observed results than either the predictions of Special Relativity or of Larmor-Lorentz Relativity.

2. The results of the 1938 Ives and Stilwell experiment

2.1. The role of protons and atomic hydrogen in the Ives and Stilwell experiment

Right away we would like to undo a confusion which French's presentation of the Ives and Stilwell experiment only accentuates, rather than dissipates. It is clear or beyond dispute that the Balmer line, and the entire series, is an emission characteristic of *atomic hydrogen* - not an emission characteristic of molecular hydrogen, H_2, or the molecular hydrogen ions detected as composing the canal rays. Now, no atomic hydrogen or free protons appeared to enter into the composition of the Ives and Stilwell canal rays ("No H_1 particles were found in this work" [1], p. 220). For us, this emphasizes the fact that the Balmer line is observed only when atomic hydrogen is formed, precisely as a marker of its formation, and this process necessarily requires a proton to capture an electron. Thus, as we shall shortly see, the proton is invariably at the center of the physical interaction. Effectively, the plasma discharge does not ionize most of the hydrogen gas, and whether by inelastic collision or still other processes, protons accelerating towards the perforated cathode latch on to atomic hydrogen to form H_2^+ canal rays, and on to neutral hydrogen gas to form H_3^+ canal rays. It is upon subsequent collision with electrons that these protons are dissociated from hydrogen gas or atomic hydrogen, to re-form, in turn, atomic hydrogen. As we shall see, neglecting to pay close attention to the physics of the processes involved is the chief cause of the failure of Einstein's SR and Ives' own explanation to account for the 1938 Ives and Stilwell experiment [3,4].

2.2. The results of the Ives and Stilwell experiment

The fundamental quantity measured by the Ives and Stilwell experiment, and given by

$$\Delta\upsilon/\upsilon = (\Delta\upsilon_2 - \Delta\upsilon_1)/\upsilon \qquad (1)$$

reflected the extent to which the emission of the resting atomic hydrogen failed to fall half-way between the blueshifted frequency υ_2 of the light emitted in the same forward direction of motion of the canal rays, and the redshifted frequency υ_1 of the light emitted in the opposite direction and reflected from a mirror at the back of the cathode. Thus,

$$\Delta\upsilon_2 = \upsilon_2 - \upsilon \qquad (2a)$$

and

$$\Delta\upsilon_1 = \upsilon - \upsilon_1 \qquad (2b)$$

At high ion velocities, the value of $\Delta\upsilon/\upsilon$ predicted by first-order classical Doppler theory could be readily distinguished from the predictions of Relativity (of either theory of Relativity, SR or LLR), and that was the main test of the experiment.

Table 1 presents the first series of results of the 1938 Ives and Stilwell experiment [1]. Column 1 gives the reported and accurately measured applied voltage, column 2 the postulated hydrogen emitter of the Balmer line of interest, H_β, as identified by Ives and Stilwell. Column 3 shows the expected $\Delta\lambda$ as computed from a first-order effect (these are the values presented by Ives and Stilwell in column 4 of their Table I), and column 4 the predicted hydrogen ion speed (for both H_2^+ and H_3^+ ions) - as per

$$v = c\ \Delta\lambda/\lambda_o \qquad (3)$$

and according to where one places the emission of the same line by the "*resting*" atomic hydrogen. Ives and Stilwell experimentally determined the *resting position of this emission* to lie at λ_o = 4849.3Å ([1] p. 219), but employed the conventional location of this line at λ_o = 4861Å in their analysis (and so does the present paper). The observed, combined direct *and* reflected Doppler shift reported by Ives and Stilwell is shown in column 5, Table 1 (and this corresponds to column 5 in their Table I).

A typical presentation of the Ives and Stilwell data for the Doppler shift of light leaves no room for doubting the superiority of Special Relativity over the classical theory, as shown in Table 2 [5]. Thus, the experiment was billed by French - under a rubric entitled "Doppler effect and Time-dilation" ([2] pp. 144-146) - as one that *decided* between two very different versions of kinematics, and *confirmed* that clocks run slower the faster they move. However, the resolution of the experiment was not good enough to decide whether SR or instead LLR was the more appropriate model.

3. The aetherometric analysis of the physics in the Ives and Stilwell experiment

3.1. New methodological principles

Aetherometry has discovered that any molecular mass m has an equivalent wavelength λ_m given by the following equation

$$\lambda_m = m\ N_A\ 10^{-2} \tag{4}$$

where the mass is expressed in grams and N_A is Avogadro’s number. This has led to the expression of all physical quantities in a simplified meter-second system of units formally equivalent to the conventional kilogram-meter-second system. For example the fundamental charge e is aetherometrically equivalent to 13.9707 $m^2\ sec^{-1}$ (and this is indicated as $e =\!\int\!= 13.9707\ m^2\ sec^{-1}$) and the volt is equivalent to a wavespeed of $1V =\!\int\!= 69{,}065.87\ m\ sec^{-1}$ [6].

Aetherometry proposes that the linear speed v of a massbound charge is a geometric mean function of the *electric wavespeed* W_v and the *magnetic field wave* W_{mag} characteristic of each charge carrier:

$$v = \beta c = \sqrt{(W_{mag}\ W_v)} \tag{5}$$

with an associated electrokinetic energy (modally) given by:

$$E_K = \lambda_m\ (W_{mag}\ W_v) \tag{6}$$

For electrons, W_{mag} is a constant written as $W_k = 2.547 * 10^6\ m\ sec^{-1}$. For as long as the linear velocity v of the charged particle is less than ~0.85c, the voltage of the kinetic energy of the charge accelerated by the applied field – which in Aetherometry corresponds to the electric wavespeed W_v – directly corresponds to the voltage of the applied field [7]. This qualified correspondence is generically expressed as $V_A =\!\int\!= W_v$.

Aetherometry also proposes that photon emission requires the deceleration of charge carriers, and that the emission reflects – in an exact way – their kinetic energy, including their linear speed, at the time of emission. If the voltage of that kinetic energy corresponds to the modal maximum of the potential of the accelerating field, the photon quantum modally produced (discharged) by a given kinetic or electrokinetic state of a charge carrier has energy given by:

$$h\ W_{mag}\ W_v/e = h\upsilon \tag{7}$$

(where h is Planck's constant and e the fundamental charge) [8]. Thus, the photon quantum frequency of emitted light is directly a function of the carrier's kinetic energy, and specifically of its linear speed:

$$\upsilon = (W_k\ W_v)/e = v^2/e \tag{8}$$

Using the aetherometric meter-second system, this relationship can be easily computed and checked. In other words, knowing the particles (or charge carriers) involved, one can check the velocity of the particles obtained as a function of the applied voltage against the velocity determined from the Doppler-shifted line spectra. Conversely, knowing the modal carrier velocity one can just as easily compute the electric wavespeed of the kinetic energy and the corresponding voltage of the accelerating field.

3.2. The physics of the kinematics of the Ives and Stilwell experiment

The energy relation of equation #6 can be directly expressed (eg in eV or $m^3\ sec^{-2}$) as a function of the fundamental electric charge, as

$$E_K = \lambda_m\ (W_{mag}\ W_v) = e\ W_v \qquad (9)$$

With the result that

$$e = \lambda_m\ W_{mag} \qquad (10)$$

Accordingly, W_{mag} is characteristic of a charge carrier and varies with the mass of the ion. The proton (H^+) W_{mag} (written as W_u) is $1.387*10^3$ m sec^{-1}, and W_{mag} for ionized molecular hydrogen, H_2^+, is half that, $6.935*10^2$ m sec^{-1}. These are the relevant values for single-charge carriers, and they mean that, for the same linear velocity, the kinetic energy of H_2^+ will have to be double that of H^+, and thus its electric wavespeed – and the corresponding accelerating potential – will also have to be double when compared to H^+. In what follows, our argument will focus on the H_2^+ ions, since Ives and Stilwell did not provide sufficient data for analysis of H_3^+ ions. Specifically, we will propose that it is ionized molecular hydrogen, H_2^+ (and not H_2), that is formed at the time the Balmer line of interest is emitted, and that it is formed from proton doublets, which we can write as $2H^{+}=H_2^{++}$. These are dual-charge carriers. When we think of a proton doublet as forming a doubly ionized molecular hydrogen ion, we have to treat its overall W_{mag} as being twice the value of H_2^{+}, ie identical to that of the proton.

With aetherometric methods (equation #5), we can check what ion velocities we should obtain from the applied potential and, in reverse, compute the voltages constitutive of the kinetic energy of the moving particles based on their speeds, and compare these voltages with the reported applied potentials. The results are shown in Table 3 for H_2^{+} hydrogen ions in the upper part of the table, and for protons in the lower part, for purposes of reference and comparison (which, as we shall shortly see, will be rather relevant to the physics of the interaction that leads to the emission under study). Columns 3 and 4 (Table 3) provide the applied field wavespeed W_{vA} and the hydrogen ion linear speed v_A predicted by Aetherometry on the basis of their correspondence to the applied voltages. Columns 5, 6 and 7 (Table 3) provide the ion velocity v_B from the observed $\Delta\lambda$ (from column 6 of Table 1), and the aetherometrically corresponding electric wavespeed W_{vB} of the kinetic energy and voltage potential V_B. Finally, columns 8, 9 and 10 provide the ion velocity v_C predicted by SR (within the displayed resolution, please note that these are the same results as those predicted by LLR) from the expected $\Delta\lambda$ (from column 3 of Table 1), and the aetherometrically corresponding electric wavespeed W_{vC} of the kinetic energy and voltage potential V_C.

It is readily apparent from a comparison of the top and bottom parts of columns 2, 7 and 10 in Table 3 that the applied potentials cannot accelerate H_2^{+} ions to the velocities based on the observed $\Delta\lambda$; whereas the proton velocity and kinetic voltage parameters correspond closely to the values of the applied field. This inconsistency is further exposed in Table 4, where a comparison of the voltage values for protons H_1^{+}, proton doublets H_2^{++} and molecular H_2^{+} ions is carried out, on the basis of the ion velocities observed in the Ives and Stilwell experiment. The applied field voltages (column 3, Table 4) are compared to the voltages predicted as being required by SR (column 5) and by Aetherometry (AToS, column 4). It is apparent that, according to Aetherometry, only protons or proton doublets can be accelerated to the reported velocities with the voltages applied by Ives and Stilwell. Also note that SR, in 2 out of 3 times, predicts the wrong ion voltages - for both protons and H_2^+ ions (compare columns 4 and 5, Table 4).

From the aetherometric vantage point, the conclusion of this comparison is inescapable: irrespective of the λ_o value chosen, the canal ray particles cannot be molecular H_2^+ ions; and since Ives and Stilwell formally showed they were not protons [1], one is forced to conclude that they are proton-doublets, $2H^+=H_2^{++}$. These can be accelerated by the reported field potentials, but carry twice the kinetic energy of the single proton. If, as shown in column 4 of Table 4, the observed velocities belonged to molecular H_2^+ ions, the required field potentials would have to be double those which were applied. Evidently, there is something wrong with the physics as described by Ives and Stilwell (and French, etc). The error is easily repaired, however, by realizing that the particles accelerated towards the cathode are, in fact protons (proton doublets, to be exact), not molecular hydrogen ions. The fact that no protons are found past the cathode in the composition of canal rays then indicates that protons traveling in the same direction (and forced together by passing through holes in the cathode) can develop non-covalent-like forces that permit them to form doublets. Apparently, the process of compacting the hydrogen discharge into canal rays generates proton doublets. In other words, the ions are not molecular per se, not H_2^+, but H_2^{++}, ie ($2H_1^+$); each member of the doublet carries an identical quantity of kinetic energy, whose electric potential corresponds to the applied voltage. Thus, the particle velocities obtained by Ives and Stilwell under the rubric of H_2^+ are in fact proton velocities, and thus also proton doublet velocities.

3.3. The physics of photon emission in the Ives and Stilwell experiment

This immediately brings to the forefront the problem with the physics of emission that have been accepted both by SR and Ives and Stilwell. It is assumed that the emissions are in all cases made by atomic hydrogen that becomes excited, so that the emitter already exists as atomic hydrogen before the emission occurs: "the assumption in every case is that of a single excited hydrogen atom, to which all particles must be assumed to revert before emitting light" ([1] p. 222).

Now, Aetherometry does not view the physics in this way. The Balmer line of interest is present upon formation of atomic hydrogen, be it in the transition of a proton doublet to ionized molecular hydrogen. Its emission can be said to be an emission from atomic hydrogen only to the extent the latter is formed at the moment of the emission, but it is an emission sourced directly in an electron (see below) in the process of becoming 'satellized' in the formed atomic hydrogen. Moreover - as already noted above for Aetherometry - the energy of the emitted photons (and their frequency) depends upon the kinetic energy of the massbound charges, and their emission only occurs when these charges discharge that energy (*in pars* or *in toto*), ie when they decelerate. Now, with the aetherometric method of analysis (equation #7), it is apparent that in the Ives and Stilwell experiment neither protons, nor their doublets, even for the highest applied voltage, have sufficient kinetic energy (or electric potential) to generate blackbody photons at the Balmer line.

This fact is brought forth in Table 5 by the aetherometric derivation of the modal-maximum blackbody frequencies that canal-ray protons or proton doublets can emit as a function of their linear velocities determined either from the applied voltage (columns 2, 3 & 4) or from $\Delta\lambda$ (columns 5, 6 & 7). The maximum frequency (υ_A or υ_B) of the blackbody photon radiation emitted by the accelerated protons (in the interelectrode region) and the canal-ray proton doublets in the Ives and Stilwell experiment could not go beyond the microwave region. This underlies the fact that the actual Balmer line emitter is the electron.

But, for the electron alone, production of the Balmer line of interest requires acceleration by a field with a potential of no less than 48kV (see ahead). That, too, exceeds the applied potential. So what is going on? Very simply, proton/electron collision - or proton-doublet/electron collision - is what is taking place; and the H_β emission by the captured electron occurs upon their joint formation of, respectively, atomic hydrogen or ionized molecular hydrogen. Protons, or rather their canal-ray doublets, capture electrons shooting from the glass-overlaying cathode sheath of the canal-ray environment (thus the electrons have an opposing velocity vector). Collision with a proton would generate atomic hydrogen, but collision with a doublet would produce precisely H_2^+. This is of particular interest, given that when the kinetic energy of these doublets together with the kinetic energy of the captured electron reach the threshold aetherometrically required to produce Balmer emission, the line of interest is produced.

In other words, the actual emitter is the electron, and its displacement rate must also enter into the formulation of the linear Doppler shift, as it is central to the physical process of photon emission. The kinetic energy of one of the protons, together with the kinetic energy of the electron, must account for the Balmer line (by the aetherometric law of kinetic and photon energy proportionality, see equations #7 and #9), but the collision decelerates the doublet and therefore decreases the magnitude of both direct and reflected Doppler shifts - besides decelerating the electron enough that it is captured upon emission.

So, let's recapitulate. The linear Doppler shift $\Delta\upsilon/\upsilon$, direct and reflected, referenced to the 'resting' proton doublets, applies independently of the frequency of the emission; but as a function of their kinetic energy, the maximum photon frequency their kinetic energy would permit them to emit is not sufficient for H_β emission. However, at these frequencies - which are shown in Table 6 (columns 2 and 5) - the full value of the Doppler shifts already applies. Note, therefore, that columns 4, 5 & 6 of Table 6 relate directly to the aetherometric treatment of proton doublets in canal-rays, and the $\Delta\upsilon_B/\upsilon_B$ linear Doppler ratio based on the observed $\Delta\lambda$ applies to potential emission from these doublets before collision, ie before formation of H_2^+ ions and, thus, before H_β emission from a captured electron. Note, furthermore, that the $\Delta\upsilon_C/\upsilon_C$ values (columns 7, 8 & 9 of Table 6) essentially predicted by both SR and LLR are close to, though different from, the $\Delta\upsilon_B/\upsilon_B$ values, but are supposed to apply, instead, to H_2^+ ions.

We said above that the emission under study comes from electrons in the process of becoming 'satellized' by proton doublets. If the emission came from electrons decelerating *in vacuo*, the resulting electron kinetic characteristics required by Aetherometry and the linear Doppler shift would be those given in Table 7: the electron would need 48.9 keV of kinetic energy before it could source the main Balmer emission under study. From the aetherometric determination of the kinetic characteristics of protons (or proton doublets) summarized in Table 8 (shown in a way that permits direct comparison to the electron characteristics in Table 7) for the canal-rays of the Ives and Stilwell experiment, it is also apparent that the single or doublet protons do not have sufficient energy (or kinetic voltage) to generate by themselves the H_β line; they can only generate photons of much lower frequency u_B (column 1, Table 8).

Since the H_β line is emitted upon capture of the electron, it is apparent that both proton doublets and colliding electrons together must contribute their energy for purposes of the emission; effectively, the two protons will make a momentary contribution of kinetic energy to the emitting electron. In the process, the electron will decelerate and become captured by the doublet to form a H_2^+ ion, and the doublet will also decelerate. In other words, the emitter whose Doppler shift is being studied is an electron, but it emits upon interaction with another charge, a proton or proton doublet, and this emission can be used to ascertain the states of motion of this other charge (the heavy ion) before and after the interaction; in the process, the heavy ion becomes the carrier of that electron (a carrier of a carrier) in the form of an H_2^+ ion.

3.4. Collisional dynamics in the Ives and Stilwell experiment

Depending upon the field voltage applied to accelerate the protons in the interelectrode region, the electron must make a varying minimal energy contribution to the H_β line emission. Indeed, the total energy (~49 keV) of the captured electron before emission must be the same as it would need to be in the vacuum state. As shown in Table 9, this varying contribution (calculated against the aetherometric minimum of 48,983 eV) is substantially lower if the canal-rays are composed of doublets rather than protons.

The question arises, where do these sheath electrons acquire their minimum kinetic energy to bombard the canal-rays? If they did not bombard the doublets (or doublets with an associated atomic hydrogen, to generate H_3^+), these would not have enough energy to confer to a trapped electron (and the same applies to any pre-existing atomic hydrogen) the energy needed to generate the H_β line. If we concentrate on the interaction with proton doublets (rows #1 to #5 of

Table 9) - since it is the interaction of interest - it becomes clear that the only way these electrons can acquire such kinetic energies as in entries #1 to #4 is by means of elastic collisions (probably near the sheath present downstream from the cathode and adjacent the glass envelope). In entry #5, the electron kinetic energy can be accounted for by the applied voltage, or the field energy, which exceed the required minimum (18.1 keV field energy vs a required minimum of 12.7 keV electron kinetic energy). The fact that the required electron kinetic energy and potential is even greater for single protons further suggests that the main canal ray population is most likely composed of doublets.

Since both particles (or colliding charges) decelerate in the process of their collision and subsequent electron capture with Balmer photon emission, both the direct and the reflected linear Doppler shifts depend not just on the relative state of motion of proton doublets, or on the state of motion of the actual emitters, the electrons, with respect to these doublets, but on the collision that decelerates both to the final solidary velocity at the time of emission. Again, we underline the fact that this is a strict aetherometric requirement - that blackbody photon emission requires a decelerating emitter.

Given the opposing velocity vectors of electrons (v_e) and proton doublets (v_{pd}), the resulting velocity v_{H2+} of the formed H_2^+ ion - upon mutual deceleration and H_β emission - is aetherometrically given by:

$$v_{H2+} = v_{pd} - [v_e (m_e/2m_p)] \quad (11)$$

Table 10 shows the correct carriers, their kinetic energy and corresponding linear velocities, including possible maximum modal photon emissions, *before* (columns #2 to #6) *and after* (columns #7 to #11) proton-doublet/electron collision. Please note that photon frequencies in columns #6 and #11 are those directly predicted for electron-emitted photons by the aetherometric relation derived from equation #7. The aetherometric prediction for the linear Doppler shift ratio $\Delta\upsilon/\upsilon$ from the formed H_2^+ ions in accordance with the entirety of the preceding aetherometric treatment is that shown in column #12, Table 10.

We should mention, at this point, that the narrow dispersion of the centerline taken to correspond to emission from so-called resting H_2^+ ions (the dispersion being less than the separation of the components of the H_β line) must be attributed to collisions of what are essentially non-modal canal-rays, or very low-velocity protons or proton doublets. If we assume elastically accelerated electrons with kinetic energy near the modal maximum of 49keV, they could, in a head-on collision, bring to a stop protons – or their doublets - having only a diminutive 27eV of kinetic energy. That must be the reason why, even below 3kV, the observed centerline frequency of the "resting ions" is very narrow but still present. However, there is another process that could force the colliding charges to cancel their states of motion and bring the formed H_2^+ ions to a near-complete stop. In essence, the electron would have to intercalate between the two protons of the doublet (or two free protons), forcing them to collide with each other or to transfer their energy to the electron in the process of a near-collision. Since, at higher applied voltages, the required electron kinetic energy would decrease, the faster moving protons would also have a better chance of capturing a bombarding electron by the intercalation process, with the result that the center or resting line would broaden and increase in intensity. Is there any evidence we can adduce for this argument? In fact, Ives and Stilwell report that "the center, undisplaced line is very weak, relative to the displaced lines, at voltages below 3,000", and that, "at voltages of 10,000 and over the center line becomes diffuse but with a sharp central core, and is much more intense than the displaced lines" ([1] p. 222).

3.5. Comparison of Aetherometry with Special Relativity and Larmor-Lorentz Relativity

Through this strictly aetherometric analysis, we come at last to the comparison of Special Relativity (SR) (see column #5 of Table 11) with aetherometric theory (AToS) (see columns #6 and #7 of Table 11) in light of the results of the 1938 Ives and Stilwell experiment (see column #8 of Table 11). The Ives and Stilwell experiment permits one to 'rule out' classical Doppler theory (see column #4 of Table 11, and how it compares unfavourably with the experimental results of column #8), but not 'rule in' which Relativity theory is correct, whether SR or Larmor-Lorentz Relativity (LLR), since they give basically the same result at this level of resolution. However, the Ives and Stilwell results leave no doubt about which is more accurate - Relativity in either of its forms *or* Aetherometry: it suffices to compare columns #7 and #8 of Table 11 to realize that the aetherometric $\Delta\upsilon/\upsilon$ prediction practically coincides with the results reported by Ives and Stilwell [1]. It is worth noting how close the predicted $\Delta\upsilon/\upsilon$ values of SR (column #5 of Table 11) are to the aetherometric values for the proton doublets *before collision* (column #6 of Table 11), and thus *before emission*. Once more, this is an example that illustrates the importance of an adequate grasp of the physical processes embedded in the reported observations.

Finally let us carry out a comparison of the theories of Relativity (SR and LLR) with Aetherometry with respect to the second-order effect. In Aetherometry, the second-order effect of the linear Doppler is a mere phenomenological consequence of the law of the geometric mean composition of velocities, and does not entail any ontological or phenomenological Lorentz-Fitzgerald transformations. For reference, Table 12 presents the computed $\Delta'\lambda$ from the applied voltage in columns #2 (as calculated by Ives and Stilwell) and #3 (as calculated by Aetherometry). The comparison between Aetherometry and Relativity comes next: the LLR $\Delta'\lambda$

prediction is shown in column #4; the SR $\Delta'\lambda$ prediction in column #5; and the aetherometric $\Delta'\lambda$ prediction in column #6, calculated on the basis of the velocities of charged molecular hydrogen at the time of emission, as per column #9, Table 10. It is apparent that, in 4 of the 5 cases, the aetherometric results (column #6, Table 12) match most closely the final results (column #7) reported by Ives and Stilwell. The differences between SR and Aetherometry shown in Table 12 are illustrated graphically in Fig. 2.

We should note that the results of Tables 11 and 12 were arrived at by a strict account of the collisional dynamics between charge-carriers of different masses (proton doublets and electrons), and by a derivation of the ion velocities (before and after collision) and corresponding blackbody frequency emissions with their Doppler shifts - including the H_β line and its Doppler shift - by strict application of the law of the geometric mean composition of velocities. This alone proves how superfluous is the hypothesis of a "constitutive" or "ontological" second-order effect, thereby *disproving* what the Ives and Stilwell experiment has to this day been *consensually believed* to prove: that there is time-dilation, reciprocal to the Lorentzian length-contraction. From our presentation, it would now appear that the 1938 Ives and Stilwell experiment proves the interpretation of time-dilation to be superfluous, and thus denies the necessity of the physical basis on which rest Einstein's theory of Special Relativity and the Larmor-Lorentz versions of Relativity, including Ives' own [3, 4].

4. Conclusions

The 1938 Ives and Stilwell experiment confirms Aetherometry's contention that SR is inconsistent in its application of the law of velocity composition, and in error when it comes to the determination of the voltages corresponding to the velocities of massbound charges (it confirms, therefore, the values presented in Table 4, column 4, and the fact that the main heavy ions involved prior to emission are proton doublets).

Ives and Stilwell did not prove that a second-order effect existed; they only showed that the second-order effect models of LLR and SR were much, much closer to predicting the observed linear Doppler shift of light than was classical theory (see Table 2). By the same token, their experiment now confirms that the correct linear Doppler shift is that predicted by Aetherometry for emission from decelerating charges without any invocation of LF transforms (cp. Table 2 to Table 11).

In closing, a word is in order regarding Ives and Stilwell's own conclusions from their experiment. The scientific epoch - and the ideology of official Science - viewed this experiment as a confirmation of Einstein's Special Relativity, but not so Ives and Stilwell, who claimed that the experiment, being the necessary optical complement to the Michelson-Morley experiment, proved the existence, along and across the direction of motion, of contractions of the apparatus ("conspiring compensations" - they wrote - composed of "contractions of dimensions [lengths] and of clock rates" ([1] p. 226) that accorded with LLR and explained the null result of the Michelson-Morley experiment. Since they interpreted their results as being positive evidence for these LF transforms (whereas the null result of the Michelson-Morley experiment was compatible with other explanations), they saw their results as evidence for changing clock rates.

For all relativists, SR or LLR - including Ives and Stilwell - this was the critical point: that time-dilation appeared to be established. In fact, as we have now shown, a phenomenological coincidence of the relativistic second order effect with the solution of the linear Doppler of light (and, for Aetherometry, the law of the geometric composition of velocities validates, *in appearance but not in essence*, SR's version of the second-order effect, rather than the LLR version) does not warrant the assumption that time-dilation exists. Proper application of the law of the geometric mean composition of velocities - along with what Aetherometry considers to be proper treatment of the relationship between field energy, kinetic energy and photon emission - then proves that, with the data of the 1938 Ives and Stilwell experiment and without prejudice to the Michelson-Morley experiment having a null result, better predictions can be made with a theoretical model (Aetherometry) that does not invoke time-dilation or any LF transforms.

It is curious that Ives and Stilwell were aware that they had *neglected the physics of collision*, but effectively hoped that "collision processes" would not just "happen to follow exactly the relation expected from the Larmor-Lorentz theory from velocity changes alone" ([1] p. 226). Yet, when properly taken into account, collision processes and velocity changes alone are sufficient to explain the observed Doppler shifts with far more exactitude than either LLR or SR can, and employing solely the law of composition of velocities. Correct application of the geometric mean law of composition of velocities should have been sufficient to predict the exact values of the observed shifts. We should note that the Ives and Stilwell experiment demonstrates how the *decelerated* velocities of formed H_2^+ ions *change* with respect to the *original* velocities of the proton doublets in the canal-rays (though less frequently, the same would be expected for H_3^+ ions with respect to H_3^{++} ions). Yet the basic physics of the interaction was entirely missed by all physicists, with the result that the *pre-collisional* velocities of the proton-doublets have, to this day, been incorrectly attributed to the H_2^+ ions that result, rather, *from the collisions* of doublets with electrons.

These results and conclusions strongly indicate that, while on one hand there is no stationary Aether required for the concatenation of light photons, on the other hand the Ives and Stilwell experiment provides no physical evidence, either, for LF transforms - or evidence that proves that relativistic changes in clock rates exist or intensify with relative speed of motion. On the contrary, a proper understanding of field velocities and their difference from the wavespeeds and linear velocities corresponding to the kinetic energy of massbound charges, together with a novel understanding of the physics of photon emission, suffices to accurately predict the observed linear Doppler shifts without any recourse to relativistic considerations.

Acknowledgements

We would like to thank the Aetherometry Study Group at the International Society of the Friends of Aetherometry (ISFA) for stimulating discussions. Particular thanks go to David Pratt.

References

[1] H. Ives and G. Stilwell, J Opt Soc of America, 28 (1938) 215.

[2] A.P. French, Special Relativity (WW Norton, NY, NY, 1966) 145.

[3] H. Ives, J Opt Soc of America, 36 (1944) 392.

[4] H. Ives, Scientific Proc R Dublin Soc, 26 (1952) 9.

[5] After D. Halliday et al, Physics, Vol. II (John Wiley & Sons, NY, NY, 1992) 895.

[6] P.N. Correa and A.N. Correa, The volt and the electron-volt in: Experimental aetherometry, Vol. 2A (Akronos Publishing, Concord, Ontario, Canada, 2003) 149.

[7] P.N. Correa and A.N. Correa, On the wave structure of energy: fundamental differences between de Broglie's theory of matter-waves and the aetherometric theory of wave superimposition (Akronos Publishing, Concord, Ontario, Canada, 2003), monograph AS2-31.

[8] P.N. Correa and A.N. Correa, Experimental aetherometry, Vol. 2B (Akronos Publishing, Concord, Ontario, Canada, 2003) 172.

Figure legends

Figure 1. Graphic representation of the 1938 Ives and Stilwell apparatus after Halliday et al [5]. (a) schematic of the canal-ray tube; (b) illustration of the Doppler shifts measured by the Ives and Stilwell experiment.

Figure 2. Computed and observed second-order shifts plotted against first-order shifts. The observed second-order shifts (small closed squares) are those reported by Ives and Stilwell ([1] Table III) and listed in column #7 of Table 12. The second-order shifts predicted by SR (large closed squares, see column #5 of Table 12) deviate from the results of Ives and Stilwell by, respectively, 8.4%, 7.4%, 3.5%, 4.3% and 0.2%. The second-order shifts predicted by Aetherometry (closed circles, see column #6 of Table 12), deviate much less from the results of Ives and Stilwell by, respectively, 3.8%, 4%, 0%, 0.9%, 1.4%.

Table captions

Table 1. Hydrogen ion velocity results for observed $\Delta\lambda$ in the 1938 Ives and Stilwell experiment. Column 2 is the conventional assumption. Column 3 gives $\Delta\lambda$ computed from $\Delta\lambda=\lambda_o(v/c)$, first-order, by Ives and Stilwell (see [1] Table I). Data in columns 4 and 6 were obtained using $\Delta\lambda=$ 4849.3 and $\Delta\lambda=$ 4861 angstroms, respectively.

Table 2. Classical theory vs Special Relativity predictions with respect to the results of the 1938 Ives and Stilwell experiment.

Table 3. Aetherometric correspondences between potentials in volts, ion velocities and electric wavespeed of kinetic energy as derived from either the applied potential, the observed $\Delta\lambda$, or the computed $\Delta\lambda$.

Table 4. Comparison of voltage values for ionized molecular hydrogen H_2^+, protons (H^+) and proton doublets (H_2^{++}): applied voltages vs voltages corresponding to observed ion velocities, as computed by Ives and Stilwell (column 6), SR (column 5) and AToS (column 4).

Table 5. Maximum photon frequencies that, according to Aetherometry, may be emitted by protons or their doublets as a function of their velocity determined either from the applied electric potential or observed $\Delta\lambda$.

Table 6. Linear Doppler shifts for photons with frequencies computed from Table 3 values (υ_A and υ_B are shown in Table 5), that may be emitted by protons or proton doublets.

Table 7. Aetherometric characteristics of electron kinetics required to observe the H_β line.

Table 8. Aetherometric characteristics of the proton kinetics observed in the Ives and Stilwell experiment, that apply to single or doublet protons. Note that the values of columns 8 and 9 are those in accordance with the aetherometric equation:

$E_K = e\ W_v = \lambda_m\ (W_{mag}\ W_v) =\!\int\!= m_o\ (W_{mag}\ W_v) = m_o\ v^2$

where e has the aetherometric value of 13.9707 $m^2\ sec^{-1}$, and the sign '=∫=' marks conversion from the aetherometric meter-second system to the quantities of the traditional SI system.

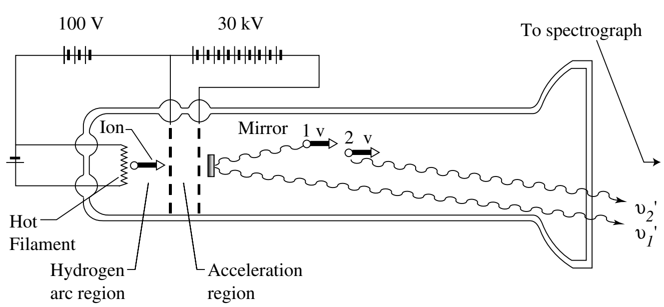
Table 9. Voltage and kinetic energy (V*e) of electrons in collisions with proton singlets and doublets, required for H_β line emission. The minimum kinetic energy of the electron is given by: eV = (48,983eV) – (kinetic energy of heavy ion)

Table 10. Aetherometric comparison of kinetic characteristics of carriers before collision (doublets and electrons) and after collision (H_2^+), in the canal-ray region of the Ives and Stilwell tube. Note that column 3 gives both the maximum kinetic energy of doublets observed from $\Delta\lambda$, and the minimum required kinetic energy of colliding electrons. Column 4 gives the corresponding linear speeds. Also note that column 9 gives the linear speed of H_2^+ upon collision and deceleration with H_β emission, as per equation #11.

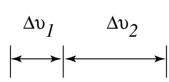
Table 11. Linear Doppler shifts for light observed in the 1938 Ives and Stilwell experiment (column #8) versus the predictions of Classical Theory (column #4), Special Relativity (SR, column #5; see column #9 of Table 6), and Aetherometry (AToS, columns #6 & #7). In accordance with the aetherometric model, columns #2 and #3 provide, respectively, the speeds of heavy ions just before emission (see column #2 of Table 8) and at the time of emission (see column #9 of Table 10).

Table 12. Proposed second-order $\Delta'\lambda$ shifts: (1) computed from the applied voltage (columns #2 and #3); (2) predicted by LLR (column #4), by SR (column #5) and AToS (column #6); and (3) reported by Ives and Stilwell [1] for their final experiments. All values are in angstroms.

Fig. 1


100 V
30 kV
To spectrograph
Ion
Mirror
1 v
2 v
υ_2'
υ_1'
Hot
Filament
Hydrogen
arc region
Acceleration
region

(a)


$\Delta\upsilon_1$
$\Delta\upsilon_2$

(b)

Fig. 2

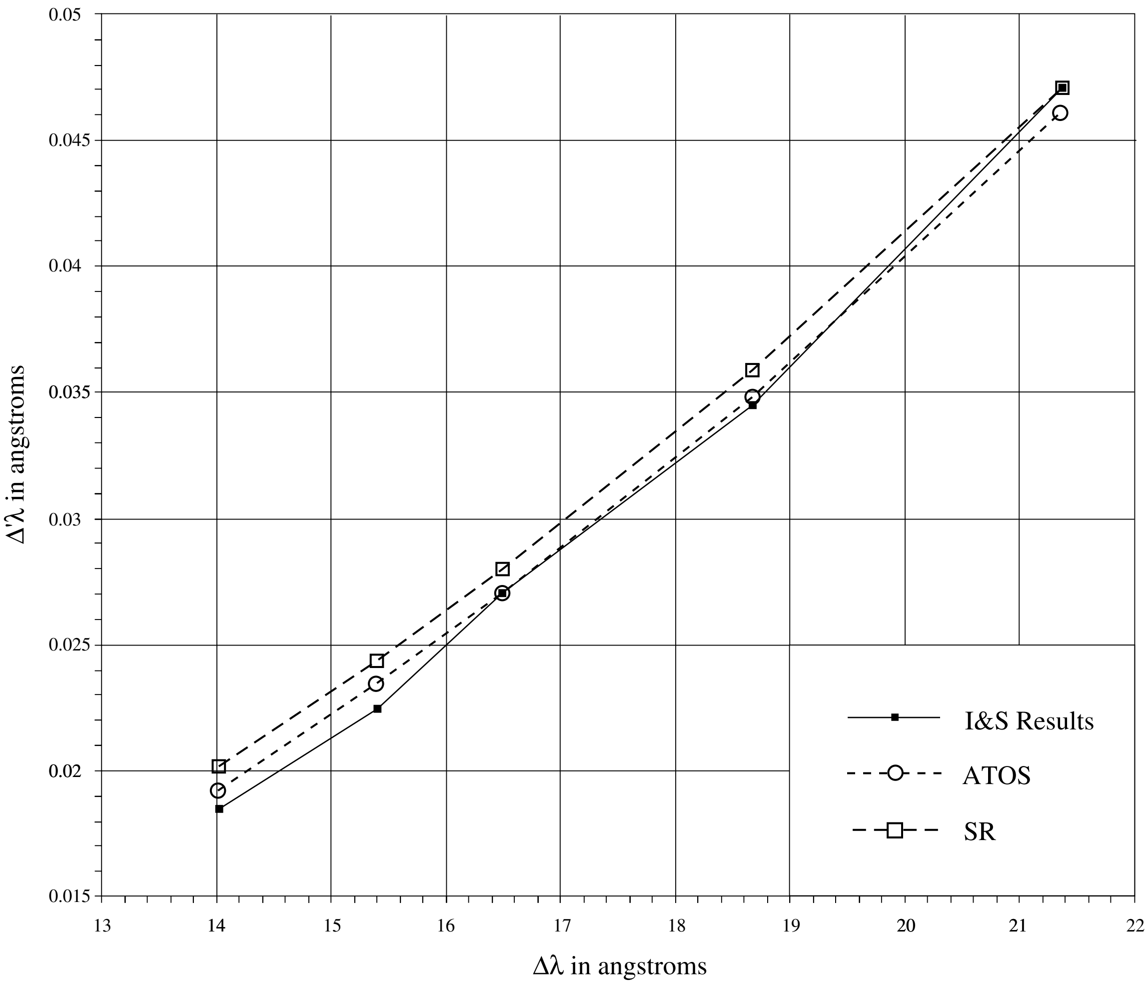

0.05
0.045
0.04
0.035
0.03
0.025
0.02
0.015
Δ'λ in angstroms
13
14
15
16
17
18
19
20
21
22
Δλ in angstroms
I&S Results
ATOS
SR

Table 1

1	2	3	4	5	6
Applied Potential (volts)	Postulated Source of the H_β line	$\Delta\lambda$ computed (10^{-9} m)	v determined from $\Delta\lambda$, computed (10^5m/sec)	$\Delta\lambda$ observed (10^{-9}m)	v determined from observed $\Delta\lambda$ (10^5m/sec)
7,780	H_2	1.404	8.68	1.402	8.647
9,187	H_2	1.530	9.46	1.540	9.498
10,574	H_2	1.634	10.10	1.649	10.170
13,560	H_2	1.850	11.44	1.867	11.514
18,350	H_2	2.155	13.32	2.137	13.179
6.788	H_3	1.062	6.56	1.035	6.383
11,566	H_3	1.388	8.58	1.407	8.677
13,560	H_3	1.505	9.30	1.514	9.337

Table 2

$\Delta\upsilon/\upsilon$, 10^{-5}	Speed of molecular hydrogen, 10^6 m sec^{-1}			
	0.865	1.01	1.15	1.33
Classical Theory	1.67	2.26	2.90	3.94
Special Relativity	0.838	1.13	1.45	1.97
I&S Results	0.762	1.10	1.42	1.90

Table 3

1	2	3	4	5	6	7	8	9	10
Accelerated ion	I. Characteristics from applied potential:			II. From observed $\Delta\lambda$ (see Table 1):			III. From computed $\Delta\lambda$:		
	Applied Potential (volts)	Corresponding * Field Wavespeed W_{vA}, (10^8 m/sec)	Corresponding * Ion Velocity v_A, (10^5 m/sec)	Ion Velocity v_B, † (10^5 m/sec)	Corresponding Wavespeed of Kinetic Energy * W_{vB}, (10^8 m/sec)	Corresponding Potential * (volts)	Ion Velocity v_C, ‡ (10^5 m/sec)	Corresponding Wavespeed of Kinetic Energy * W_{vC}, (10^8m/sec)	Corresponding Potential * (volts)
H_2^+	7,780	5.373	6.104	8.647	10.780	15,609	8.679	10.863	15,729
H_2^+	9,187	6.345	6.634	9.498	13.007	18,833	9.459	12.900	18,678
H_2^+	10,574	7.303	7.117	10.170	14.913	21,593	10.106	14.714	21,304
H_2^+	13,560	9.365	8.059	11.514	19.117	27,679	11.437	18.861	27,309
H_2^+	18,350	12.674	9.375	13.179	25.046	36,264	13.323	25.593	37,055
H_1^+	7,780	5.373	8.633	8.647	5.390	7,804	8.679	5.432	7,864
H_1^+	9,187	6.345	9.381	9.498	6.503	9,416	9.459	6.450	9,339
H_1^+	10,574	7.303	10.064	10.170	7.457	10,796	10.106	7.357	10,652
H_1^+	13,560	9.365	11.397	11.514	9.558	13,839	11.437	9.430	13,654
H_1^+	18,350	12.674	13.259	13.179	12.523	18,132	13.323	12.796	18,528

* Aetherometric determination
† corresponds to column 6, Table 1
‡ corresponds to column 4, Table 1

Table 4

1	2	3	4	5	6
	V_B	V_A	V_B (AToS)	V_B (SR)	
H Ion	Observed H Ion Velocity, v_B ⧆ (10^5 m/sec)	Applied Potential (volts)	Voltage Predicted from Observed Ion Velocity, by AToS (volts)	SR ⊛ (volts)	Voltage Attributed and Computed by I&S (volts)
H_2^+	8.647 ⧆	7,780	15,609	7,760	7,859
H_2^+	9.498 ⧆	9,187	18,833	9,363	ND
H_2^+	10.170 ⧆	10,574	21,593	10,736	ND
H_2^+	11.514 ⧆	13,560	27,679	13,762	13,702
H_2^+	13.179 ⧆	18,350	36,264	18,030	20,755
H_1^+	8.647	7,780	7,804	3,880	
H_1^+	9.498	9,187	9,416	4,681	
H_1^+	10.170	10,574	10,796	5,368	
H_1^+	11.514	13,560	13,840	6,881	Where the I&S Results Belong: (volts)
H_1^+	13.179	18,350	18,132	9,015	
$2H_1^+ = H_2^{++}$	8.647	7,780	7,804	7,760	7,859
$2H_1^+ = H_2^{++}$	9.498	9,187	9,416	9,363	ND
$2H_1^+ = H_2^{++}$	10.170	10,574	10,796	10,736	ND
$2H_1^+ = H_2^{++}$	11.514	13,560	13,840	13,762	13,702
$2H_1^+ = H_2^{++}$	13,179	18,350	18,132	18,030	20,755

⧆ According to AToS, these applied potentials cannot accelerate H_2^+ to the reported/observed ion velocities. Compare columns 3 & 4 for H_2^+ and $2H_1^+$.

⊛ Ratio m_p/m_e employed is aetherometric whole number 1836, not the conventional value of 1836.16. SR formula: $V = 300\ m_o c\ \{[1 - (v^2/c^2)]^{-0.5} - 1\}/e$

Table 5

1	2	3	4	5	6	7
H Ion	From Applied Potential:			From observed $\Delta\lambda$:		
	Voltage (volts)	v_A (10^5 m/sec)	$\upsilon_A = v_A^2/e$ (10^{10} Hz)	Voltage (volts)	v_B (10^5 m/sec)	$\upsilon_B = v_B^2/e$ (10^{10} Hz)
H_1^+	7,780	8.633	5.335	7,804	8.647	5.352
H_1^+	9,187	9.381	6.300	9,416	9.498	6.457
H_1^+	10,574	10.064	7.251	10,796	10.170	7.403
H_1^+	13,560	11.397	9.298	13,839	11.514	9.490
H_1^+	18,350	13.258	12.583	18,132	13.179	12.433
$2H_1^+$	7,780	8.633	5.335	7,804	8.647	5.352
$2H_1^+$	9,187	9.381	6.300	9,416	9.498	6.457
$2H_1^+$	10,574	10.064	7.251	10,796	10.170	7.403
$2H_1^+$	13,560	11.397	9.298	13,839	11.514	9.490
$2H_1^+$	18,350	13.258	12.583	18,132	13.179	12.433

Table 6

From Applied Potential:			From Hydrogen Ion Velocities Based on Observed $\Delta\lambda$:			From Theoretical Velocity Predicted by SR based on computed $\Delta\lambda$		
1	2	3	4	5	6	7	8	9
Voltage (Applied) (volts)	υ_A (10^{10} Hz)	$\Delta\upsilon_A/\upsilon_A$, 10^{-5}	Potential of Kinetic Energy (volts)	υ_B (10^{10} Hz)	$\Delta\upsilon_B/\upsilon_B$, 10^{-5}	Kinetic Potential (volts)	υ_C (10^{10} Hz)	$\Delta\upsilon_C/\upsilon_C$, 10^{-5}
7,780	5.335	0.8293	7,804	5.352	0.8319	7,864	5.3928	0.8382
9,187	6.300	0.9792	9,416	6.457	1.0037	9.339	6.4040	0.9954
10,574	7.251	1.1271	10,796	7.403	1.1508	10,652	7.3044	1.1354
13,560	9.298	1.4453	13,839	9.490	1.4752	13,654	9.3631	1.4554
18,350	12.583	1.9559	18,132	12.433	1.9327	18,528	12.705	1.9749

Table 7

H_β Frequency (Hz)	H_β λ (Å)	$v = \sqrt{e\ \upsilon}$ (10^7 m/sec)	$W_v = v^2/W_k$ (10^9 m/sec)	V (volts)	β	$\Delta\upsilon_{H\beta}/\upsilon_{H\beta}$
$6.167 * 10^{14}$	4861	9.2819	3.3831	48,983.6	0.30961	0.10034

Table 8

1	2	3	4	5	6	7	8	9
Max Frequency of photon emission υ_B	Linear Velocity of protons or doublets $v_B = \sqrt{e * \upsilon_B}$	$W_{vB} = v_B{}^2/W_u$	$V =\int= W_{vB}$	Applied Potential	Observed $\beta = v_B/c$	$\Delta\upsilon_B/\upsilon_B$	Kinetic Energy of Protons (eV)	
(10^{10} Hz)	(10^5 m/sec)	(10^8 m/sec)	(volts)	(volts)	(10^{-3})	(10^{-5})	singlet	doublet
5.352	8.647	5.390	7,804	7,780	2.8842	0.8319	7,804	15,609
6.457	9.498	6.503	9,416	9,187	3.1681	1.0037	9,416	18,833
7.403	10.170	7.457	10,796	10,574	3.3923	1.1508	10,796	21,593
9.490	11.514	9.558	13,840	13,560	3.8408	1.4752	13,840	27,679
12.433	13.179	12.523	18,132	18,350	4.3962	1.9327	18,132	36,264

Table 9

1	2	3	4	5	6	7
#	Heavy Carrier	Kinetic Energy of Heavy Ion (eV)	Electric Potential of Kinetic energy, per charge carried by heavy ion (volts)	Light Carrier	Kinetic Energy of Electron (eV)	Minimum ElectricPotential of Electron Kinetic Energy (volts)
1	$2H_1^+ = H_2^{++}$	15,609	7,805	electron	33,374	33,374
2	$2H_1^+ = H_2^{++}$	18,833	9,416	electron	30,150	30,150
3	$2H_1^+ = H_2^{++}$	21,593	10,796	electron	27,390	27,390
4	$2H_1^+ = H_2^{++}$	27,679	13,840	electron	21,304	21,304
5	$2H_1^+ = H_2^{++}$	36,264	18, 132	electron	12,719	12,719
6	H_1^+	7,804	7,805	electron	41,179	41,179
7	H_1^+	9,416	9,416	electron	39,567	39,567
8	H_1^+	10,796	10,796	electron	38,187	38,187
9	H_1^+	13,840	13,840	electron	35,143	35,143
10	H_1^+	18,132	18, 132	electron	30,851	30,851

Table 10

1	2	3	4	5	6	7	8	9	10	11	12
#	Carriers Before Collision	Kinetic Energy (eV)	Linear Velocity (m/sec)	β	υ_{max} (Hz)	Carriers after Collision	Electron Kinetic Energy Before Emission (eV)	H_2^+ Linear Velocity upon Deceleration (m/sec)	β of H_2^+	$\upsilon_{H\beta}$ (Hz)	$\Delta\upsilon_{H\beta}/\upsilon_{H\beta}$ 10^{-5}
1	doublet proton (canal-rays)	15,609	$8.647 * 10^5$	0.00288	$5.352 * 10^{10}$	$2H_1^+ + e^- =$ $= H_2^+$	48,983	$8.438 * 10^5$	0.00281	$6.167 * 10^{14}$	0.792
	electron	33,374	$7.6615 * 10^7$	0.25556	$4.202 * 10^{14}$						
2	doublet	18,833	$9.498 * 10^5$	0.00317	$6.457 * 10^{10}$	H_2^+	48,983	$9.300 * 10^5$	0.00310	$6.167 * 10^{14}$	0.962
	electron	30,150	$7.282 * 10^7$	0.2429	$3.796 * 10^{14}$						
3	doublet	21,593	$10.170 * 10^5$	0.00339	$7.403 * 10^{10}$	H_2^+	48,983	$9.981 * 10^5$	0.00333	$6.167 * 10^{14}$	1.108
	electron	27,390	$6.941 * 10^7$	0.23152	$3.448 * 10^{14}$						
4	doublet	27,679	$11.514 * 10^5$	0.00384	$9.490 * 10^{10}$	H_2^+	48,983	$11.347. * 10^5$	0.003785	$6.167 * 10^{14}$	1.433
	electron	21,304	$6.121 * 10^7$	0.20418	$2.682 * 10^{14}$						
5	doublet	36,264	$13.180 * 10^5$	0.00440	$12.433 * 10^{10}$	H_2^+	48,983	$13.051. * 10^5$	0.00435	$6.167 * 10^{14}$	1.895
	electron	12,719	$4.730 * 10^7$	0.15777	$1.601 * 10^{14}$						

Table 11

1	2	3	4	5	6	7	8
			$\Delta\upsilon/\upsilon$, 10^{-5} Predictions:				$\Delta\upsilon/\upsilon$, 10^{-5}
Applied Potential (volts)	Heavy Ion Speed Before Collision (10^{-6} m sec^{-1})	Heavy Ion Speed After collision (10^{-6} m sec^{-1})	Classical Theory	SR	AToS		Experimental Results (I&S, 1938)
					Before collision (Proton doublets)	At emission upon deceleration (H_2^+)	
7,780	0.865	0.84	1.67	0.838	0.832	0.792	0.762
9,187	0.95	0.93	2.02	0.995	1.004	0.962	ND
10,574	1.02	1.00	2.26	1.135	1.151	1.108	1.10
13,560	1.15	1.135	2.90	1.455	1.475	1.433	1.42
18,350	1.32	1.31	3.94	1.975	1.933	1.895	1.90

Table 12

1	2	3	4	5	6	7
Applied voltage (volts)	$\Delta'\lambda$: Computed from applied voltage V_A: LLR (I&S, 1938) ⊡	AToS for H_1^+ or H_2^{++} ⊛	$\Delta'\lambda$: Computed from observed $\Delta\lambda$ * **LLR**	$\Delta'\lambda$: Computed from observed $\Delta\lambda$ ‡ **SR** ⦿	$\Delta'\lambda$: Computed from observed $\Delta\lambda$ ‡ **AToS** ⊗	$\Delta'\lambda$: Observed by I&S in final experiments †
7,780	0.0203	0.0202	0.0202	0.0202	0.0192	0.0185
9,187	0.0238	0.0238	0.0243	0.0244	0.0234	0.0225
10,574	0.0275	0.0275	0.0280	0.0280	0.0270	0.0270
13,564	0.0352	0.0351	0.0360	0.0359	0.0348	0.0345
18,350	0.0478	0.0477	0.0469	0.0470	0.0461	0.0470

⊡ Date from Ives & Stilwell, Table III, column 4.

⊛ Calculated with the aetherometric method.

* According to the LLR formula: $\Delta'\lambda = 0.5\ \lambda_o(v^2/c^2)$. Data from Ives & Stilwell, Table III, column 5.

‡ According to the SR and aetherometric formula: $\Delta'\lambda = \{\lambda_o/[1 - (v/c)^2]^{0.5}\} - \lambda_o$.

⦿ Please note that these values are very close to those obtained by AToS for the proton doublets before the collisions that produce H_2^+.

⊗ Computed from observed $\Delta\lambda$ for the aetherometric velocities of molecular hydrogen (see Table 10, column 9) at the time of emission.

† Data from Ives & Stilwell, Table III, column 6.