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The experiments of F. T. Rogers, M. M. Rogers and A. H. Bucherer and a natural explanation without SRT

by

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Abstract:

In this paper it is shown that three further experiments can be described without special relativity in a more natural way. They depends only on a *(c-v)*-behaviour as already the crucial experiments of W. Bertozzi[3], Liangzao Fan[9] and Zürich in 1963 showed. In case of particles travelling perpendicular to a force it is not mass wich is increasing but the curvature of particles way in a deflection area created by magnetic or electric fields is altered. So on particles level mass must be something interacting with the aether or vacuum according to μ_0 and ε_0. In the Bertozzi experiment is was already shown that the relativistic energy equation could not explain the used energies in praxi and especially at speeds greater than v/c ~ 0,95. Due to the vectorian notation of Newtons acceleration formula enhanced with a *(c-v)*-behaviour M. Abdullahi[1] showed easily the three important cases for movements in respect to a force wich is propagating with the speed of light. So for circular movements all inconsistencies (i.e. singularities, infinite mass and energy) are removed.

Keywords: Rogers[5,6], Bucherer[4], Bertozzi[3], Abdullahi[1], relativistic electron, *(c-v)*-behaviour, Lorentz, special relativity, accelerated charge, centrifugal energy

§1 Introduction

Musa Abdullahi[1] pointed out a remarkable way to explain the dependency of forces on charged particles in an easy to understandable way. He took the force as a vector to obtain:

$$\mathbf{F} = F/c\cdot(\mathbf{c} - \mathbf{v}) = m\cdot d\mathbf{v}/dt = m\cdot\mathbf{v}\cdot d\mathbf{v}/dx \qquad (1)$$

where **F** denotes the force (bold means a vector), c is the speed of light and **v** the velocity of a particle in a certain direction regarding to the lines of force.

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Figure 1 gives a picture of that:

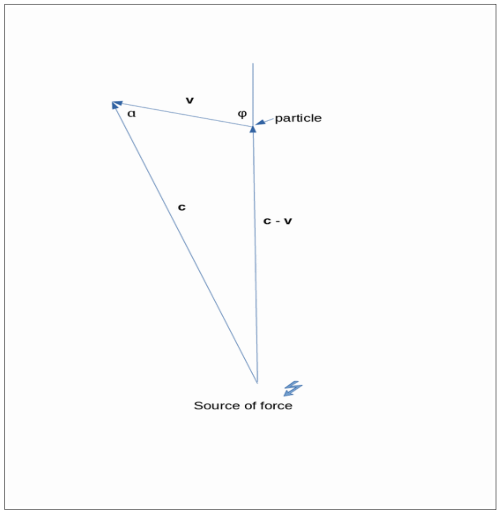

Figure 1 Particle travelling under an angle φ with v regarding to the lines of force.

From equation 1 he calculated the modulus of (**c-v**) hence

$$\mathbf{F} = F/c\cdot\{c^2 + v^2 - 2\cdot c\cdot v\cdot\cos(\alpha)\}^{\mathbf{1/2}} \qquad (2)$$

According to table 1 we can distinguish between 3 major cases

Table 1 the three interesting cases of movement of a charged particle				
Direction of movement	angle φ	cos(α)	Force F (scalar expression)	Remark
away from F_0	0°	1	$F_0\cdot(1 - v/c)$	as observed by me[2] in the Bertozzi experiment
perpendicular to F_0	90°	v/c	$F_0/c\cdot(c^2 - v^2)^{1/2}$	Rogers, Bucherer etc. experiment
in direction to F_0	180°	-1	$F_0\cdot(1 + v/c)$	experiment up to now not known

So obviously the proposal of W. Weber (about 1845) is adopted such that the propagation of energy or the connected force is with the speed of light. Hence the influence of this force on a moving particle with velocity v will decrease with increasing speed. This limit was clearly shown in the experiment of W. Bertozzi[3]. Bertozzi had **measured** the velocities with regards to the used energy eU of a linac (linear accelerator) with energies up to 15 MeV. This limit was in the case of Bertozzi 28,02 nsec (s = 8,4 m and $v_{limit} = c \sim 3*10^8$ m/sec). SRT could not explain the used energies at v/c ~ 0,95 and above. In fact EM-waves propagate with the speed of light according to $c = \{\varepsilon\cdot\mu\}^{-1/2}$ as Maxwell determined. So empty space is not conceivable. Nothing or empty space does not have properties. It is also wellknown that the speed of light will alter if either ε_r or μ_r changes (for example: water, glass an so on..). So like sound depends on the density of air, light depends on the properties (density) of the vacuum or ether. This ether is dragged due to heavy bodies or masses like for instance our earth. Due to a dragged ether Carel van der Togt[7] showed clearly that aberration of stars is easily explained, and not only as a maximum value as SRT can calculate. And furthermore aberration is not angle independent.

§2 Obtaining formulas for the rectilinear and circular movement according equation 1

Case 1 rectilinear movement:

So Abdullahi calculated after integration according to equation 1 and 2 for rectilinear movement:

$$eU/m_0c^2 = -\ln(1-v/c) - v/c \qquad (3)$$

ln denotes the logarithm naturalis.

But unfortunately this function is not able to reproduce all the findings of Bertozzi. Table 2 shows a comparision of the empirical formula 4 found by me[2], the equation 3 and the well known relativistic expression

$$eU\cdot(1-\beta) = F\cdot(1-\beta)\cdot s_a = m_0c^2\cdot k\cdot c/s\cdot\beta = p_0\cdot v = m_0c^2\cdot k_1\cdot\beta \qquad (4)$$

where $v/c = \beta$, F is the force working on a particle within a path of s_a, $p_0 = m_0\cdot c\cdot k\cdot c/s = m_0\cdot c\cdot k_1$, p_0 maybe an intrinsic momentum of one particle, s = 8,4 [m], k is a constant with a value of 3,28 [nsec], and $k_1 = k\cdot c/s = 0{,}117$ [-].

Table 2 shows a summary of all equations:

Table 2: comparision of equation 3, 4 and the relativistic one. Case rectilinear movement

Bertozzi observed		Abdullahi equation 3	empirical 1/x function equation 4	relativistic expression	
eU/mc^2	v/c obs.	P/mc^2	eU/mc^2	$Ekin/mc^2$	Remark
0,978	0,8675	1,154	0,766	1,010	
1,957	0,9097	1,495	1,179	1,408	v/c too low as seen in [2]
2,935	0,9596	2,249	2,779	2,554	
8,806	0,9866	3,326	8,614	5,129	
29,353	0,9961	4,551	29,883	10,334	
1,957	0,9410	1,889	1,866	1,955	v/c corrected as of [2] page 8

As we can see equation 3 and the relativistic one are not able to describe the measurements properly. We must note that v/c is **measured** with respect to the energy. Equation 4 is an empirical formula, so there is no preferred theory behind it, although it shows clearly that there is a *(v-c)*-behaviour. It looks like equation 1 has problems after integration due to the right side expression m·v·dv/dx. If we take the derivates of all equations then we get:

in case of equation 3

$$d(P/mc^2)/d(v/c) = v/c\cdot(1-v/c)^{-1} \quad (5)$$

for the relativistic equation

$$d(E_{kin}/mc^2)/d(v/c) = 2\cdot(v/c)\cdot[1-(v/c)^2]^{-3/2} \quad (6)$$

and in case of the empirical equation 4

$$d(eU/(mc^2)/d(v/c) = k_1\cdot(1-v/c)^{-2} \quad (7)$$

with k_1 = 0,117 [-]

So the derivatives of the energy/velocity equation has to be in the order of $(1-v/c)^{-2}$ **.** Equation 5 and 6 do not fulfill this requiremend. Both their curvature is to weak. Note again the velocities are measured! In the low range of the velocities equation 5 and 6 are able to describe the measurements, but in the relativistic range (v/c ~ 0,95 and above) they fail.

Case 2 movement perpendicular to the lines of force (circular movement):

From table 1 we obtain for circular or movement perpendicular to the lines of forces:

$$F = F_0/c\cdot(c^2 - v^2)^{1/2} \quad (8)$$

The energy of the acting force has to match the centrifugal energy, hence

$$W_p = F_0\cdot R/c\cdot(c^2 - v^2)^{1/2} = m_0\cdot v^2 \quad (9)$$

W_p denotes the working energy on a particle, F_0 is the constant magnitude of the force working on the particle and R the radius of particles path and v is particles velocity.

Interestingly the centrifugal energy of a particle is twice the classical kinetic energy and it‘s build is the same as equation 4. In case of a magnetic field we obtain:

$$e\cdot B_0\cdot v/c\cdot(c^2 - v^2)^{1/2} = \varrho_B\, m_0\cdot v^2 \quad (10)$$

where i switched to the curvature $\varrho = R^{-1}$. In case of an electric field we obtain:

$$e\cdot E_0/c\cdot(c^2 - v^2)^{1/2} = \varrho_E\, m_0\cdot v^2 \quad (11)$$

dividing equation 10 by equation 11, if we have a combined E+B field with the lines of force both perpendicular to particles path, yields

$$B_0/E_0 = \varrho_B/(v \cdot \varrho_E) \qquad (12)$$

or

$$v = (E_0 \cdot \varrho_B)/(B_0 \cdot \varrho_E) \qquad (13)$$

v denotes the so called compensation velocity to traverse an assigned path where E_0 and B_0 has certain values and the curvatures are equal and gives unity. In textbooks equation 12 or 13 are then put back into the normally derived equations 14 or 15

$$e \cdot B_0 \cdot v = \varrho_B \cdot m \cdot v^2 \qquad (14)$$

$$e \cdot E_0 = \varrho_E \cdot m \cdot v^2 \qquad (15)$$

to obtain

$$m_{rel} = e \cdot B_0^2 \cdot R_m^2/(E_0 \cdot R_E) \qquad (16)$$

But now m suddenly denotes a relativistic mass $m_{rel} = m_0 \cdot [1-(v/c)^2]^{-1/2}$ without having derived it properly! The Lorentz factor is only sticked on to the mass m. This is not a logically and physically derivation of a relativistic mass. This is only an ad hoc assumption to fit measured data into a variable named m.

A more logically and physically approach is, when we put equation 13 into 10 or 11. This yields for equation 10:

$$e \cdot B_0/c \cdot (c^2 - v^2)^{1/2} = \varrho_B \; m_0 \cdot (E_0 / B_0) \cdot (\varrho_B / \varrho_E) \qquad (17)$$

rearranging 17 with mass m_0 on the left side yields:

$$m_0 / [1-(v/c)^2]^{1/2} = e \cdot B_0^2 \cdot R_m^2/(E_0 \cdot R_E) \qquad (18)$$

But this is exactly equation 16, although mass is left constant. So this equation is a straight forward derivation out of the assumed *(v-c)*-behaviour. Thus to use measurements to assign a specific value or formula to an otherwise constant value is an arbitrarely method.

So in a combined E+B field the magnetic force and the electric force determines the ratio of the radii or curvatures according to equation 12.

§3 The experiment of Fred Terry Rogers[5] in 1936

F. T. Rogers realized in 1936 a remarkably precise experiment. He used a radioactive radon B source to send out β – particles with 3 major velocities or energies. These particles were deflected in a magnetic field with a strenght of 1250,7 Gauß. This field was kept constant for the three major velocities. The velocities are calculated using equation 13 and the electric field used by M. M. Rogers. Eventually the radii of the three lines were measured. Table 3 showes the observed data and the calculated values of the curvatures ϱ_B according to equation 10. If we rearrange equation 10 to have ϱ_B on the left side we yield:

$$\varrho_B = e \cdot B_0 \cdot c^{-1} \cdot (c^2 - v^2)^{1/2} (m_0 \cdot v)^{-1} = e \cdot B_0 \cdot (1 - (v/c)^2)^{1/2} (m_0 \cdot v)^{-1} \qquad (19)$$

Table 3: Experiment of F. T. Rogers 1936								
observed values in cgs units			observed values in SI units				equation 13	equation 19
H_0	R_B	$H_0 \cdot R_B$	B_0	R_B	$B_0 \cdot R_B$	ϱ_B	v/c calc.	ϱ_B calc.
Gauß	cm	Gauß·cm	Tesla	m	T·m	1/m	-	1/m
1250,7	1,12440	1406,3	0,12507	0,011244	0,0014063	88,936	0,6332	89,60
	1,33644	1671,5		0,013364	0,0016715	74,826	0,6955	75,73
	1,54472	1932,0		0,015447	0,0019320	64,737	0,7492	64,82

So calculated curvature is in good agreement with the observed values. Equation 19 is now used to extrapolate the measurements to v/c = 1. The curvature ϱ_B then becomes zero. The meaning of this is simply that particles then move in a straight line, so not affected by the magnetic field due to the (c-v) effect! So, if one adopts the assumption of Wilhelm Weber indicated by equation 1 then this idea is proved here without any other postulates. Furthermore there is no need of a varying mass and energy conservation law is not violated, too. In addition there are no difficulties with singularities. If $R \to \infty$, so becomes infinite, then this means only a particle is flying in a straight line.

Figure 2 shows this in more detail

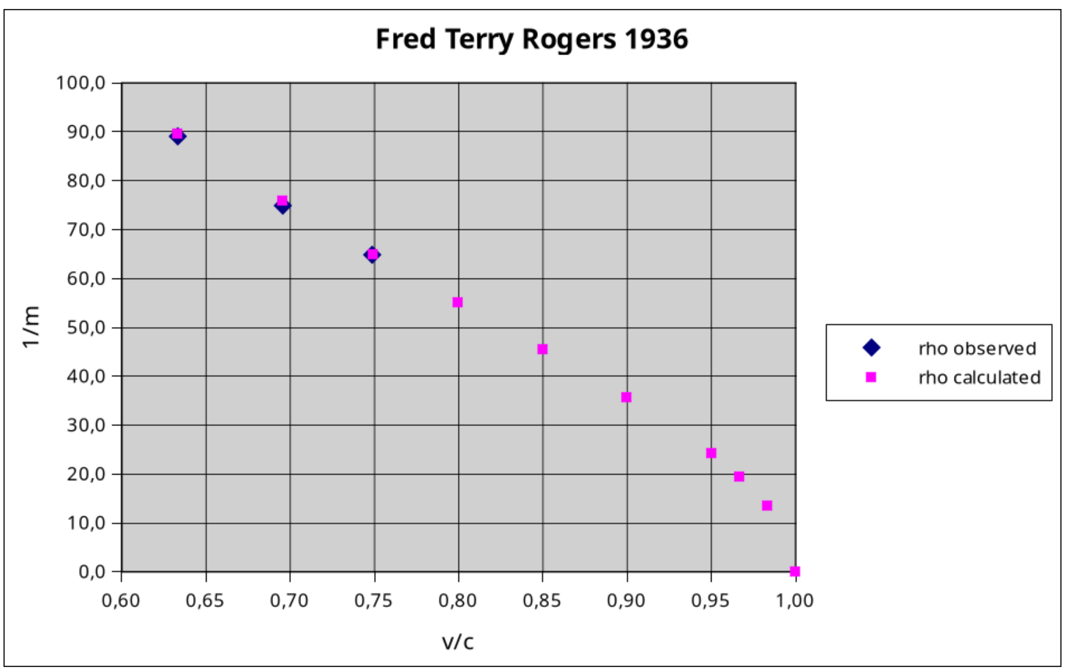

Figure 2: curvature versus v/c in a magnetic field

§4 The experiment of Marguerite M. Rogers[6] 1940

A crucial experiment was undertaken by M. M. Rogers. She used the findings of F. T. Rogers to prove the formula of H. A. Lorentz regarding the mass increase. Here again she used a radioactive radium β source as used by F. T. Rogers. This source of β particles was taken to let the particles (electrons) fly perpendicular into a radial E field (mechanically fixed due to a cylindrical tube constisting of two isolated segments [electrostatic spectrograph] with a given radius of 0,1605 m). At the end of this tube a Geiger-Müller counter was placed to find the maximum counts in respect to the applied tension or voltage. Then the maximum counts and the connected tension were used to calculate m_L/m_0. Accordingly the particles had then traversed the spectrograph with a certain radius of nearly 0,1605 m. The task was to prove the Lorentz-relation m_L/m_0 against the Abraham model.

Index $_L$ denotes Lorentz.

So finally $m_L/m_0 = [1-(v/c)^2]^{-1/2} = \gamma$ should be confirmed. Wich was of course in full agreement with the measurements according to equation 16 if m was set to a relativistic term.

The results of M. M. Rogers are shown in Table 4.

Table 4 The experiment of M. M. Rogers 1940								
observed values in cgs units 1940					observed values in SI units now			calc.
$H \cdot R_m$	P*	$E \cdot R_E$	v calc.	v/c	$B \cdot R_m$	$E \cdot R_E$	m/m_0	m_L/m_0
Gauß·cm	Volt	emu·cm	cm/sec	-	Tesla·m	V·m	-	-
1406	9970	2,671E13	1,8998E10	0,6337	1,4060E-3	2,671E5	1,298	1,293
1671,1	13017	3,487E13	2,0868E10	0,6961	1,6711E-3	3,487E5	1,404	1,393
1931,5	16200	4,341E13	2,2470E10	0,7496	1,9315E-3	4,341E5	1,507	1,511

*meant is the tension or voltage U. E13 means 10^{13} and so on.

So obviously experiment and calculation are in best agreement as the last two rows in table 4 show. The row before the last row is calculated according equation 16 divided by m_0. The last row is the Lorentz function. But again, this is a complete misinterpretation of the physical nature. Again, at $v \sim c$ m_L becomes infinite and so the relativistic E_{kin}. Every particle flying with the speed of light holds infinite mass and energy. This is not conceivable. And there is up to now no explanation how to solve this dilemma. A more simple approach to make things more natural is to apply equation 11 and calculate ϱ_E with regards to v and E_0. R_E was fixed to 0,1605 m for all three major velocities and so the therefore needed tensions U must vary. Due to the cylindrical arrangement of the spectrograph the field was calculated according to equation 20

$$E \cdot R_E = U / \ln(r_2 / r_1) \qquad (20)$$

due to the hardware in the experiment the radii were r_2 = 16,05 + 0,29945 = 16,34945 cm and r_1 = 16,05 – 0,29945 = 15,75055 cm , hence $\ln(r_2 / r_1)$ = 1/ 26,796. So equation 11 becomes with taking equation 20 into account:

$$\varrho_E = eU\cdot\{R_E\cdot\ln(r_2 / r_1)\cdot(m_0c)\}^{-1}\cdot(c^2 - v^2)^{1/2}\cdot v^{-2} \qquad (21)$$

R_E is the given radius of the spectrograph, U the applied Tension, v the 3 major velocities.

Table 5 Calculation of curvature with respect to the applied Voltage U and the velocity v				
U	v/c	ϱ_E calc.	deviation	remark
Volt	-	1/m	%	unit
9970	0,6337	6,2773	0,75	$1/R_E = 6{,}2305\ m^{-1}$
13017	0,6961	6,3062	1,21	
16200	0,7496	6,2370	0,10	

Table 5 showes the calculated curvature ϱ_E and the deviation in % with respect to the hardware radius R_E^{-1}=6,2305 m^{-1}.

So although M. M. Rogers did not measure the magnetic part as F. T. Rogers did, the results are remarkable precise. She relied on the sample to be the same as F. T. Rogers used. But the calculated velocities match and the sample is regarded to be the same type as F. T. Rogers used. This result depends on 4 variables namely the tension, velocity v radius R_E and the proper alignment of the Geiger-Müller counter. So an overall deviation of < 1,3% is very satisfying.

If we analyze equation 21 then it is obvious that ϱ_E depends on two variables namely U and v. Mass m_0 and all other are constant in this scenario. So it is evident that ϱ_E is constant within the measurements of M. M. Rogers. On taking the total differential of ϱ_E (equation 21) we yield:

$$d\varrho_E = (\partial\varrho_E/\partial U)\cdot dU + (\partial\varrho_E/\partial v)\cdot dv = 0 \qquad (22)$$

hence

$$(\partial\varrho_E/\partial U)\cdot dU = -(\partial\varrho_E/\partial v)\cdot dv \qquad (23)$$

this is a consequence of the experiment because $d\varrho_E$ is indeed nearly zero. So calculating the derivates of ϱ_E yields:

$$dU/dv = U/v\cdot[\beta^2/(1-\beta^2) + 2] \qquad (24)$$

so dU/dv should be nearly zero in the experiment. U denotes the tension and v particles speed and β = v/c. This is as we see totally independent of m_0.

Table 6 showes the outcome of this

Table 6 Impact of U and v on dU/dv.			
U	v/c	dU/dv	remark
V	-	V/(m/sec)	unit
9970	0,6337	0,0001	
13017	0,6961	0,0002	
16200	0,7496	0,0002	

so table 5 showes clearly that due to the velocities and accordingly the adjusted tension the derivation of equation 21 has to be zero and that has its origin in a *(c-v)*-behaviour as equation 24 points out.

§ 5 The experiment of A. H. Bucherer[4] 1908

A. H. Bucherer in 1908 performed an experiment of importance on this subject.He worked with a small circular condenser with a diameter of 8 cm. The plates had a distance of 0,25 mm. In the middle of this capacitor a radio active radium fluoride was placed wich served as a point source of β-rays. Around the condenser and pressed against the wall of the vessel was spread cylindrically a photographic film. The whole was evacuated and placed into a solenoid wich served for the magnetic field. This magnetic field was parallel to the plates of the condensor and perpendicular to particles path. The electric field between the plates of the condenser was also perpendicular both to the path and the magnetic field. When the electric and the magnetic fields are applied , the β-particles are driven to the plates of the condenser unless they have a proper velocity (so called compensation speed v_{comp}) to enable the electric and magnetic forces to compensate each other. So according equation 12 and 13 and the assumption of a straight traverse within the capacitor equation 13 becomes:

$$v_{comp}=E_0/B_0 \qquad (25)$$

v_{comp} denotes the compensation velocity

Having left the condenser the particles move a certain distance under the action of a magnetic field only. According to the created curves on the film the ratio e/m could be derived. Based on the curves on the films the deflection was measured and the curvature could be calculated according to equation 26 wich was given due to the set up of the hardware.

$$\varrho_B = 2\cdot z/(z^2+a^2) \qquad (26)$$

where z denotes the observed deflection and a = 0,04 m is the distance from condensers plates and the film. Bucherer later corrected a by -0,00031 m to take additional effects, due to the capacitors edge, into accounts. Additionally other effects were mentioned. A part of the particles could escape although they had not the proper compensation speed [Bucherer called them „ Nebenstrahlen“ (side-rays)]. So according equation 10 we yield:

$$e/m_0 = v_{comp}\cdot\varrho_B\cdot[B_0\cdot(1-(v_{comp}/c)^2]^{-1} \qquad (27)$$

the value e/m_0 should be constant.

Table 7 shows the result of A. H. Bucherer.

Table 7 Results of A. H. Bucherers experiment						
line	$E_0/(B_0 \cdot c)$	H	B	z	e/m_0	Remark
1	-	Gauß	Tesla	m	J/(V·kg)=C/kg	unit
2	0,3173	104,54	0,010454	0,01637	1,7043E11	
3	0,3787	115,76	0,011576	0,01445	1,7165E11	
4	0,4281	127,35	0,012735	0,0135	1,7131E11	
5	0,47	127,54	0,012754	0,00971	1,4559E11	side ray
6	0,5154	127,54	0,012754	0,01018	1,7144E11	
7	0,588	127,54	0,012754	0,00954	1,9566E11	side ray
8	0,687	127,54	0,012754	0,00623	1,7155E11	

line 5 and 7 are obviously out of range. They are due to the side rays. e/m_0 is calculated according to equation 27. With $m_0 = 9{,}11 \cdot 10^{-31}$ [kg] $e = 1{,}602 \cdot 10^{-19}$ [J/V = C] we nowadays yield $e/m_0 = 1{,}759 \cdot 10^{11}$. Later Bucherer corrected his values to $1{,}730 \cdot 10^{7}$ [emu/gr].

This constant e/m_0 ratio was evidence enough to imply a relativistic mass. More obvious is to interpret equation 19 as assumed here in a (c-v) behaviour way (regarding to B_0 and the resulting impact on a particle) as equation 28 implies. In reality the only thing what was measured was the deflection z where ϱ_B is thightly connected thru equation 26. So there is no need to design a relativistic mass. If v_{comp} reaches the velocity of c then ϱ_B simply becomes zero, so no deflection or z = 0. M. M. Rogers[6] mentioned it herself on page 4 (quote „in the direction of H we have only particles whose velocity approaches that of light, and transversally to H we find the slowest particles“).

$$\varrho_B = (e \cdot B_0/m_0) \cdot (1 - (v_{comp}/c)^2)^{1/2} \, (v_{comp})^{-1} \qquad (28)$$

Figure 3 on next page showes the results including the prolongation of the calculated values until the speed of light.

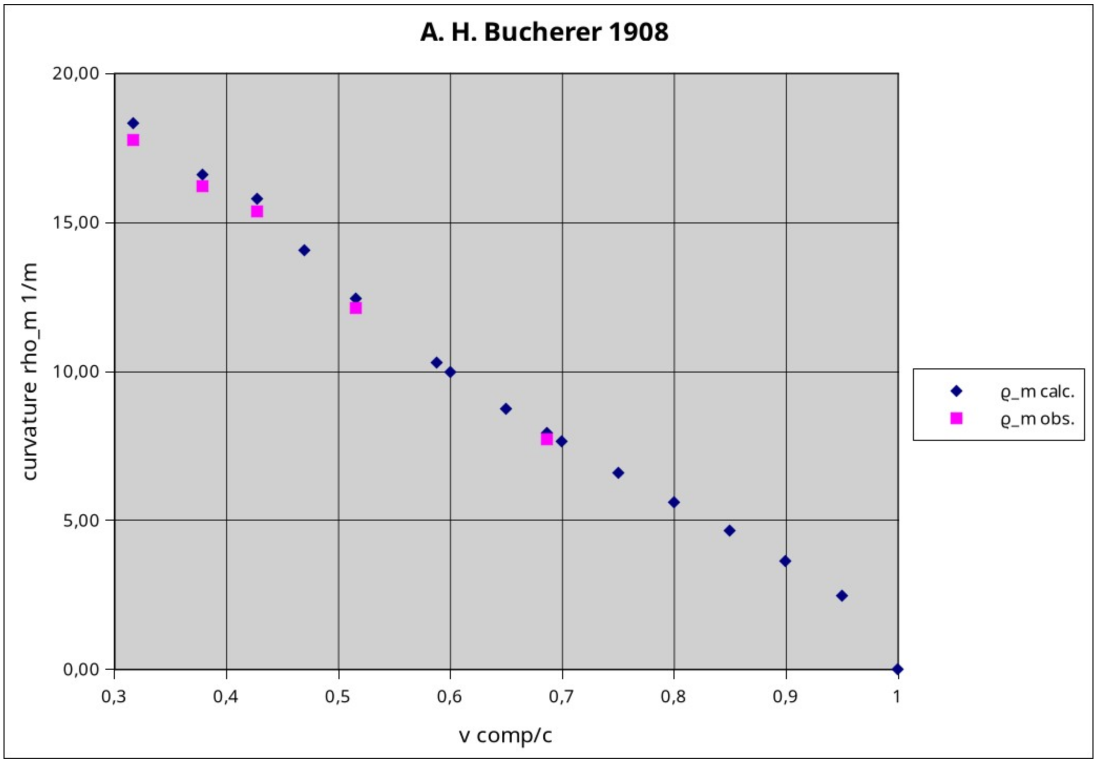

Figure 3: curvature ϱ_B versus compensating velocity.

So this is equal to figure 2 but apparently not so precise as with F. T. Rogers. From this one can see that it is extremely important to select the right deflections z for the result and not the so called side rays. Figure 4 shows the meaning of that. But we have to bear in mind that this experiment was done in 1908!

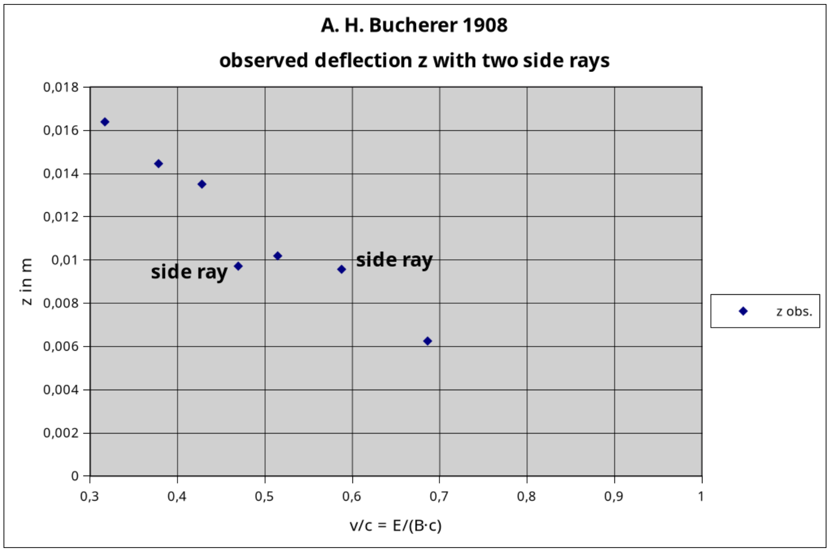

Figure 4: deflection z versus velocity v_{comp} including two side rays.

§ 4 Summary

A simple approach was made to explain the experiments of F. T. Rogers, M. M. Rogers and A. H. Bucherer in a more natural consensus than explaining it with a relativistic mass, wich is not derived properly on a common sense base. It is shown that only the assumption of a *(c-v)*-behaviour is enough to get the same results as commonly used due to an artificial formula. The mass definition is incorrectly changed due to relativistic interference. Mass is a quantity of natural particles. The higher the quantity the higher is inertia. But the quantity of natural particles will not grow with increasing speed. There must be an interaction with the vacuum or aether. Already W. Bertozzi and Liangzao Fan[9] proved in their up to now remarkable experiments (because of measured speeds) that there is a limiting speed. And these experiments clearly refutes special relativity, because growing mass according to SRT could indeed not explain the energies Bertozzi used (this is proved by me in [2] due to calculating the energies for given (measured) velocities according to SRT energy equation). Important is that Bertozzi's velocities are real **measured** values and not calculated as common. So real measurements should be conducted, and all the powerful Linac's should be used to do more physical work and not to burn extremely much money to search for useless particles. On the other hand, and maybe much more important: education is important, but if physics is going into a metaphysical/religious direction, or is already there (clergyman Georges Edouard Lemaître and his big bang of the universe), then fear is justified.

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