letters

The clock "paradox"—majority view

My friend Mendel Sachs has stirred up greatly unneeded confusion in the theory of relativity by his new attempt at resuscitation of the "Clock Paradox" (September, page 23). The correct result of the special theory was first given by Einstein: "If one of two synchronous clocks at A is moved in a closed curve with constant velocity until it returns to A, the journey lasting t seconds, then by the clock which has remained at rest the travelled clock on its arrival at A will be $(tv^2/2)/(c^2)$ seconds slow."[1]

There have perennially been a few physicists who have refused for philosophical reasons to accept this easily derived result. Herbert Dingle, for one, carried on this controversy for decades until he finally realized that this prediction regarding clocks (or twins) did indeed follow from special relativity, at which point he decided that special relativity itself must be rejected.[2]

The standard reason for rejection of Einstein's result is the feeling held by Sachs that a paradox *would* exist if Einstein were correct—that all reference frames should be equivalent and that the Lorentz rest-frames so basic to special relativity have no right to their special property, that of the simplest description of physical events. The twin who is accelerated and thus changes reference frames cannot expect, however, to observe the same simple physical phenomena as his nontraveling brother. His observations of distance and relative motion will be internally inconsistent and confusing, as I have pointed out in some detail elsewhere.[3] For example, when he decelerates to begin his return journey he will see (through his telescope) his brother suddenly shrink in apparent size, jumping to a much larger apparent distance away from him.

There is thus no reason to believe in the equivalence of the two reference frames, or thus in the identity of clock readings at the end of the journey. Position and velocity are relative matters in special relativity, but acceleration is not, so that all motion is *not* completely relative. Acceleration with respect to Lorentz reference frames is an absolute matter, readily detected, as anyone who has been a passenger in an automobile or airplane knows.

Sachs is also convinced, as have been most of his predecessors, that the special theory, which applies whenever gravitational fields may be neglected, is unable to handle problems involving acceleration, such as the clock problem (not "paradox," please!). He believes that general relativity, with its vastly greater opportunities for misunderstanding and error, must be used in this simple problem. However, it was through studying the dynamics of an accelerated electron that Einstein, in his special-relativity paper of 1905, derived the relativistic variation of mass. Apparently most of this fundamental paper must be rejected if Sachs's point of view, or Dingle's, is to be followed.

It seems strange that special relativity should still be viewed as a controversial theory after countless experimental verifications, in particular of the slower decay rate of fundamental particles at relativistic speeds. Perhaps the experiment currently being performed by J. C. Hafele and R. E. Keating, in which a highly accurate clock is being carried around the world on commercial jet planes, will produce proof acceptable to everyone. However, the long history of this controversy does not encourage this hope.

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Concerning the twin paradox, Sachs states that he is "unaware of any direct experimental evidence to answer this question." In fact there are at least three classes of experiments that verify the usual conclusion that the traveling twin will find himself younger than his brother when they meet after the journey.

The first, and oldest, evidence must be constructed from pieces of verified phenomena and is most clearly presented as a *gedanken* experiment. Let us take a beam of rather low-energy positive pions split into two equal parts (the two twins). Let one part stop in an absorber where the pions will decay to muons (the first twin ages) while the other part (the second twin) travels onward to a scatterer where the pions that have not decayed in flight are backscattered to stop in a second absorber set beside the first. (The twins meet again.) The proper age of the second sample (the second twin) can be determined by the intensity of decays of that sample. We have ample experimental evidence that conventional time dilatation operates as far as the pions in flight are concerned, and if there is no attenuation of the beam through decay (or aging) in the acceleration involved in the scattering, the second sample of muons stopped in the absorber must be larger (and younger) than the first. It then follows that, if the final samples were actually to be the same size and same age, the extra decay required of the second sample must take place during the acceleration of that sample at the scatterer or absorber. Furthermore,

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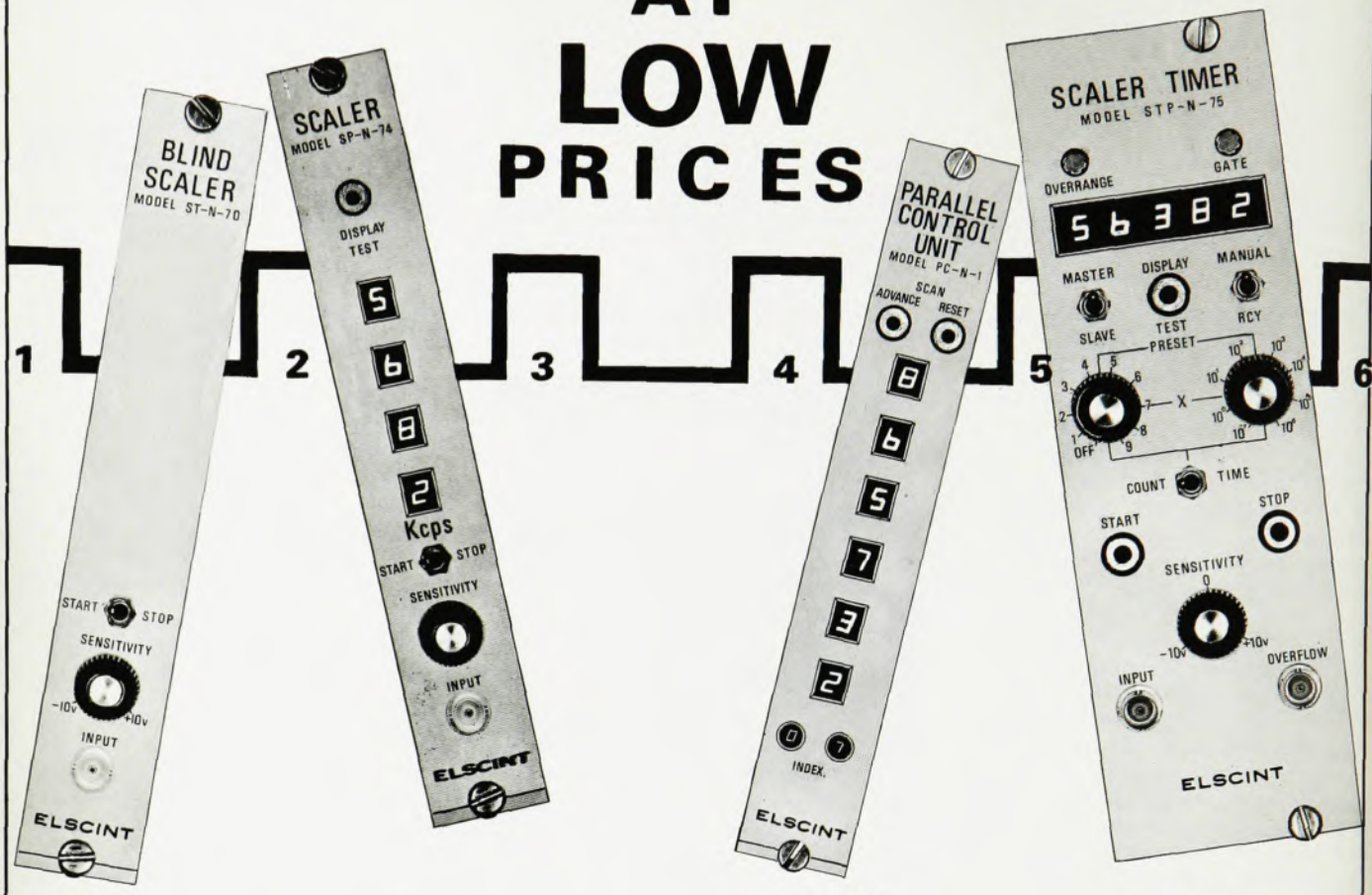

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the number of extra decays must, somehow, depend upon the distance between the absorber and scatterer. Aside from that serious logical difficulty, we know from experiment that pions do not decay to muons with anomalous probabilities in scattering and slowing processes. It then follows that the two samples stopped in the two absorbers must be of different sizes and different ages; the traveling twin will have aged less than his brother.

A second piece of evidence, which may seem more appealing to many, is derived from comparatively subtle measurements using the Mössbauer effect. Here we consider two twins who both take journeys to and fro, but one goes faster than the other. Our fast twin is a group of excited atoms at high temperature; the slow twin is a similar set of atoms at low temperature. We find that the fast twin ages slower than the slow twin inasmuch as the frequency emitted by the warmer atoms is *less* than for the colder atoms. This effect was first pointed out, and analyzed, by Brian Josephson as an undergraduate (!) at Cambridge.

The third experiment on twins, with which I am familiar, concerns the observations on muons moving in magnetic fields in the course of measurements of the g-factor of the muon at CERN. These muons really make *round* trips, and because the time dilatation is observed to operate in the expected fashion, these muons, traveling in circles, are observed to age less than their twins at rest.

I will not comment on the differences between Sachs's theory and Einstein's theory of relativity. However, I do believe that the deduction of the twin-paradox results from special relativity can be made quite transparent and accessible even to bright high-school students who have no calculus, for example. This is attempted, I believe with some success, in my book *Concepts in Physics* (Academic, New York 1969), pages 80–85 and 387–392.

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•

The lengthy and (to me) baffling article by Sachs on the clock paradox is rendered useless by a single experimental fact: The unequal aging of accelerated and nonaccelerated "twins" has been observed. The predictions of conventional relativity were born out in the CERN muon storage-ring experiment,[1] in which muons travelling at 0.9965 of the speed of light were sent *in a circle*. They thus *returned* to their point of origin, allowing a local comparison of their "clock"—their lifetime against disintegration into lighter particles—with that of their identical twins who stayed behind in the production target. The stopped muons had a lifetime of 2.2 microseconds, as stopped muons always do, while the circulating muons enjoyed a lifetime 12 times longer, just as Einstein's factor of $(1 - v^2/c^2)^{-1/2}$ requires. A skeptical student might ask that the circulating muons be literally stopped in the same target, to see if they undergo ultrarapid aging or something. All right, that was not done in this particular experiment, but it has been done in countless others, and the result is always the same: No hanky-panky is observed as the result of accelerations or decelerations.

In fact, we high-energy physicists would have been very surprised had the outcome been otherwise. We frequently transport beams of unstable particles over long distances, such that no particles would be left without the help of Einstein's factor. The transport systems have huge magnets that bend the beams with great accelerations, yet Einstein's factor always works. Since the gravitational constant G never enters, there is no need to invoke general relativity.

It is disheartening that Sachs, and the editors, were apparently unaware of the CERN muon-moment ("$g - 2$") experiment, since it is one of the brightest stars in the crown of modern physics, with a content far more profound than the relativity verification discussed here. Incidentally, because of the wide interest in the twin paradox my colleagues have tried to point out that the experiment is also a relativity check, in a letter to *Nature* on the subject,[2] and in a chapter of a review.[3]

I used to think of relativists as elements of a finite mathematical group, operating only on each other, but surely this must now change: The wild phenomena of present-day astronomy seem to be a meeting-ground of high-energy physics, general relativity, and practically everything we know. *Ad astra per aspera.*

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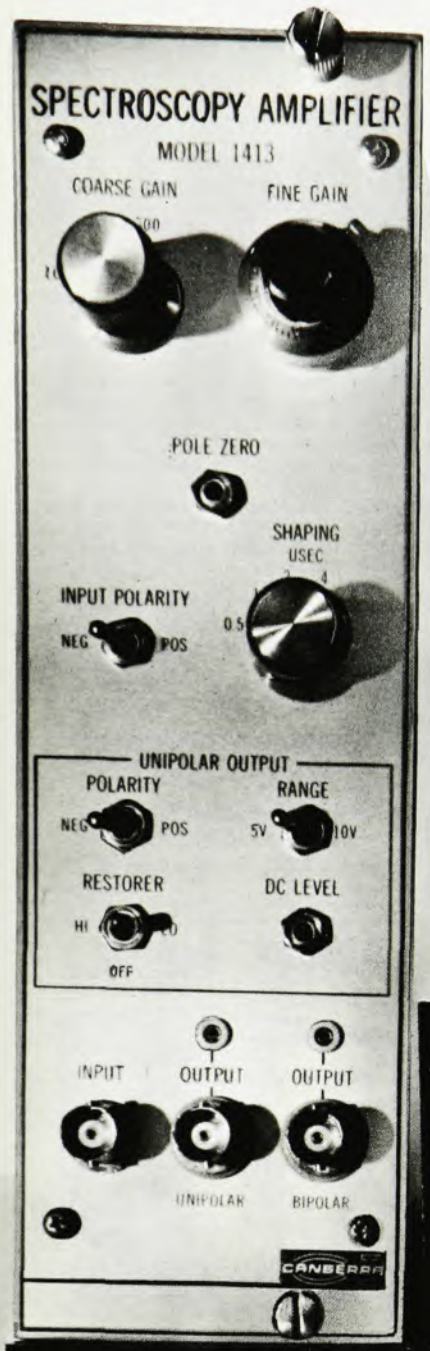

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For there to be a clock paradox, there must be a paradoxical inconsistency. There is none. *Both* traveler and stay-at-home agree that the traveler has aged less. Accordingly, there is no paradox to be resolved. Let me pose the problem in paradoxical form: traveler (T) and stationary observer (S) both have identical clocks that emit pulses of light at a fixed frequency ω. By applying the accelerations briefly (they need not be large, remember), say entirely between pulses, we introduce *at most* an ambiguity of only a single pulse, which we ignore henceforth. On the outbound journey, both T and S agree that the other's clock pulses slower at frequency $\omega(1 - \beta)\gamma$ where $\beta = v/c$ and $\gamma = (1 - \beta^2)^{-1/2}$ and on the return they *both* agree that the other's clock pulses faster [frequency $\omega(1 + \beta)\gamma$]. They each supposedly infer an average rate of $\gamma\omega$ for the other's clock, compared to ω for their own, which is impossible.

If T sent out N_T pulses during the journey, S will have observed each and every one of them, since there is nowhere in between to hide any extra pulses once T and S have been reunited. In the same way, T and S agree on the number of pulses S has emitted (N_S). The only possible question is how N_T compares to N_S. If T travels in and out with the same velocity, he will observe an average pulse frequency from S that is half the outgoing frequency plus half the incoming frequency (obviously, it takes him the same time to travel the same distance at the same velocity), namely the frequency quoted above. Therefore

$$N_S = \gamma N_T \text{ (T's point of view)},$$

and since S has emitted more pulses than T, he is the older on any objective chronological basis. Now what about S? The essential error introduced in the statement of the paradox is the implication that halfway between the time T left and the time he finally returned, *S observed T to start back.* This assumption is spectacularly wrong in the case where T moves at nearly the speed of light, since then he arrives home almost simultaneously with the change in pulse frequency that would herald his turnaround. To S almost the entire journey would appear to be the outbound leg. If the duration of the journey is t as far as S is concerned, he observes the outbound leg for a time $t(1-\beta)/2$ and the inbound leg for the time $t(1 - \beta)/2$, giving S an average observed frequency for T's clock of ω/γ and once again

$$N_S = \gamma N_T \text{ (S's point of view)}.$$

Since the two *agree*, there is no paradox to be resolved. If Sachs can support his claim that $N_S = N_T$, it is he who has finally created a paradox.

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•

. . . The twin paradox arises only if one incorrectly assumes that the two twins take "identical trips." By carefully applying special relativity one can see that there is no paradox—both twins agree that the traveling twin is the younger. Furthermore, the explanation occasionally given, which states that the traveling twin is younger, but that it is *due* to the periods of acceleration, is also wrong. The periods of acceleration only cause very small corrections to be made to the ages as calculated from special relativity alone. Correctly understanding the twin paradox is really just being careful in the use of special relativity, as general relativity is used only in determining that an asymmetry does exist and hence in deciding which twin changes frames of reference.

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. . . The Sachs conjecture that proper time is a single-valued, analytic function of $(\mathbf{x},t)$ not only eliminates the twin-paradox effect, but all relativistic effects. It is completely inconsistent with relativity. For example, imagine the following experiment. Two observers A and A′ are at rest in an inertial frame, a distance L apart. A emits a light signal to A′, who immediately reflects it back to A. The total elapsed time is $t_A = 2L/c \equiv 2t_0$.

Now imagine another observer, B, initially coincident with A. At the moment A sends his signal, B accelerates up to speed v in negligible time and travels at constant speed in a direction perpendicular to the line AA′. At the same moment A′ receives the signal, B reverses his direction in negligible time and returns to A at constant speed v. As he reaches A he comes quickly to rest. According to Sachs, B's clock will also read $t_B = t_A = 2t_0$. To B, the trips out and in are quite symmetrical (being connected by time reversal and reflection). However, to B the distance travelled by the light on each trip is $(L^2 + v^2t_0^2)^{1/2}$, in the same time t_0, so the speed of the beam is $(c^2 + v^2)^{1/2}$. (We assume no transverse distance contraction.)

So the Sachs conjecture contradicts the principle of the constancy of the speed of light and in fact implies the

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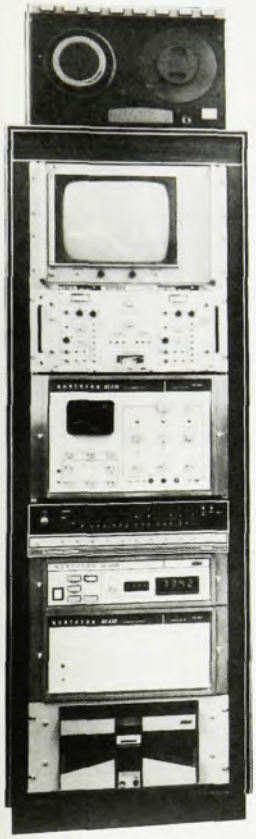

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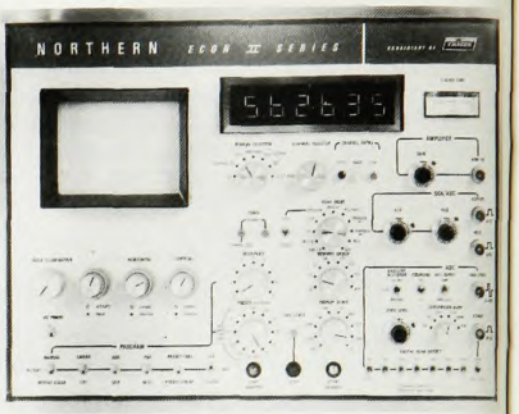

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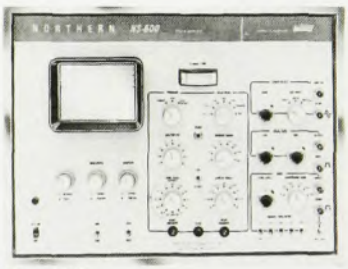

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classical vectorial addition of velocities and consequently a complete Newtonian view of space and time as separate entities. Further examples can show that his conjecture implies that there is no time dilatation, and also that proper time depends on t alone, and not $\mathbf{x}$.

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•

. . . A counter example to Sachs's conclusion is worth a thousand words. Since his conclusion applies to curved space-times as well, let us consider the gravitational effect of the sun. The gravitational red-shift is an experimentally observed fact. Twin B can leave A and move toward the sun at any given $v < c$ and then return to A at a slow enough speed such that the blue-shift Doppler effect is dominated by the red-shift gravitational effect. A receives the pulses from B as red-shifted for the entire experiment. Since A is always receiving the pulses from B at a slower rate than his own (and considerably slower for a time), A does not observe B to have aged as much as A ages. The twins' asymmetric aging is experimentally justified and the interesting discrepancy lies entirely in Sachs's analysis.

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•

Sachs's "proof" of the twins' equal aging is, at best, incomplete. One must *demonstrate* that $f_\mu(z)$ is analytic. It is not enough that $f_\mu{}^1(x,y)$ and $f_\mu{}^2(x,y)$ be nonsingular; they must also satisfy the Cauchy-Riemann equations. As presented, the proof proceeds by assuming the final result and then rederiving it.

As for the philosophical preamble, how many times must it be said that the *felt* acceleration of the travelling twin is sufficient asymmetry to remove the paradox? Whether or not the fact of the experience of acceleration arises from motion with respect to the remainder of the universe is an interesting question, but irrelevant to the matter at hand. . . .

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•

. . . Sachs states: "The fundamental assertion of the (special) theory (of relativity) is that the law of nature itself must be the same to all possible observers, *irrespective of their relative motions*" (my italics). Unfortunately, Sachs is mistaken. The fundamental assertion of special relativity is that natural laws must be the same regardless of *inertial* frames. They may not be the same in accelerated frames. . . . . .Special relativity, several facets of which are experimentally verified,[1] leads unambiguously to the time discrepancy in the twin paradox. There can be no objection to a person who wishes to work out a theory which eliminates the time discrepancy. But such a theory would necessarily differ from special relativity and would probably disagree with the experimental evidence for special relativity. However, such an approach would seem to be better than to try to work within the framework of special relativity as Sachs had done.

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. . . Sachs claims that physics looks the same to all observers, accelerated or not. This must be, he reasons, because acceleration is purely relative. In the rest frame of the rocket-driven observer, the stay-at-home twin and the distant stars are all seen to accelerate. The acceleration of the rest of the universe must be accomplished by the rocket engines (?). It is reasoning like this that is giving Mach a bad name.

Then there is that unambiguous mathematical "proof" with which Sachs administers the *coup de grâce* to those who would argue with him. The careful (in fact the not-so-careful) reader would be disturbed by the fact that a specialization of this argument to a spatial hypersurface shows that all closed curves in Euclidean 3-space have zero length, a statement even further from the "establishment" viewpoint than Sachs's relativity of acceleration.

The fatal flaw is the belief that if dS is some representation (quaternion or whatever) of ds, in the sense that some multiplication process gives

$$\langle dS, dS \rangle = ds^2$$

then

$$\int dS \text{ represents } \int ds$$

It is easy to destroy this with a *reductio ad absurdum*. Let $\mathbf{e}_x, \mathbf{e}_y, \mathbf{e}_z$ be triternions (also called basis vectors) in

Continued on page 47

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Euclidean 3-space. They obey the algebra

$$\mathbf{e}_i \cdot \mathbf{e}_j = \delta_{ij}.$$

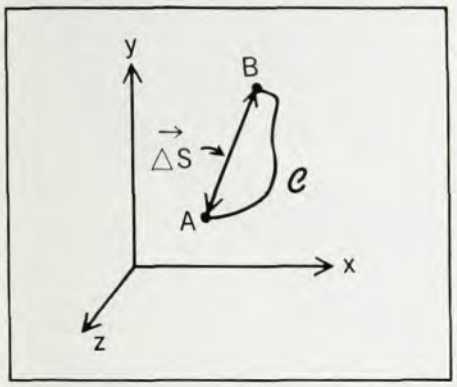
Now $\mathbf{dS} = \mathbf{e}_i dx^i$ is a representation of ds since

$$\mathbf{dS} \cdot \mathbf{dS} = ds^2 = dx^2 + dy^2 + dz^2.$$

Sachs's argument would then tell us that

$$\Delta\mathbf{S} = \int_{A\,e}^{B} dS$$

is a representation of the length of e between A and B. We need only look at



a picture of S to see that

$$(\Delta\mathbf{S} \cdot \Delta\mathbf{S})^{1/2} \neq \int_{A\,e}^{B} ds.$$

It is most unfortunate that many people may have been misled by Sachs's article and we hope that PHYSICS TODAY will make it clear that the article was ill conceived.

RICHARD PRICE
VERN SANDBERG
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It is surprising that someone should try to prove that $\oint ds = 0$ in relativistic space-time. Since Sachs claims his result to be valid for any closed path in any reasonable metric it is enough to give an example of just one closed path for which $\oint ds \neq 0$ to show his theorem to be untenable. Take an inertial system in a flat metric. A light flash is sent out, is reflected at some distance and received again at the same place in the inertial system. The intergral $\int ds$, taken along the path of the emitting and receiving point in the inertial system, is just the (proper) time elapsed between the two events of emitting and receiving the light signal; so for this path $\int ds \neq 0$, while the integral taken along the path of the light is zero; therefore for this particular closed path the total closed-path integral is not zero.

To see how fundamental the property $\oint ds \neq 0$ is (in general), one should remember that in general relativity the path of a free-falling body is just that for which $\int ds$ is extremal.

P. H. POLAK
S. R. DE GROOT
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. . . Sachs's resolution (with no symmetric aging) can hardly be accepted. What one usually does in analyzing the clock paradox is just to calculate the proper-time intervals for both clocks. They turn out different. No timelike geodesics would exist if Sachs's equation 11 were true not only for formal quaternions but also for numerical proper-time intervals. His mathematical arguments in connection with equation 10 seem misleading, since a unique function of x_1 and x_2 is not automatically an analytic function of $z = x_1 + ix_2$.

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. . . One must remark on the author's "proof" that the integrated space–time interval around a closed path is zero. The fact is, that just because the "quaternion square-root" integrates to zero, it does not follow that the more familiar square root employed by Einstein does also; it does not. Even without following the details, it is easy to see that the author's conclusions must be wrong: There is nothing in his derivation that precludes its application to purely space-like curves. Thus he would conclude that the length of a circular path is zero (or $\pi = 0$)! Similarly, consider two space-like curves joining two nearby points in space, one curve short and direct, one long and meandering; clearly they are not of the same length.

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The author comments: I thank my critics for their comments and the opportunity to further clarify my stand. Let me start by stating what I feel to be a misunderstanding of a crucial point in my logical analysis that was not discussed by the critics. This is my rejection of their tacit assumption (made originally by Einstein) that I feel to be incompatible with Einstein's axiomatic starting point in his relativity theory. It is the idea that there is a one-to-one correspondence between an observer's

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estimate of a time parameter in a frame of reference that moves relative to him, and a physical process (such as aging) that is going on in that moving frame. Such a correspondence can indeed be made in the observer's own frame simply by using one type of clock (say a pocket watch) to calibrate another (say the human's rate of irreversible cell decay that he associates with his aging). But there is no justification to use this calibration in the observer's frame to deduce a similar time-parameter-age correlation in the physical system that is in motion relative to the observer. In Einstein's theory, the symbol t stands for an abstract (nonobservable) parameter to be used as a "language element" in a physical law. The only logical role of the transformation $t \rightarrow t'$ here is to ensure that the forms of the physical laws in the different reference frames will be in one-to-one correspondence (the "principle of relativity"). The actual aging (the observable) is then *in principle* derived from the solutions of the physical laws (for example, the "field equations") in which the symbol t (or t', etc) had been inserted. This is the role of t in relativity theory.[1] In contrast with Jim Terrell's implication, it is my full acceptance of Einstein's relativity theory that leads me to reject asymmetric aging as an effect that is logically and mathematically inconsistent with the premises of this theory. I fully accept the logical and mathematical content of Einstein's general-relativity theory—with "special relativity" playing the role of a special limit that is useful in a particular approximation. My criticism of Einstein is only the very minor one having to do with his particular *interpretation of the time transformations* in terms of asymmetric aging.

In contrast with Terrell's (and Korenman's, Noonan's, and Price and Sandberg's) opinion, relativity theory implies that acceleration is just as much a relative motion as is velocity. For it follows from the argument that if space-time is defined to be relative only to a particular frame, then clearly the rates of change of any of these coordinates with respect to any other must also be relative quantities, whether they are first, second or 97th derivatives! (It is only the law of nature that has objective connotation in this theory.) To claim that acceleration is an absolute quantity (with respect to any sort of frame) because one can "feel it" is to confuse it with force—which is derived from a law of nature. If the stay-at-home who waves goodbye to the airplane traveller were sufficiently sensitive, he (and the earth) would also "feel it" at the take-off. But they do not because they are too inertial. But all of this is actually beside the point because in the clock problem, force, *per se*, has nothing to do with the usual conclusion about asymmetric aging. It has strictly to do with the *relative measures* of time coordinates. The claim that acceleration is not a relative quantity implies the Newtonian stand, which, of course, is opposed to Einstein's relativistic stand. If this is so, how can these critics argue for the asymmetric aging effect *as a consequence of Einstein's relativity theory?*

Contrary to Terrell's assertion, Einstein's original derivation of the mass-energy relation followed from kinematic (not dynamical) considerations.[2] In any case, whenever there would be a transfer of energy and momentum between relatively moving frames (that is, forces) there is nonuniform relative motion involved, and this must necessarily be treated in Einstein's theory, *in principle*, according to general relativity.[1]

Adair and Williams both claim that confirmations of asymmetric aging follow from the observations of the lifetimes of unstable particles in flight, compared with their lifetimes in a stationary frame. I fully agree that these confirm the time-dilatation prediction of special relativity, just as the measurements of Doppler effects also do. On the other hand, the "age" of a physical system (*number* rather than *number per second*) is a different sort of observation. These comments also apply to Adair's reference to Mössbauer-effect measurements. My point is that the actual number of particles that are left (in the muon's frame) is strictly a function of the internal forces that cause its decay and should not depend on the state of motion of some observer who happens to be looking at the process. Williams admits that the conclusion from this experiment is based on combining the time-dilatation observation with a *deduction* from a *gedanken experiment*. But the latter is only a *logical exercise* that is based on a premise that I claim to be inconsistent with Einstein's relativity theory. There is no substitute for hard experimental facts! The recent experiment of Hafele is the first attempt (I know of) to test asymmetric aging directly. If these results should be conclusively positive, it would imply to me the necessity to consider altering some aspect of general-relativity theory.

I do not agree with Michel that the frame-dependence of frequency, according to relativity theory, logically implies that the total number of oscillations (in corresponding time intervals) is also frame-dependent. One need not say that "S observed T to start back" to arrive at the paradox. One merely has to *deduce* the total number of pulses emitted by each of them *from the other's view* and assume the time-parameter-

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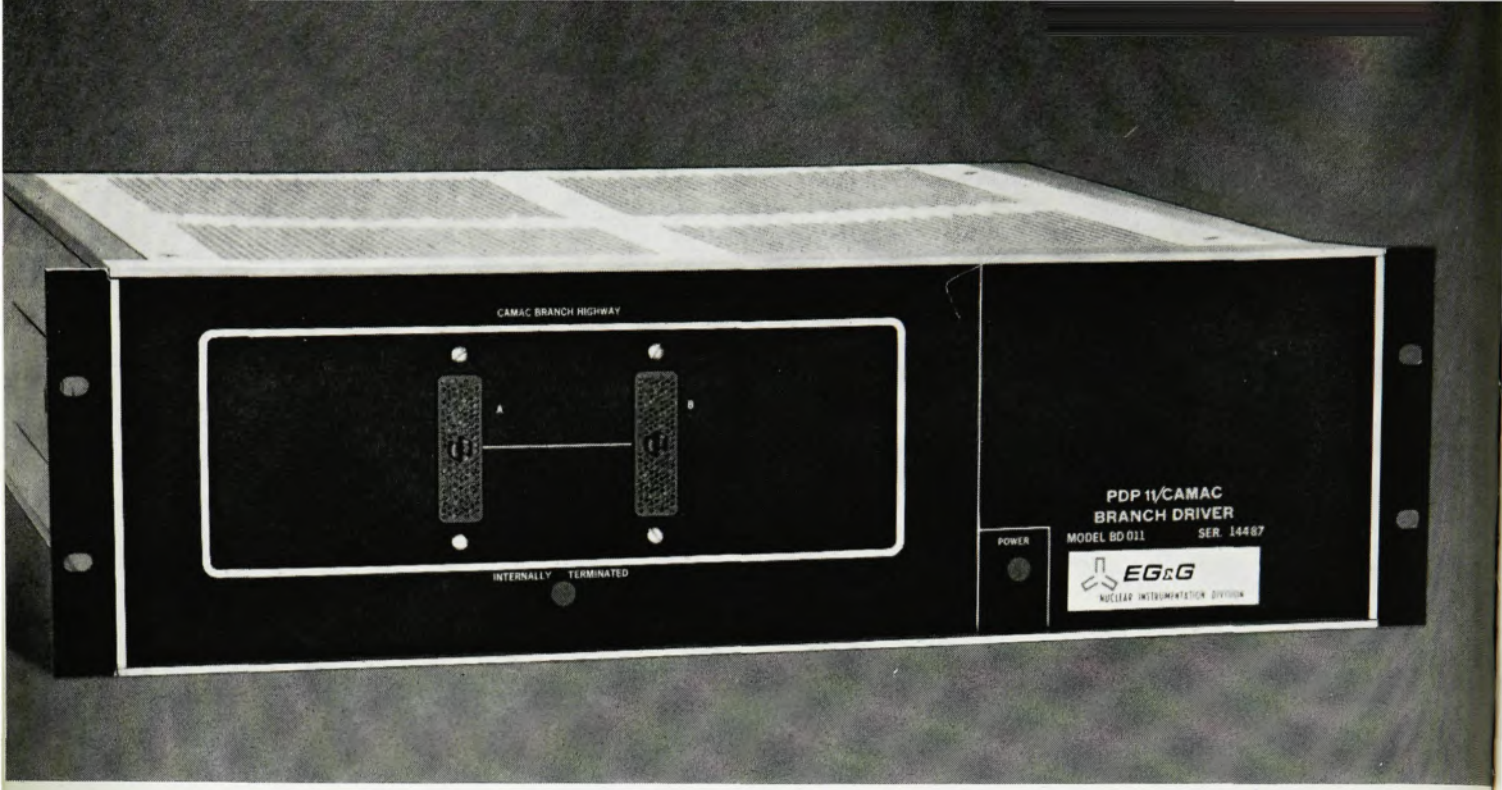

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aging correlation. It is true that if *both* S and T *agree* (quantitatively and qualitatively) that it is T who has aged less, then there is no logical paradox. This was Einstein's resolution, arrived at by including the whole universe. But my claim was that his resolution was never demonstrated unambiguously. But if S and T *both agree* that there is no asymmetric aging, then this also is not a logical paradox, contrary to Michel's claim!

Greenberger's error is to assume that I claim that B's time parameter is the same as A's time parameter. I emphasize that relativity theory *requires* that they are not the same! Matthesen's error is to equate a frame-dependent quantity, "rate," with a frame-independent quantity, "age." In his example, the "seconds" relative to A in the measured frequency (cycles *per second*) is a function of the relative gravitational field and speed. My assertion is that according to relativity theory, the physical age of a closed system is analogous to the invariant phase of a wave, as contrasted with the frame-dependent frequency and time parameters, whose combination gives this invariant phase.

In contrast with Lüders's assertion, I find that the proper time intervals of the departing and rejoining clocks are rigorously equal. Each of these proper times relates to a different geodesic in the global space-time. They are different geodesics because the separate paths entail different forces, thereby giving different solutions of the geodesic equation.

It is certainly true that a unique function of x_1 and x_2 is not automatically an analytic function of $z = x_1 + ix_2$. But in my analysis (in answer to Lüders and Korenman) the functions in question are not arbitrarily chosen out of the blue! They are the solutions of definite, prescribed equations for the metric field, with definite boundary conditions. Their role in general-relativity theory requires them to be continuous and continuously differentiable functions of the space-time parameters. The pertinent property of these functions relating to Lüders's comment is that in the local domain—corresponding to the *Newtonian limit* of the theory—in an arbitrary neighborhood of any space-time point (that is away from possible singularities) these functions satisfy Laplace's equation.[3] This limit ensures that the Cauchy–Riemann equations will be satisfied in a two-dimensional projection of any neighborhood and consequently that an *analytic continuation* of these fields into the complex plane can follow. Interesting specific examples are given by Brendan Godfrey.[4] Thus, the extension of the metric field components into the complex plane necessarily leads to the analytic functions $f(z)$ by virtue of the containment of the Newtonian limit in the generally covariant metric field equations. This result then allows the use of the Cauchy theorem, leading to the prediction of the path-independence of proper time intervals—and of the corresponding aging in the proper frame. I apologize to the readers for not making this more clear in my article.

With reference to Polak and de Groot: There is confusion here as to my use of the closed-path integral in my proof. I use it only as a mathematical device—not to claim that the total aging of any physical system can be zero. (See the paragraph after equation 11.) Also, these critics refer to the time parameter, not to aging (in their case, "aging" would refer to the *number* of cycles emitted in a light wave). As to Fletcher's comments, the "more familiar square root of Einstein" *cannot* be employed in this problem because it is a double-valued function while the geodesic path itself is single-valued. Ljung's assertion is logically inconsistent. In a round-trip journey, there must be periods of nonuniform motion to provide (at least) the changes in inertial frames. Without these, and along with the assumption of the time–age correlation, the paradox persists. Thus, these periods of nonuniform motion must relate to the cause of the alleged effect (nonparadoxically) and not simply to a way of observing "strange happenings." Price and Sandberg's (and Fletcher's) "refutation" of my mathematical proof by assuming that $\mathbf{ds} = \mathbf{e}_i dx^i$ is an example of my relation $ds = q^\alpha dx_\alpha$ (in the general proof) is a *non sequitur*. It amounts to claiming a refutation by replacing an essential term in a proof with a totally non-equivalent term, and then drawing a conclusion for the general case from the latter.

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