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RICHARD H. BOLT
Bolt Beranek and Newman Inc.
Cambridge, Mass.

Relativists criticized

I have read Alfred Landé's letter on subjective relativity (November 1969, page 11) and Mendel Sachs's reply to it.

I consider, like Landé, that the theory of relativity is very far from the objectivity that is necessary to the very nature of science; this theory is indeed founded on various abstract postulates, represented by equations or statements that can not be verified directly by measurements of the quantities that appear in them.

Nevertheless one of these postulates is related to a physically measurable magnitude; it is that of the invariance of the velocity of light. The relativist is so lacking in objectivity that the velocity of light from a distant star has never been compared with the velocity of light from a local source. Certainly there is no reason why the velocity of light that left a star a million years ago, in a gravitational field different from that on earth and from a star moving relative to the earth, should equal the velocity of light from a local source.

Relativity explains Michelson's experiment, but it only shows that, within experimental error, the space enclosed by the interferometer is isotropic, as is well known.

This failure of objectivity has had, as a consequence, that many experiments have been done to show that the velocity of light originating from a source having radial velocity V_r with respect to the frame of the measuring apparatus is not such that $c'/c = 1 - V_r/c$ where c is the velocity of light issuing from a local source. This

formula is contrary to rational mechanics as confirmed by experiment.

To be objective we should find the function f in the equation $c'/c = f(v/c)$ which has not been done. One must, however, note that an experiment by D. Sadeh [*Phys. Rev. Lett.* 10, 271 (1963)] showed $c'/c = f[(v/c)^2]$ within experimental error, which was not given in Sadeh's note.

Another consequence of the lack of objectivity: Pound and Reka's experiment, made to confirm the theory of relativity by showing that the frequency of a Fe^{57} source depends on its height ("Einstein's effect") begs the question because the velocity of light was not measured at the time of the experiment. This experiment, if we ignore the postulates, shows that the velocity of light depends on the height of the source.

For the case of the sun, the same Einstein effect has another interpretation if the postulates are ignored; the velocity of light in the gravitational field of the sun is $c' = c + 0.636 \text{ km/sec}$ in rational mechanics [*Appl. Optics* 7, 1391 (1968)].

JEAN LOISEAU
Paris

THE AUTHOR COMMENTS: I believe that in Loiseau's interesting comments there are perhaps some misconceptions about the meaning of the term "objectivity" in science and about the role that is played by the speed of light in relativity theory.

Loiseau assumes that a theory which is based on abstract postulates, rather than assertions that are directly related to observations, can not be an objective theory. Thus he assumes that the philosophical stand of realism can not lead to an objective theory of natural phenomena and that the only philosophical stand which can do so is the one of positivism. I think that this is a false interpretation of the word "objectivity." The latter term, when applied to science, requires that the natural laws be independent of the particular characteristics of any observer or measuring device (for example microscopic or macroscopic, at rest or in motion, and so on) that deduces these laws. Thus, if any sort of observation or interaction should be described with a theory based on abstract postulates, and its formal structure is covariant with respect to the transformations from one observer to any other, then this would be an objective as well as an abstract theory (that is, a theory that is based on assertions, some of which are not directly observable with the human senses or his instruments). The theory of relativity is of this sort. Thus, in contrast with Loiseau's comment, this theory does indeed entail an objective description of nature.

Regarding his comment about the

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letters

speed of light, it is certainly correct that future experimentation could lead to the result that the speed of light is not a universal constant. Nevertheless, the theory of relativity, which has so far been quite accurate in describing a large class of data, contains the assertion that *in any local frame of reference*—where any measurement is actually performed—this speed, which must be inserted to correctly describe the data, has been shown to be constant and independent of the motion of the source of light. To my knowledge, the theory of relativity has not been refuted in this regard. I believe that in Loiseau's comments about various experiments that entail the speed of light, he was confusing the global entity, dx_μ/ds —which is generally a function of the space and time coordinates—and the universal constant c , which involves the measured speed of light in any local frame of reference.

MENDEL SACHS
State University of
New York at Buffalo

Refereeing versus censorship

With respect to the "refereeing" controversy, it has always been my belief (or perhaps misunderstanding) that the professional journals such as those represented within the AIP exist to allow workers in the various fields to be heard via publication of their results regardless of the opinions of others, the only constraint being that the writer bear the cost of publication.

Hence the question of refereeing is inane except as a limited monitoring function to ensure that the journals, no matter how large a particular edition might become, are not clogged with papers by writers who are irrelevant or obviously incompetent. Any other action on the part of a "referee" is censorship and is to be eschewed.

JOHANNES G. BELLAK
Budd Lake, New Jersey

Bicycles again

In "The Stability Of The Bicycle" (April, page 34) David Jones considers various aspects of this problem, but all in connection with fixed-geometry machines propelled by pedalling. I would like to add one or two comments:

If one examines (perhaps subjectively) the steering of a bicycle whilst pedalling and whilst gliding one finds that there appear to be different forces involved in steering. There is in fact one school of racing cyclist who prefers a fixed-wheel machine because he considers this to be inherently more stable. Furthermore, if the tracks of a cyclist

pedalling on a wet road are followed, a regular precession of the front wheel will be noticed, whereas, a free-wheeling track will be seen to have irregular corrections at random intervals.

Now, if we add the complications of the high gyroscopic forces from the heavy wheels of a motorcycle, we find that many early machines, which had steering geometry identical with that of a pedal cycle, were quite stable at lower speeds but became virtually unridable at speeds above say 40 mph due to steering wobble, unless the freedom of movement of the steering head was restricted by friction damping. (It is interesting to note that modern machines with a steering geometry that varies in quite a complex fashion due to the springing of frame and forks have none of these problems.)

As a final comment I would like to mention bicycles with a geometry that varies in the horizontal plane. Several makes of motorcycle and at least one pedal cycle have been produced in which the front wheel as well as turning moves to bring the center of gravity of the system in towards the center of the arc traversed by the machine. In this case no lean is involved and the center of gravity of the system remains at the same level. I have ridden only one such machine (a motorcycle of 1920's vintage called a "Neracar"). My general impression of this was of frightening stability, because it gave no impression of the speed at which one was cornering and it travelled straight, as if it were on rails, with quite strong self-centering characteristics.

I trust this may give Jones some additional factors to add to his BICYC routine.

R. ROBERTS
Philips Electrical Pty. Limited
Sydney, New South Wales
Australia

THE AUTHOR COMMENTS: I doubt whether there is a real difference in stability between a pedalled and free-wheeling bicycle: the regular steering-wobble during pedalling is surely a muscular reflex of the rider? Several correspondents have commented on the motorcycle's steering layout and its heavy front wheel, and I agree that it raises problems not fully covered by my simple analysis, though I do not believe that the springing system is deliberately designed to aid stability. I am very intrigued to learn of the "Neracar" and the other lean-compensating bicycles. They sound fearsome creations that merit completely separate mathematical study. Can any reader supply geometrical details of such a machine?

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