

Appeal from Benjamin Levich

Since I applied to the Soviet authorities for exit visas eight months ago, my family and I have gone through various hardships. In particular, I am totally isolated from my foreign colleagues, for my telephone has been cut off; few letters, either from me or to me, ever reach their destinations. Therefore I was pleasantly surprised to receive a letter from Professor Brenet, of the University of Brussels, one of the past-presidents of the International Society of Electrochemistry, which Society has recently done me the honour of electing me as a vice-president.

However, as soon as I read the contents of this letter, which is a copy of Professor Brenet's appeal to all the national secretaries of the Society, it became clear for me that this message had reached me not quite by chance. Professor Brenet proposes that my predicament should be resolved by reference to humane principles, and by taking into account both my interests and those of my Government; but Professor Brenet also argues that the discussion of my case by international associations, such as the Society of Electrochemistry, is inadmissible, for it would disturb its everyday work; and the problem is absolutely nonscientific. This means that Professor Brenet recommends that learned societies should keep strictly to the ancient principle of non-intervention.

One would like to ask if Professor Brenet would express this opinion so strongly if he were subjected to various kinds of oppressions, for having expressed the wish to leave Brussels and to find his new fatherland in, for instance, the Soviet Union; or if, while being the president of the International Society of Electrochemistry, he were deprived by the Belgian Authorities of any possibility of fulfilling his duty. Despite Professor Brenet's concern for human liberties, the principle of non-intervention objectively proves to be nothing but the notorious Policy of Munich, transferred into the fields of science and relations between scientists.

The problem with which Professor Brenet is dealing, namely whether a



scientific association as a whole should interfere in the fate of individuals, is in my opinion one of principle. I would therefore like to express openly my view of the matter. I believe that the answer to this question was already given by the great Einstein, in his protest against the indifference of the Bavarian Academy of Science to the hardships of persecuted scientists. Albert Einstein declared that he had no wish to belong to any scientific society that could behave like that, no matter what the external pressure.

At present, when the role of science and scientists in the life of society has greatly increased, when science itself cannot develop while being limited to any single country, the situation has considerably changed. New concepts have appeared, those of professional honor and of the solidarity of scientists all over the world. I believe that nowadays the world scientific community cannot remain indifferent to the persecution of even one of its members for his national or religious convictions. The progress of science can by no means be separated from the problems of humanism and of the freedom of

conscience of scientists. This is evidently why a great many individuals, universities and learned societies have declared their support for my colleagues and myself in our struggle for that right, recognized by civilized humanity, to decide for ourselves which country, the Soviet Union or Israel, is "our country."

My family has been detained in this country not because I am engaged in any political activity against the government (I am a scientist but not a politician); not because I wish to take with me any government secrets (I do not know any, since for the last 23 years I have never had anything to do with classified work), and not because my repatriation could possibly contravene any internal or international law accepted by the USSR. By no means. I am detained only because, in conformity with the dogma that is accepted in this country, the fate of the scientist is ruled not by any established principles of law, but by mysterious "government considerations" or "government interests." Are scientists free human beings? Or are they the property of the government? This is the question I believe to be of major significance for the future of all scientists, and for science as a whole. The discussion of this problem with Soviet scientists is necessary and important, not only because they belong to the world scientific community and are responsible as well for the future of Science, but also because a number of Soviet scientists are members of leading party and government institutions; therefore their opinions are evidently very important for the solution of the problems of my colleagues and myself. Experience has shown that individual appeals have found no response in the hearts of leading Soviet scientists; this is one of the reasons why the activity of scientists as a body has become so urgent. It is true that this kind of activity could perhaps disturb the everyday work of learned societies, and perhaps somebody will not be so happy about it. But what can guarantee the progress of science and culture in the long run? Hardly anything, if high moral

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letters

principles are disregarded. And who is to be held responsible for the present situation? Those who created the problem? Or those who are the victims?

BENJAMIN LEVICH
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The letter above was dictated by telephone to D. B. Spalding of Imperial College, London, and transmitted to PHYSICS TODAY by Spalding at Levich's request.

Theories of gravitation

The article by Clifford Will (October 1972, page 23) gives a timely and interesting account of the separation of viable and nonviable theories of gravitation. However, in a parenthetical statement, which I assume referred to the recent around-the-world flying-clock experiments of Richard Keating and myself, Will states: "Cesium-beam clocks flown recently on commercial jets detected only the time dilation in relative motion—a special-relativity effect; the gravitational red-shift effect was at the limit of their precision." This statement is incorrect, and I would like to set the record straight for those readers who have not read our reports.¹

with their corresponding standard deviations. It can be seen that the measured mean for the westward trip agreed with the predicted value to within about 0.7%, and that the standard deviation (or precision of the measurement) is about 3% of the mean. In fact, the greatest uncertainties reside in the predicted values, whose error estimates were two to three times the precision in the measured values. Clearly the measurements contained both the red-shift and dilatation effects in comparable proportions, with neither at the limits of our precision.

In this context it is interesting to note that these experiments provided more than an empirical resolution of the "clock paradox" of special relativity; they also resolved an issue on the behavior of photons in a gravitational field. The red shift is often described as being due to a loss of energy (and frequency) of the photon as it climbs out of the gravitational field. Another less common explanation, but actually the one Einstein suggested, is that the clocks (or atoms or nuclei) have different frequencies at different gravitational potentials. E. T. Jaynes has argued that without an experimental distinction this issue involves only the meaning of words, and is not a question of physics.² Møller, on the other hand, claims that we should regard the frequency of the photon as being con-

Time gains for round-the-world flying clocks

	Time gains (nanoseconds)	
	Eastward	Westward
Red shift	144 ± 14	179 ± 18
Kinematic Dilatation	-184 ± 18	96 ± 10
Predicted	-40 ± 23	275 ± 21
Observed mean	-59 ± 10	273 ± 7

The Table lists values (in nanoseconds) from our reports for the gravitational red-shift effect, the kinematic dilatation effect, and their sums, which give the predicted relativistic time gains for the flying clocks. It can be seen that the red-shift produced a positive time gain for both circumnavigations, while the kinematic effect had opposite signs—a result that is primarily due to the rotational motion of the earth. Because the red-shift and dilatation effects were comparable in absolute magnitude, near cancellation occurred for the eastward trip where the kinematic contribution was negative, but a relatively large positive time gain was predicted for the westward trip. In this case, the red shift represented about 65% of the predicted value.

Also listed in the Table are the means of the four measured time gains

stant along its path of motion, with the red shift arising from a difference in the frequencies (or energy levels) of the atoms at different potentials.³ Our flying-clock experiments have proved conclusively that the atoms that regulated the clocks had different frequencies at different altitudes.

References

1. J. C. Hafele, R. E. Keating, *Science* 177, 166, 168 (1972).
2. E. T. Jaynes, *Am. J. Phys.* 26, 197 (1958).
3. C. Møller, *Nuovo Cimento Suppl.* 6, 381 (1957).

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THE AUTHOR COMMENTS: I would like to apologize for having given the wrong impression of the Hafele-Keating

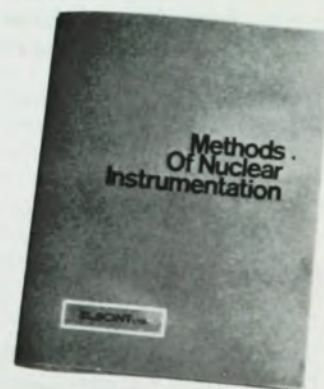
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