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letters

Rewards for referees?

The exchange of letters between Mark Azbel and Robert Adair (October, page 96) indicates that the editors of "Letters" journals have difficulty in persuading referees to provide prompt and thorough reports on papers submitted. As Adair points out, American journals cannot use the kinds of pressures available in Russia, and offering a cash payment big enough to make any difference would be prohibitively expensive.

May I suggest that an effective incentive would be to pay referees in a currency they probably consider even more precious than money: rapid publication of their own papers. When a referee (who is presumably a reputable scientist doing research that might be published in the same journal) has turned in, say, three satisfactory reports within the specified time limit, the reward would be the right to publish one paper without any refereeing at all, subject only to meeting the usual standards of format, length and appropriateness of content as judged by the editor.

STEPHEN G. BRUSH
University of Maryland
College Park, Maryland

10/19/79
THE EDITOR OF PRL COMMENTS: In the course of responding to the specific comments of Mark Azbel and others, we may have left the incorrect impression that our referees are typically dilatory and irresponsible. This is not the case: most of our referees respond promptly with carefully written reports. It is true that we do receive some late reports and some very poor reports, but these delinquencies lead to only a portion of the faults attributed to the journal.

In an imperfect world, we are not categorically against bribing men to do their duty; but, if a bribe is required—and we do not believe that is the case—we would hope to find a less meretricious reward.

ROBERT K. ADAIR
Editor
Physical Review Letters

Developing nation debate

I find Michael Moravcsik's reply to E. J. Ansaldo (September, page 102) unsatisfying. The position that Moravcsik takes in leaving the export of science and

technology up to the developing nations contains a crucial flaw with respect to the proliferation of nuclear materials. Part of the worldwide problem that now exists in this regard is a direct result of leaving the matter up to the developing nations. It is now a matter of fact that a great international insecurity exists as a result of distributing too freely (or at all) to the developing nations some of the most poisonous substances in the universe—ostensibly for their peaceful use. The experience in India and lately Pakistan comes to mind, with the former's detonation of atomic devices and the latter's plans to do alike.

Amory Lovins makes it quite clear in his book *Soft Energy Paths* that the nuclear leaders should lead, not follow, with respect to both peaceful and other uses of radioactive materials. He suggests that the US immediately terminate all peaceful nuclear development as an example to others. I suspect that Lovin's proposal may be one of our few sane leadership options if we wish to avoid turning the world into an armed camp.

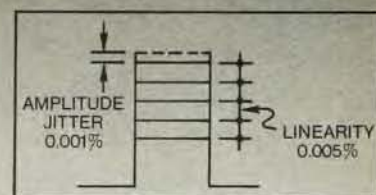
10/4/79
THE AUTHOR COMMENTS: I generally hesitate to answer statements that claim to represent the "sane" side of controversy, not because I am reluctant to appear to have labeled myself "insane," but rather because such statements generally spring from a degree of intolerance toward other views that makes rational discussion impossible. I therefore will restrict this reply to three very brief statements expressing my beliefs relevant to the issue. I do not say, however, either explicitly or by implication, that people holding different beliefs are less sane than I am.

► I do not believe that it is either right or feasible for the now developed countries to make science policy decisions for the now developing countries either in general or with respect to specific issues such as the use of nuclear technology.

► I do not believe that a withholding of nuclear technology from the developing countries, or the halt in the developed countries of the further development of such technology, would be successful in limiting such technology to the now developed countries. On the contrary, I believe that eventually all countries would



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letters

be able to acquire such a technology on their own if they wished, and I also believe that they would have an extra incentive to do so if the developed countries withheld the present technology from them.

► I believe that nuclear technology, on the balance, has been of immense benefit to mankind and therefore it would be very detrimental to halt its further evolution or to withhold its results and products from the developing countries.

MICHAEL J. MORAVCSIK
University of Oregon
Eugene, Oregon

11/20/79

Einstein and Maxwell

I feel that another centenary should be mentioned, if not celebrated: James Clerk Maxwell died in 1879, the year Einstein was born. The opening sentence of Einstein's first paper on relativity: "It is known that Maxwell's electrodynamics—as usually understood at the present time—when applied to moving bodies, leads to asymmetries which do not appear to be inherent in the phenomena." Considering the fact that Einstein's theory of relativity was born out of considerations based on Maxwell's theory of electrodynamics, the coincidence is striking!

P. HALEVI
Universidad Autonoma de Puebla
Puebla, Mexico

10/22/79

Our opening paragraphs to the "Einstein" issue (March, page 26) made brief mention of the coincidence. *The Editors*

Jovian issue

In August (page 15), Leonard Larks proposed that the "immiscible" character of the swirling vortices in the Jovian atmosphere might be caused by electromagnetic interactions.

There are two problems with this hypothesis. The first is that there is no detectable correlation between atmospheric and magnetic field features (see, for example, page 806 of *Jupiter*, T. Gehrels, ed., University of Arizona Press, 1976). Since the data have limited resolution, it might be contended that this is not a compelling argument.

A second, more convincing argument (at least from a theoretical point of view) can be made by considering the electrical properties at the relevant level of the atmosphere ($T \approx 130$ K, $P \approx 0.5$ bar). This is well below the ionosphere, yet well above the deep, conducting regions of the planet (see my review paper on page 395 of *The Origin of the Solar System*, S. Dermott, ed., Wiley, 1978). At this level, the only charge carriers would be non-equilibrium species produced by cosmic rays, thunderstorms, and so forth. Al-

though thunderstorm activity may be greater on Jupiter than on Earth (but not by much) it is difficult to justify an electrical resistivity much less than around 10^{15} ohm-cm, the value that characterizes the sea-level atmosphere on Earth (See the *CRC Handbook of Chemistry and Physics*). For this value, it is easy to show from the dynamo and magnetohydrodynamic Navier-Stokes equations that the ratio of Coriolis force to Lorentz force is around 10^{10} . Electromagnetic effects are not, therefore, directly important (for the same reason that they do not directly modify circulation in the Earth's atmosphere).

There is, of course, the possibility of an indirect effect. It is known, for example, that there is a correlation between solar activity and photometric brightness of Uranus and Neptune (G. W. Lockwood, *Icarus* 35, 79, 1978). It is conceivable, therefore, that the behavior of the ionosphere or magnetosphere may affect the behavior of the neutral atmosphere. However, this would hardly constitute an explanation for the "immiscible" character of the motions detected by the Voyager Spacecraft.

DAVID J. STEVENSON
University of California
Los Angeles, California

8/23/79

THE AUTHOR COMMENTS: David Stevenson appears to represent the "conventional wisdom" as applied to the fascinating behavior of the Jovian atmosphere.

I agree completely that data of limited resolution do not form a compelling argument against my hypothesis, and while I have not had the opportunity to study the properties of the Jovian atmosphere in depth, I feel that there may be problems with Stevenson's analysis.

Stevenson states that he cannot justify a resistivity of the atmosphere (at the altitude imaged by Voyager's cameras) of less than the order of 10^{15} ohms, which would make the atmosphere a poor conductor or a reasonable insulator. If this estimate is correct, and if the current flux tube between Jupiter and Io, estimated in NASA publications to be on the order of 10^6 amperes (and a possible energy source according to some reports for the volcanic activity on Io), really exists, then the potential difference across the atmosphere where the flux tube penetrates it is on the order of 10^{21} volts. This is well above the atmospheric breakdown voltage given by the *CRC Handbook* for the Earth sea-level atmosphere as 10^9 volts. In the absence of large amounts of atmospheric discharge phenomena near the Jovian terminus of the flux tube one must conclude that

- the atmospheric resistivity is much lower or
- the current in the flux tube is lower than estimated or
- the electrical discharge characteristics

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