

letters

lished work. We established warm friendships with many of the Soviet participants who spared no effort to make our visit enjoyable and useful.

On Tuesday 27 May, two days after our visit to the Sunday Seminar, Azbel received a summons to report to KGB headquarters on the following day. When he appeared, he was informed that the Sunday Seminar is viewed by the KGB as a "group participating in anti-Soviet propaganda aimed at undermining the Soviet power and contacts between the USSR and the West" and that criminal action, including a possible charge of treason, would be initiated against him unless the seminar is stopped. (*The New York Times*, 8 June 1975.)

We saw Azbel twice more during that week. Clearly concerned by the gravity of the KGB threat, he was nevertheless adamant in his determination to continue the Sunday Seminar; to discontinue it would mean abandoning the last means of maintaining any level of professional activity, particularly for the younger participants. Furthermore, he asked that Western scientists who have the opportunity to visit the Soviet Union continue to come, and that they also attend the Sunday Seminar and bring current issues of scientific journals in physics, chemistry, mathematics and biology—all disciplines represented by some of the regular participants. He stressed the importance of this infusion of outside scientific information and the additional visibility that it gives to the Seminar.

The emotional impact of this entire experience was overwhelming. In both the Sunday Seminar and the official symposium we met many fine men and women who are excellent scientists. Yet the second group carefully avoids any possibility of contact with the first. We were deeply saddened by the aura of fear that seemed to weigh so heavily on the entire Soviet intellectual community.

We must now consider how to shape our own future actions and attitudes in view of these experiences. Recently, there have been numerous calls for a total boycott of further scientific exchange with the Soviet Union in view of the persistent violations of human rights. Although boycotts of particular events can be effective for protesting specific Soviet actions, we believe that the most effective means of exerting humanitarian pressure on the Soviet hierarchy is by an active participation of concerned scientists in the US-USSR scientific exchanges. We believe that these exchanges should continue, but that each event should be consistent with the basic ideals of free scientific inquiry. We hope that those who par-

ticipate in these exchanges will use the occasion to express their insistence on the freedom so basic to both the spirit and practice of science and that those who visit the Soviet Union will insist that their freedom to attend the Sunday Seminar, and meet freely with other Soviet scientists, is necessary to their participation in the official exchanges. We urge our fellow scientists not to abandon our brave and dedicated colleagues.

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Why no moon for Mercury?

I want to report an explanation of the fact that Mercury has no satellites. Believe it or not, the explanation comes from a paperback popular book by Isaac Asimov, entitled *Of Time And Space And Other Things* (New York: Lancer Books, Inc., 1965; Mercury Press, Inc., 1959).

On page 96, Asimov shows the fact that the Roche limit (the distance from the planet's center at which the satellite moon would be broken up by tidal forces—2.44 times the planet's radius) prohibits a moon from existing close enough to Mercury to avoid an appreciable tug-of-war with the Sun's gravitational force, which would make the moon's orbit greatly elliptical.

The author adds the following remark, which encourages one to have patience with exercises with pencil and paper by which Asimov came to his discovery:

"In actual truth, no satellite has been located for Mercury but, as far as I know, nobody has endeavored to present a reason for this or treat it as *anything other than an empirical fact (emphasis mine)*. If any Gentle Reader, with a greater knowledge of astronomic detail than myself, will write to tell me that I have been anticipated in this, and by whom, I will

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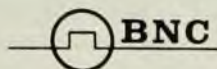
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try to take the news philosophically. At the very least, I will confine my kicking and screaming to the privacy of my study."

I would welcome any correspondence on whether this explanation of why Mercury has no moons has been anticipated. It is rare that such a significant theoretical discovery in physics and astronomy has resulted from a leisurely exercise in a chair. It is possibly even more rare to have the discovery mentioned only in a small portion of a book of assorted essays.

BRUCE E. BUSHMAN
Laguna Beach, California

Peer vs. rival review

The discussion of usefulness of outside advisers in the National Science Foundation (September, pages 77 and 96) may be helped by using a more exact nomenclature. What is euphemistically called "peer review" often in reality is "competitor review" or "rival review."

As a rule, funds available to a section of the NSF are insufficient to satisfy all requests. Also, many reviewers are at the same time applicants. Simple arithmetic teaches them that, if many proposals submitted by competitors are rejected, the reviewer's proposal has more chances to be approved.

Even if the reviewer is not an applicant this year, he is very likely to be working on the problems treated by the applicant, and to have a difference of opinion with the latter. Thus he may sincerely believe that financial support of the applicant will result in proliferation of unconvincing results and promotion of a rival and incorrect explanation.

JACOB J. BIKERMAN
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More on plutonium recycling

I would like to comment on two of the points made in the news story in the August issue (pages 61-64) on plutonium recycling. The first is the attribution to William Higinbotham, "that the waste-disposal problem from light-water reactors is potentially a serious one." Higinbotham's quoted remarks actually do not lead to that conclusion except perhaps in the economic sense. In view of the large publicity given to the rather small technical problem of waste disposal, I think this should have been pointed out.

The other remark concerns the development of plutonium recycle industry as an economic matter. The comment of Frank Von Hippel is not currently correct, although it was until about 18 months ago. Price increases in the ura-

nium fuel cycle due to escalations in the cost of both uranium ore and enrichment services have made plutonium a significantly more valuable material to use now in thermal reactors. In fact it is now appropriate to consider redesign of light-water-reactor fuel loadings for higher plutonium production than has been the case in the past. Such redesign would lead to considerably more significant decreases than Von Hippel indicated as the effect of plutonium recycle, both in the amount of uranium ore and in enrichment services required to support a significant nuclear power industry.

Finally, I would like to add my comment that any delay in utilization of plutonium simply adds to the amount of material of concern for diversion. I believe the case is strong for early burning of plutonium as a valuable material in power production rather than as a worrisome material for potential weapons use.

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COMMENT BY VON HIPPEL: As far as the economics of plutonium recycle in current light-water reactors are concerned, I will merely quote the March 1975 report of the ERDA Task Force on the Nuclear Fuel Cycle (ERDA-33, page 25): "Initial estimates for the cost of reprocessing were about \$30/kg of fuel. As a result of the great increases in the capital cost of reprocessing plants, this cost is now estimated to be in the range of \$100 to \$200 per kg. At these prices including about \$25/kg for waste disposal, plutonium recycle in light-water reactors may not be economic. Many utilities, reactor manufacturers, and consulting firms are now considering whether they should plan for plutonium and/or uranium recycle." As for the uranium conservation benefits of plutonium recycle: According to the numbers quoted in the *Report of the Liquid Metal Fast Breeder Reactor Program Review Group* (ERDA-1, January 1975, Attachment 5, page 17), plutonium recycle in current LWR's would stretch the uranium supply by less than 20. Uranium recycle would stretch it by a like amount.

These are merely quibbles, however. The important point is that, if our society ultimately decides that fission should supply a substantial portion of the US energy supply over the long term, then we will have to develop reactors that are less wasteful of our limited resource of high-grade uranium ores. One possible development route would be to improve the design of our current reactors (as Spinrad suggests), another would be to introduce reactors with naturally higher ratios for the conversion of

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