gallium experiment, and it appears that American participation in the experiments abroad, if it were to come about, would constitute the total extent of the US program to study the fundamental solar fusion reaction and the implications of the solar-neutrino problem.

It may of course be argued that science is international, and therefore it is not of great moment where a given experiment is done. Nevertheless it is difficult to view the present status of gallium experiments in the world without questioning the behavior of the US science establishment. The situation might be understood if there had been a division of opinion on the potential significance of the experiment or on its feasibility—or even on its cost. But the reports of the review panels do not reflect divided opinion: They have been without reservation in favor of the gallium experiment as proposed in the US, in part because the experiment would continue work in an area pioneered and developed by American scientists. How then does one explain the failure to act on the positive recommendations of those panels?

The answer to that question appears to consist of several parts, which have, not entirely coincidentally, reinforced one another. First, as the experimental facilities in all areas of physics and astronomy have become more expensive and more time consuming to build and maintain, the single-minded concentration by scientists and funding agencies needed to ensure the success of the projects for which they feel responsible has increased proportionally. In that atmosphere, an experiment that is tangential to the primary interest of those busy individuals is likely to be treated in a kindly but distracted way, as a child often is when one is deep in concentration. Second, it follows that in the absence of a large number of scientists who propose to work on a given experiment and know themselves to be necessary to its success, vocal support for such experiments by the community tends to be muted and a sense of urgency tends to be lacking in administrators. Third, the ratio of the cost of an experiment to the number of scientists employed by it is high for experiments such as the gallium experiment, and perhaps thought too high by administrators. Finally, the funding of an experiment that bridges different areas of science, but is apart from the momentary mainstreams of those areas, raises the fear of dilution of already scarce resources if it is funded, unless it is minimal in cost. It is natural for each area to give approval and at the same time exhibit reluctance to bear the cost.

What all this adds up to is that the gallium experiment is another example of the inability of American science, as it is now organized, to react flexibly and to prosecute aggressively an idea for an experiment of great potential interest, despite the manifest merit of the experiment.

The fate of the gallium experiment, which is important in its own right, raises a significant concern for the future: namely, that venturesome scientific ideas that lack a large supportive constituency, that cross disciplines and that are apart from the mission-oriented mainstreams of those disciplines will find it increasingly difficult to obtain funds, whatever their merit.

To forestall such a development American scientists must strengthen their resolve that ideas of the highest quality are to be realized no matter what their disciplines or constituencies. And US science administrators must be willing to provide less compartmentalized, more enlightened care of future proposals than they have given the ill-treated proposals for the gallium experiment.

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Microphysical reality

Quantum mechanics is already 60 years old, but still a lot of discussion is going on about the real meaning of the quantum formalism. This was evident during the conference on microphysical reality and the quantum formalism held in Urbino, Italy, last fall. The conference was organized to celebrate the 50th anniversary of the famous Einstein–Podolsky–Rosen paper.[1]

Recent experiments done to see whether Bell's inequalities are violated in reality answered[2] in the affirmative: The inequalities are experimentally violated (see PHYSICS TODAY, April 1985, page 38). Now the hard question arises: Is Einstein locality violated? Some physicists claim that because no signals can be transferred with the apparatus used in these experiments it is proper to talk not about "action faster than light," but rather about "influence faster than light." Others do not believe in the interpretation of the crucial experiments and claim that some of the additional hypotheses necessary to interpret the experiments are wrong. The question of locality was the hottest issue of the conference. Only one thing was clear from the discussions that took place: It is difficult to find agreement even on minor issues. Therefore we thought that it would be a good idea to organize a poll on quantum mechanics using questions that would be answered "yes" or "no" only. We ob-

tained answers from 56 participants and believe these answers are representative of physicists working on the foundations of quantum mechanics.

Our poll began with these instructions:

> This conference has shown that there is a great disagreement concerning the interpretation of quantum mechanics and the significance of recent experiments. The only way out of this confusion seems to be a statistical one; therefore we would like to ask you for a *sincere* answer to the questions below. If you think that you are a really existing individual please put your name and signature; if you think that you are just a member of a statistical sample you do not have to.

▶ Do you believe in Einstein locality? 54% answered yes, 39% answered no and 7% had no opinion.

▶ Do you believe that recent experiments have falsified Einstein locality? 30% said yes, 57% said no and 13% were undecided.

▶ Do you believe that recent experiments have shown that there are signals faster than light? Only 5% believe this, 89% do not and 6% are undecided.

Because signals faster than light would imply closed time loops we asked the next question:

▶ If yes, do you think it will be possible to kill your grandfather? Only a few (extremists) replied "yes" to this question.

Some physicists, though not believing in action faster than light, do claim that the experiments have shown some "influence" faster than light. Let us call it "passion faster than light." Therefore we asked the following question:

▶ Do you believe that the recent experiments prove that there is an influence (passion) faster than light? 21% answered yes, 52% answered no and 27% were without a firm opinion.

We obviously were eager to know whether some of the 21% had some opinion about the nature of this passion. Hence:

▶ If yes, do you think that it will be possible to fall in love with your great-grandmother? This question (11% yes, 50% no) aimed also to create a good mood for the more serious one:

▶ Do you believe that there will ever be an interpretation of quantum mechanics as firmly established as the one we now have for classical mechanics? Here optimists prevail: 71% answered yes and only 18% answered no (despite the fact that 60 years have passed and opinions differ more than ever).

▶ Are you a realist? It is remarkable that except for one person everyone considered himself to be a realist (86%), although some found this question too ambiguous to answer (12%).

▶ Are you a solipsist (one never knows)? 80% answered firmly no, while 5%, evidently unaware how rude it is to *be* a solipsist, answered yes.

▶ Do you believe in a world outside still existing after your death? This time only one true solipsist answered no.

▶ If no, will you leave some money for your children?

▶ Is glass transparent in the dark? This was a tricky question. 64% answered yes, 9% answered no (all considering themselves to be realists) and 27% could not decide.

▶ Do you believe in some form of parapsychological phenomena or magic? It turned out that only 18% do (much below most national averages), while 27% still hesitate and 55% say no.

Only one person decided not to sign the questionnaire.

In concluding, we would like to point out that if disagreement on the fundamental issues of quantum mechanics is so large, one should be very careful in formulating opinions about various aspects of the newer theories like quantum electrodynamics or quantum chromodynamics.

* * *

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References

1. A. Einstein, B. Podolsky, N. Rosen, Phys. Rev. **47**, 777 (1935).
2. A. Aspect, J. Dalibard, G. Roger, Phys. Rev. Lett. **49**, 1804 (1982).

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Quousque tandem, EPR?

Cats are said to have nine lives. The alleged "paradox" or "conundrum" of Einstein, Podolsky and Rosen seems to have still more. In its latest resurgence (PHYSICS TODAY, April 1985, page 38) there is not even any indication that it was reverentially pronounced[1,2] dead and disposable quite some time ago. What a hardy monster—or are there several?

All the EPR experiments that have been done or discussed[1–3] are based on conservation laws, a fact most writers fail to mention. For example, when a deuteron is photodisintegrated, on account of charge conservation the detection of a proton implies that a neutron

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