letters

powerful Senate Appropriations Committee, Allen Ellender of Louisiana, had suggested that science would compete more favorably for public support if it contributed more effectively to international cooperation with the Soviet Union. Likewise, Senator Fong, a friend of science and another member of the Appropriations Committee, is understandably interested in future development of scientific exchange with China. Basic sciences, like astronomy and high-energy physics, are particularly relevant to international exchange, since these fields at least do not have to worry about classified material.

S. F. TUAN
University of Hawaii
Honolulu

THE EDITOR COMMENTS: For a different view of the budget see our news story on page 69.

Minority groups

I am working on a project to publish a directory listing the scientists and the technically trained professionals representative of the Spanish surnamed and the American Indian communities. This project is a personal attempt to assist in the development of opportunities for scientific and technical training for members of these minority groups. Often programs designed to offer such training have been ineffective, or have not been implemented because the professionals needed to relate to such programs were not identified and could not be consulted. The problem has arisen in both government and industrial efforts. Hopefully the directory planned will help remove this obstacle.

I have solicited information from approximately 800 individuals, who were identified by analysis of membership listings of societies or associations of which I am a member. However, to make this effort more complete, I ask that anyone not yet contacted, who feels he should be included in the directory, should write me.

J. V. MARTINEZ
464 Furnace Road
Ontario, New York 14519

Superconductors

The article by Bernd Matthias on "The search for high-temperature superconductors" (August 1971, page 23) unfortunately gives a rather parochial view of the field. The latter part of the article, which attempts to deal with the more challenging questions of higher-temperature superconductivity, is particularly disappointing. This results from a number of imprecise statements, omissions and trivial errors, some of which we wish to point out here.

First, following a reference to my work on the possibility of superconductivity occurring in organic structures, he states that instead of becoming superconductors, "the compounds" become ferroelectric semiconductors and backs this up by quoting the work of L. I. Buravov *et al.*[1] While the compounds studied by Buravov bear a superficial resemblance to those required by our theory, this is not sufficient. A careful study of the theory would show that there are precise criteria that must be satisfied before one could hope to test the basic concept. The problem of synthesizing the compounds that we believe are needed is comparable in degree of difficulty to the total synthesis of a complex natural product. This study is opening up new areas of organic and metal–organo chemistry, and while progress has been good, it would be naive to expect a solution to so difficult a problem in only a few man-years. In addition, many theoretical questions remain to be answered, and some of these answers depend upon material parameters that are not yet available. In view of these problems, some of which are analogous to the prediction of the classic crystal phases, it is curious that Matthias should so uncritically consider the example above as a proof of the stability of the ferroelectric phase relative to the superconducting phase.

Secondly, through a serious omission Matthias gives a misleading impression of W. L. McMillan's[2] beautiful work on the theoretical reasons for an upper limit on T_c. After criticizing earlier those who are unwilling to deal with instabilities in superconductivity, Matthias quotes McMillan's *figure* of 40K for the predicted maximum T_c for V_3Si-like compounds. Unfortunately, however, he failed to note that McMillan very clearly states that this figure is based on the assumption that in this structure the phonon frequency can be decreased indefinitely. In fact, McMillan goes on to say: "Of course, this is not the case. We are likely to drive some phonon mode unstable, so the metal prefers a different crystal lattice... This would set an upper limit on the coupling constant that one could obtain experimentally and provide a stronger upper bound on T_c." These instabilities are, of course, well known and have been extensively studied by all serious contributors to this field.

Thirdly, Matthias appears to believe that the exciton theory of a possible high-temperature superconductor has been disproved theoretically by the work of J. P. Hurault.[3] This conclusion is the result of a rather trivial error in Hurault's paper, which has been pointed out

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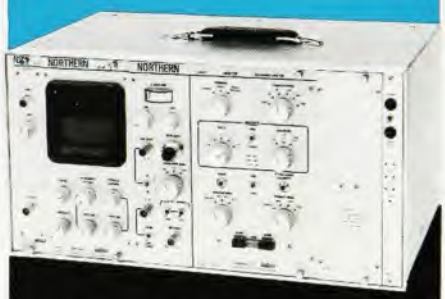

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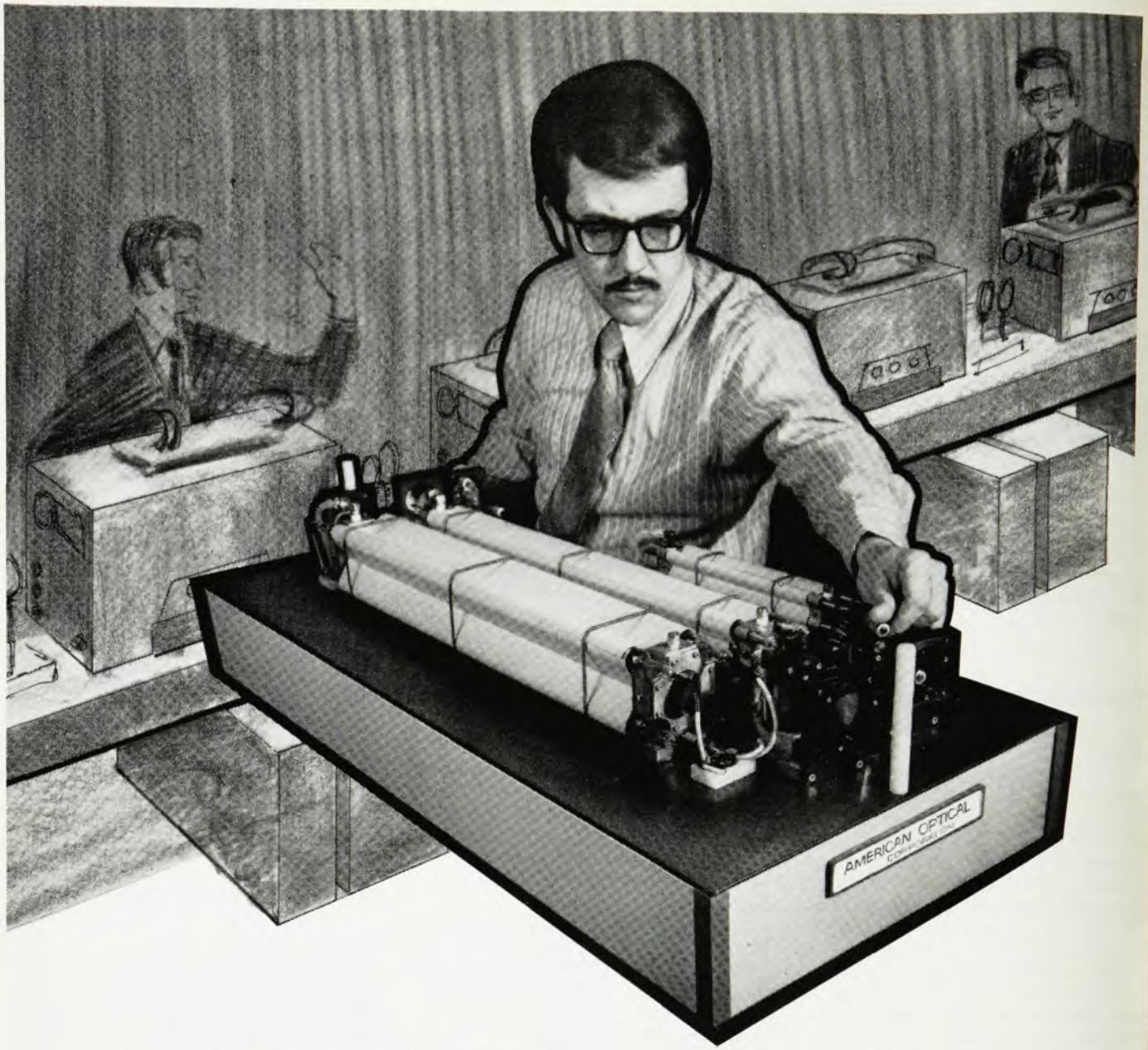

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previously by V. L. Ginzburg.[4]

One point that Matthias does not make but that should be made, is this. In view of the heroic efforts which have gone into raising the transition temperature of conventional superconductors to date, recognizing the rather modest return from this (less than 13%) increase in 17 years) and the dismal prospects in continuing this approach, it would be far more worthwhile from the *technological point of view* to devote proportionally less effort to this dying approach and a much bigger effort to the goal of improving the efficiency of cryogenic refrigerators. The return is likely to be much greater from this tack, for the absolute value of T_c is less important technologically than its value relative to what can be achieved economically. The distinctive feature of the newer approaches, based on the development of materials using an excitonic interaction with a much higher *theoretical* limit on T_c is that, *if they are successful,* their use would bring about a change of technology that could not be matched by any improvement in refrigeration. In this sense such work is on a different plane.

Finally, the "Proceedings of the International Conference on Organic Superconductors" cited in Matthias's article as being "in press" were published by the *Journal of Polymer Science*[5] in July 1970.

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WILLIAM A. LITTLE
Stanford University

Language requirements

Many graduate schools are now in the process of rethinking their graduate foreign-language requirement for the PhD in physics.[1] It seems appropriate, therefore, to share with the physics community some facts and figures that were established at Dartmouth College about a year and a half ago while undertaking a similar study. At that time, our language requirement stated that "all candidates for the PhD must demonstrate, prior to enrollment in the third year of graduate study an adequate reading ability in two foreign languages or a reading, writing, listening and speaking ability in one foreign language: French, German or Russian (or other languages with the approval of the department)." As a consequence of the above investigation the above requirement was abolished in January 1970. In its place was substituted the following policy: "No formal foreign language requirement exists for PhD candidates; however, in individual cases depending on the research topic a reading knowledge in one or two languages may be required by the thesis advisor." The motivation for making this change was the fact that over the last few decades English has become the language of physicists. To justify this statement the following facts were established:

1. English is an official language at *all* international physics conferences,
2. 80 to 85% of *all* periodic physics literature appears in English (see below),
3. 95% of the *important* periodic physics literature appears in English. "Important" as used here relates to the number of citations that a given article receives (see below).

The results quoted in **2** above were derived from two literature surveys made by the American Institute of Physics.[2,3] Both surveys examined one year of *Physics Abstracts,* a British publication that attempts to abstract all pertinent physics and closely allied periodicals. In the first survey (*Physics Abstracts,* 1961) 20 287 abstracts from 405 journals and 39 countries were analyzed. Among other things information concerning the language of the original paper and whether it had been translated into another language was provided. The results derived from these data give the following language distribution:

English	81.3%	original or translated into English,
French	7.2%	original and not translated into English.
German	6.4%	
Russian	2.4%	
Other	2.7%	

It is noted that almost all Russian journals are translated into English by the AIP or some independent publisher and that almost all Japanese journals are published solely in English. The second survey (*Physics Abstracts,* 1965) included 32 279 abstracts from 495 journals and 40 countries. This survey listed the journal from which the article came but unlike the previous survey did not provide information about the language(s) in which the article appeared. In order to derive the desired data the number of abstracts listed for a given journal were weighted by the average percentage of that journal that appears in English. These percentages were derived from the 1961 survey.

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