however, the manuscript and the correspondence with referees should be cataloged, indexed and placed in the files of the American Physical Society. The rejected paper should be listed by title in a publication of the society, and the file containing the manuscript and the correspondence with the referees should be available to the public at a nominal fee. The expense of preparing the original file should be paid for by the author or by the institution supporting his research.

JACOB NEUFELD
Oak Ridge National Laboratory

GOUDSMIT REPLIES: Neufeld's description of the referee system is hopelessly out of date. In the case of controversial papers more than one referee is consulted. If the referees disagree, the editor often decides in favor of the author. Otherwise a third referee is asked to judge the paper as well as the referees' reports and authors' rebuttals. He plays the role of Neufeld's "arbiter."

Neufeld's fear that by rejecting a paper "the scientific community . . . is deprived of potentially valuable information" is also behind the times. That could happen in the past when refereeing was in the hands of a small "elite." (In 1937 a referee rejected my paper because in the atomic nucleus "there cannot be much left of individual particle states and even less of 'shells'." Thus, I am well aware of this difficulty.) At present, however, rejection merely means that the paper will be printed in another journal. I doubt that any paper in which the author has confidence remains unpublished nowadays. Moreover, the author can always present his paper at one or more meetings of our society. The published abstracts are not refereed and assure him priority. Anyone interested can ask the author for the complete paper. This is much better than placing the manuscript in some depository as Neufeld suggests. (Presentation at a meeting also allows an open discussion of controversial points.)

The present referee system, which uses essentially all active physicists as potential referees, is not perfect. It indeed causes some lack of uniformity in standards, as Neufeld observes, but it is not at all effective in suppressing the most basic and most valuable information, as he claims it does. Its failure lies more in the opposite direction. Too many physicists burst into print nowadays with premature results. These papers fill the scientific community with potentially false information. This is more detrimental than the nonexisting suppression of information presumed by Neufeld. Our journals from time to time print papers that are definitely wrong and others in which a right conclusion is based on insufficient or incorrect evidence. The latter can lead to unfair priority claims. In any case, I see no advantage in following Neufeld's suggestions.

S. A. GOUDSMIT
Editor-in-Chief
The American Physical Society

More on employment

For the past few months there have been letters in PHYSICS TODAY discussing the employment prospects for physics students. I believe a few facts about the present situation would be helpful to you (or to the people more directly concerned with manpower), so I'm enclosing a data table from my own experience in seeking employment this fall.

Employers contacted	27
Initial result	
Not hiring anyone	4
Not hiring physicists	15
Not interested in me	1
No response	3
Interview	4
Result of interview	
Offer accepted	1
Offer rejected	1
No offer	2

There are three immediate limitations on these data. First, most of the employers are located in the South because I want to live in the South. Second, only one educational institution was contacted because I have neither the talent nor the desire to teach. Third, many of the employers are in the aerospace field because that is why I am in physics—to work in the space research and development program.

Beyond these limitations, the outlook is bleak, especially as I had been promised a position at the Marshall Space Flight Center, and I know that only a year ago all of the employers contacted would have immediately hired anyone with any degree in

physics. In addition, my friends who will soon receive the PhD degree are having even more trouble finding employment than I have had. The standard reply from an employer is that we are "over-educated" or that they do not need physicists now.

It is obvious that most of the trouble comes from reduced federal spending for research, and that physicists are not the only people hurt by this. Also, my data and my conversations with other physics students seeking employment show that a physicist can still find employment if he is not too selective. The point is, that when a physicist can no longer be employed to do physics, there *is* an employment problem for physicists.

RONALD I. MILLER
Clemson University

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Accustomed as I am to seeing labor unions, government agencies, and so on, futilely trying to repeal the law of supply and demand, it was nevertheless a shock to read the proposals of Owen Fleischman, Larry Smalley, and others (PHYSICS TODAY, January).

As I understand their proposal, they would solve the employment problem by featherbedding, subsidies and restrictive work practices. Judging by the results in other lines of work, these practices would result in less employment, *over the long run*, rather than more.

The only way to increase employment is to increase *demand* for physicists. How? By offering courses that are relevant to the needs of the employers rather than courses that are relevant to the needs of the teachers.

TOM SNOUSE
Saratoga, Calif.

•

Recent letters concerning the "trials and tribulations" of physicists seeking to adjust themselves in today's world, have been read with interest—and even with some compassion. Younger physicists who are still disappointed might be interested in how the world looked to some of us "old-timers" about 40 years ago. The ink was still drying on my University of Iowa PhD; it was 1931 and I was seeking employment. Here are some quotes taken from my mail of that period:

6 July, 1931—(from RCA Photophone, Inc.) "I really do appreciate your interest in our company, and hope to be able to offer you a position some day when conditions improve. At present all emphasis is still being laid upon economy, and additions to the staff are prohibited. . . . ."

17 March, 1931—(from The Gulf Companies) "When your letter first arrived we had hoped to increase our staff somewhat, but in the meantime an unfavorable turn in the business situation in the oil industry has required a change in these plans. We therefor regret to advise you that we will not be in a position to discuss employment in this laboratory with you. . . . ."

29 April, 1931—(from The General Electric Company) "I have your letter of April 27th, but since the uncertainty of the early part of 1931 about our summer plans has resolved itself into the certainty that we cannot even make temporary additions to our payroll this year, I am unable to ask you to come to us for the summer. I am sorry. . . . ."

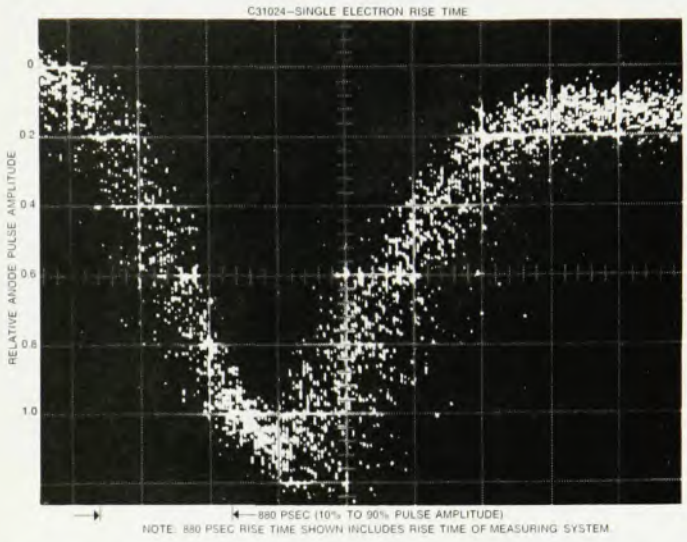
23 November, 1931—(from US Coast and Geodetic Survey) "The position about which I wrote you has now been definitely filled by a transfer from the Bureau of Standards . . . . . I am returning your papers."

5 May, 1931—(from General Motors Corporation) "I would like very much to have you join our staff but it is impossible to carry out such arrangements at the present time. I guess we will have to pass the matter up for the time being. Perhaps later when conditions improve there may be opportunities."

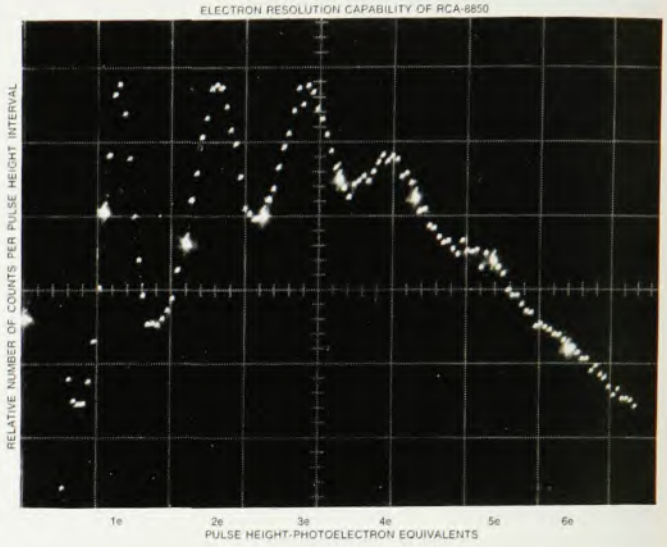
23 April, 1931—(from RCA Victor Company, Inc.) "I regret that we are not able to offer you employment here . . . I, therefore, advise you not to wait for any definite offer with this company and would suggest if nothing else is available that you accept the temporary teaching position . . ."

30 March, 1931—(from Bell Telephone Laboratories) "I can now write you definitely about employment in the laboratories. Our present program for the year's activities in research and development does not provide for expansion, and because losses from the technical staff have been so few, there is virtually no occasion to make replacements. I am sorry that under these conditions there is no opening in prospect for which we can consider you . . ."

RCA Leadership Paces Photomultiplier State-of-the-Art



NOTE: 880 PSEC RISE TIME SHOWN INCLUDES RISE TIME OF MEASURING SYSTEM.



The industry's widest and most diverse line of photomultipliers—more than 250 established and state-of-the-art types—comes from RCA.

A variety of new photocathodes and high-efficiency secondary emitters provide tubes with outstanding features such as: broad spectral response with high sensitivity from UV to IR; resolving capability of one, two, three or more photoelectron events, and sub-nanosecond anode pulse rise time.

Broad Spectral Response

Gallium Arsenide Photocathode Types:

C31025C—1⅛", 9-stage side-on QUANTACON photomultiplier mechanically interchangeable with 1P28. 200 to 910 nm spectral response.

C31000K—2", 11-stage QUANTACON photomultiplier with a 4 mm x 7 mm photocathode. Fits 8575 socket and covers spectral range from 300 to 910 nm. Especially intended for restricted photocathode-area applications.

ERMA Photocathode Types

C31000E and C31000F—QUANTACON photomultipliers featuring gallium phosphide first dynode. Typical photocathode sensitivity is 10 mA/W at 860 nm.

C70042K — Compact ¾" 10-stage tube having a typical sensitivity of 10 mA/W at 860 nm.

C7151W and C7164R—1½" and 2", 10-stage tubes having typical photocathode sensitivities of 23 mA/W at 694.3 nm. Intended for applications requiring good "red" response at a popular price. C7151W fits 6199 sockets—C7164R fits 6342A sockets.

Resolution of Single and Double Photoelectrons

8850—2", 12-stage QUANTACON photomultiplier similar to 8575 having a gallium phosphide first dynode and a bialkali photocathode with a typical quantum efficiency of 31% at 385 nm.

C70133B—5", 14-stage QUANTACON photomultiplier similar to 4522. Gallium phosphide first dynode provides the same photoelectron resolution as type 8850. UV transmitting glass window extends spectral response to 200 nm.

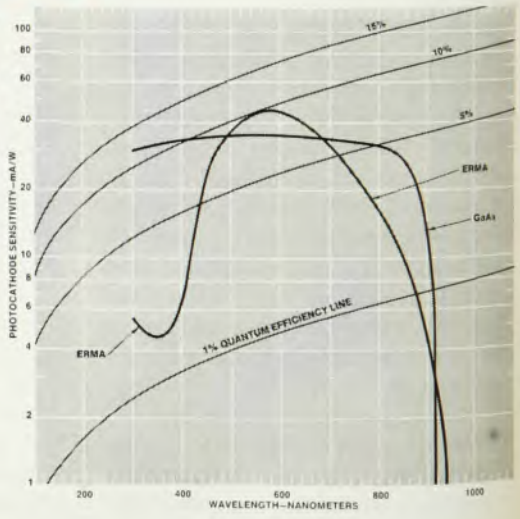
Sub-Nanosecond Response

*C31024—2", 5-stage QUANTACON photomultiplier with gal*lium phosphide dynodes. First easy-to-use tube having a typical anode pulse rise time of less than 800 ps.

The unparalleled performance of these new photomultipliers in areas such as broad spectral response, resolution, and speed are shown by the accompanying illustrations. The page opposite outlines the characteristics of some of the many established photomultipliers now available.

Consult your local RCA Representative for more information, including prices and delivery and special requirements. For technical data on specific types, write: RCA Electronic Components, Commercial Engineering, Section **D159P/ZP5**, Harrison, N.J. 07029. In Europe: RCA International S.A., 2-4 rue du Lièvre, 1227 Geneva, Switzerland.

RCA



TYPE	SIZE (INCHES)	NO. OF STAGES CAGE STRUCTURE*	SPECTRAL RESPONSE	SUPPLY VOLTAGE	CATHODE SENSITIVITY μA/lm	ANODE SENSITIVITY A/lm	GAIN	DARK CURRENT mA@A/lm	RISE TIME (NS)	COMMENTS	TYPICAL APPLICATIONS
8571	1/2	9-C	S-4	1000	35	75	2.1×10^6	2@20	1.2	EXTREMELY RUGGED SMALLEST PMT	PHOTOMETRY, RADIOMETRY
931A	1-1/8	9-C	S-4	1000	40	80	2.0×10^6	5@20	1.6	LOW COST, SIDE-ON PMT	GENERAL PURPOSE, SPECTROSCOPY
1P21	1-1/8	9-C	S-4	1000	40	120	3.0×10^6	1@20	1.6	HIGH PERFORMANCE VERSION OF 931A	SPECTROSCOPY
1P28	1-1/8	9-C	S-5	1000	40	100	2.5×10^6	5@20	1.6	UV SENSITIVE SIDE-ON PMT	UV SPECTROSCOPY
1P28/V1	1-1/8	9-C	MOD. S-5	1000	60	200	3.3×10^6	2@40	1.6	HYSTERESIS-FREE VERSION OF 1P28	WIDE RANGE DENSITOMETRY
C70102B	3/4	10-I	S-1	1250	30	3.3	1.1×10^5	800@4	1.8	IR SENSITIVE COMPACT	LASER DETECTION
7102	1-1/2	10-C	S-1	1250	30	7	2.3×10^5	1900@4	2.2	IR SENSITIVE	GENERAL PURPOSE IR DETECTION
8644	3/4	10-I	S-20	1500	150	12	8.0×10^4	1.2@30	1.4	RUGGED COMPACT	LASER RANGE FINDER
4526	1-1/2	10-C	MOD. S-20	1250	300	15	5.0×10^4	2@20	1.8	REFLECTIVE SUBSTRATE PHOTOCATHODE	LASER DETECTION SPECTROSCOPY
4463	2	10-V	S-20	2000	160	25	1.6×10^5	5@12	9	NEAR IR SENSITIVE	LASER DETECTION
7265	2	14-I	S-20	2400	150	7200	4.8×10^7	50@1000	2.8	NEAR IR SENSITIVE	LASER DETECTION
6199	1-1/2	10-C	S-11	1000	45	45	1×10^6	4.5@20	2.6	LOW COST HEAD-ON DEVICE	GENERAL PURPOSE
8053	2	10-V	S-11	1500	70	42	6×10^5	4@9	12		SCINTILLATION COUNTING
8054	3	10-V	S-11	1500	80	43	5.4×10^5	4@9	14		MEDICAL EQUIPMENT
8055	5	10-V	S-11	1500	110	44	4×10^5	4@9	18		FLYING SPOT SCANNER
4516	3/4	10-I	BIALKALI	1500	60	42	7×10^5	0.2@7	1.6		SCINTILLATION COUNTING
C31016B	1	10-C	BIALKALI	1250	67	13	1.9×10^5	0.5@7	1.4	VERY COMPACT NON-MAGNETIC	SPACE PROBES
4517	1-1/2	10-C	BIALKALI	1500	67	47	7×10^5	0.3@7	2.2	SMALL SIZE	SCINTILLATION COUNTING
8575	2	12-I	BIALKALI	2000	85	850	1×10^7	1@200	2.2	VERY HIGH PERFORMANCE TYPE	NUCLEAR PHYSICS SCINT. COUNTING
4523	2	10-V	BIALKALI	1500	60	27	4.5×10^5	0.5@13	12	LOW DARK CURRENT	SCINTILLATION COUNTING
4524	3	10-V	BIALKALI	1500	60	27	4.5×10^5	1@13	14		MEDICAL EQUIPMENT
4525	5	10-V	BIALKALI	1500	67	27	4×10^5	1.5@13	18	HIGH QUANTUM EFF.	FLYING SPOT SCANNER
4522	5	14-I	BIALKALI	2000	77	2300	3×10^7	60@2000	3	HIGH SPEED	NUCLEAR PHYSICS CERENKOV DET.
4460	3/4	10-I	S-11	1250	60	7.5	1.3×10^5	6@7.5	1.8	RUGGED COMPACT	SCINTILLATION SPACE PROBES
C70102M	3/4	10-I	BIALKALI	1500	67	27	4×10^5	0.2@7	1.6	RUGGED LOW DARK CURRENT	"
4461	1-1/2	10-C	S-11	1250	60	10	1.7×10^5	5@10	2.4	RUGGED	"
8664	2	10-V	BIALKALI	1500	67	17	2.5×10^5	1@7.5	8	EXTREMELY RUGGED	SPACE PROBES

*C=CIRCULAR I=IN LINE V=VENETIAN BLIND

ESTABLISHED TYPES FROM THE BROADEST LINE IN THE INDUSTRY.

See the other side of the coin

There's more to Europe than history-steeped castles, picturesque scenery, windmills, traditional costumes and centuries of culture. In the research laboratories of the Philips group of companies, small teams of scientists are cooperating in many fields of fundamental and applied science. Every member has creative freedom, plus the responsibility of seeing a project through to its logical conclusion. The European-based scientist scores because of better career prospects, free exchange of ideas with his colleagues in other fields - and the unparalleled opportunity to recharge his mental batteries on the other side of the coin.

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The Office of the Director for Research, Dr. H. B. G. Casimir,
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PHILIPS

22 April, 1931—(from Signal Corps Laboratories) "We wish to advise that the vacancies in the position of Associate Physicist in these Laboratories have been filled . . ."

There came the day, however, when a bit of sun broke through the clouds. It was summer and the year was still 1931. In the same week there came two job offers, one from the Signal Corps and the other from RCA—salary for both about $2500. I accepted the first one with a special-delivery letter, reporting to Fort Monmouth on 7 August, 1931. Thirty-five years later, now the Director of Research, I retired—this time voluntarily, rejoining the ranks of the unemployed.

HAROLD A. ZAHL
Holmdel, N.J.

•

Letters by the dozen appear on my desk—letters of application for a job teaching physics. I am appalled, not by the number of applications, but by the naiveté of their authors. Of every ten, nine are *mimeographed form* letters. Some of them lack even a salutation.

I have the impression, when I talk to my fellow chairmen elsewhere, that such letters to them end up where mine do—in the wastebasket.

Is it too much to expect that the applicant recognize the enormous diversity of the educational institutions to which he is applying? If he wants to be considered at a particular college or university, let him say why he thinks he would be happy there. More importantly, let him also say how he thinks his interests and talents would mesh with what he conceives to be the needs of the department to which he is offering his services.

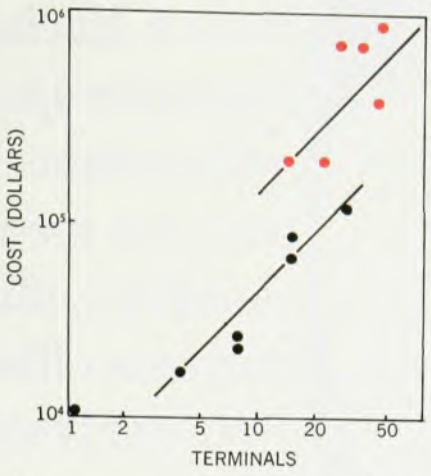
An imaginative personal letter will put the writer near the top of my list of candidates entitled to first consideration.

EDWARD P. CLANCY
Mount Holyoke College

Computer learning costs

The article by Guenter Schwarz, Ora Kromhout, and Steve Edwards (PHYSICS TODAY, September, page 40) is a good review of the *possibilities* of using computers to aid the learning process, but does not answer the *practical* questions on the necessary investment of time and money that newcomers to the field need.

A plot of the purchase price of 13 CAL systems versus the number of (time-shared) terminals is shown in the accompanying figure. The black



dots represent systems primarily intended for computational use having a minimum of one high-level language (such as BASIC) available. The colored dots represent larger systems with expensive mass-storage devices and communications hardware especially adapted to computer-supervised instruction (CSI) as well as computation. With some imagination, both of these sets may be fitted with a line of unit slope, showing the basic price to be about $4000 per terminal for the computation systems and $15 000 per terminal for the CSI systems.

To compute the actual instructional cost, exclusive of the cost of programming, we must add maintenance charges (which can amount to 30–75% of the purchase price over a five-year period), the costs of machine operators or monitors, and the costs of supplies (such as teletype paper). If the terminals are made available a minimum of 1600 hours per year, the instruction costs of all the circled computational-type systems lie in the range 50–90 cents per student terminal hour when amortized over five years, which compares favorably with the costs of college instruction.

The actual cost of instruction on the systems represented by colored dots fluctuated widely from a low of $1.75 to a high of $4.50 per student terminal hour, indicating that a little shopping might produce a "best-buy" in this area. Very few manufacturers offer a CAI language compiler that enables relatively untrained authors to write programs easily, and only two offer operating systems on which CAI and