compact to be accomodated within the space allocated to a hospital radiotherapy department, yet provide dose rates adequate for practical treatment. This facility is the product of an international collaboration involving the German firm of AEG-Telefunken and two American firms, Radiation Dynamics and TDN. It embodies many unique structural and functional features. Of particular interest to nuclear and accelerator physicists is the application of what has been called "co-analysis," whereby the several molecular species produced by a conventional deuterium ion source are directed to impinge on adjacent areas of the neutron-producing target. This permits full use of the ion output of an ion source without the impairment of target life, which is now well established when ions of different mass-species impinge on the same portion of a target.

If the current series of clinical trials of neutron therapy produce encouraging results, there should be many opportunities for nuclear physicists and technologists to apply their skills and training in this challenging field.

LAWRENCE CRANBERG
Austin, Texas
1/84

•

We read with interest the article by D. Allan Bromley, in December. We would like to correct a minor error in the explanation of the use of neutron damage to reduce dynamic-RAM soft error rates. The mechanism for producing soft errors is in part due to minority carrier diffusion from ionization tracks in the silicon substrate into the devices. Neutron damage reduces the soft errors by this mechanism by reducing the minority carrier lifetime in the substrate, and hence the diffusion length. The RAM gate capacitance is also increased by neutron irradiation so that a bit contains additional charge. Finally, this technique has improved[1] soft error rates by a factor of 80 to 100 in 16K d-RAMs, not a factor of 10 as stated in the article.

Reference

1. C. E. Thompson, J. M. Meese, IEEE Trans. Nuc. Sci. **NS-28**, 3987 (1981). C. E. Thompson, J. M. Meese, in *Defects in Semiconductors*, J. Narayan, T. Y. Tan, ed., North-Holland, New York (1981), page 247.

JON M. MEESE
University of Missouri
Columbia, Missouri
12/83

THE AUTHOR COMMENTS: Larry Cranberg, of course, is entirely correct in pointing out that in my review the applications of neutrons in nuclear medicine were conspicuous by their absence. So also, of course, were their vital applications in the entire nuclear-energy program and in a substantial range of basic physics applications. This is unhappily a reflection of the structure of the symposium for which this review was originally prepared and of the condensation process required to make it suitable for publication in PHYSICS TODAY.

In arranging the program for this Fortieth Anniversary Symposium commemorating the first artificially produced self-sustaining nuclear chain reaction, Robert Sachs and his associates at the University of Chicago specifically requested that I exclude these two general topics inasmuch as a complete session featuring Glenn Seaborg, Alvin Weinberg, Walter Massey, Albert Carnesale, Hans Bethe and Frank von Hippel was planned for discussion of the nuclear-energy questions and an invited paper by Henry Kaplan was focused specifically on medicine and the biological sciences. These papers and my own will appear in full in the Proceedings of the Symposium edited by Robert Sachs.

In the condensation it was agreed further that the more familiar aspects of neutron applications to such important areas as condensed matter and material science, with which many of the readers are already completely familiar, could be greatly condensed or excluded entirely to make room for applications with which they might be less familiar.

I am, of course, indebted to Jon Meese for the additional detailed information he provides concerning the techniques that he and his colleagues have developed involving neutron irradiation of computer memory units.

D. ALLAN BROMLEY
Yale University
New Haven, Connecticut
2/84

Physicists and the GRE

At the risk of fueling further the Jehovah complexes of some members of the physics community, we will cite some statistics on graduate record exam scores of students, categorized by intended graduate disciplines. These data are extracted from a report from the Educational Testing Service, *GRE Guide to the Use of the Graduate Records Examination Program, 1983–84*, E. T. S., Princeton (1984), on GRE scores obtained during the period 1 October 1981 to 30 June 1983. There are 98 disciplines listed as intended major fields. Of the 98, the highest combined quantitative and verbal average was for physics (1251), followed by astronomy (1240), biophysics (1200) and applied mathematics (1197). Rounding

continued on page 106

letters

continued from page 15

out the top ten were mathematics (1183), aeronautical engineering (1183), classical language (1177), molecular and cellular biology (1177), philosophy (1174) and chemical engineering (1168). The overall average was 1036. Physics was also first on the quantitative test alone (697, overall average 545) and was eighth of 98 on the verbal test (554, overall average 491). First and second on the verbal test were classical language (616) and philosophy (593). Astronomy was the only field other than physics to rank in the top ten on both quantitative (sixth, 674) and verbal (seventh, 566) scores.

We are sure that this information will come as little surprise to the readers of PHYSICS TODAY.

R. E. FORNES
J. D. MEMORY
D. W. STEWARD
J. F. ARNOLD
North Carolina State University
Raleigh, North Carolina

12/83

Polonium halos

With reference to Robert Gentry's "polonium halo" phenomena, one of the first tenets of science is that a thing must be examined before it is condemned. However, certain facts of nature rest on such an extensive background of examination, that when confronted with an apparent discrepancy, they need not be further defended. No competent physicist worthy of the name need spend his time examining an apparent conflict with the second law of thermodynamics, or that the Earth is flat. I am afraid that this polonium halo business falls in this category.

Any reasonably intelligent person can easily satisfy himself of the following:

- The oldest tree ring count goes back to 7124 years before 1983.
- The oldest written document goes back to about 5483 years before 1983.
- The earliest structures of man date back to between 120 000 and 1 750 000 years before 1983.
- Earliest man appeared during the Paleocene period, some 70 000 000 years ago.
- Overwhelming "scientific" evidence—radioactive dating—places the oldest terrestrial rocks at 3 800 000 000 years ago.

Accordingly, when one comes across something like this polonium halo business, which suggests that the Earth and the universe as we know them are only some 6000 years old, having satisfied oneself as to facts listed above, one would be well advised to dismiss the