

## letters

ed. Of course, the misunderstanding is not surprising if "NSF accounts" are used as a source of information about European organizations. For our part, we shall continue to fly the "twin-engine, eight-passenger de Havilland" as a cost-effective replacement for a nine-hour drive from Santiago. US astronomers visiting the American observatories in Chile will continue to be welcome to use seats on the plane when space permits.

L. WOLTJER  
Director General

10/83 European Southern Observatory

Your comparison between the spending of the Cerro Tololo and La Silla (ESO) observatories in Chile was highly inaccurate. The annual contributions of the member countries to the budget of the European Southern Observatory have totalled a constant DM 32.5 million (roughly \$12 million, rather than the \$25 million suggested in your article) for the last four years. This budget includes operations at ESO Headquarters in Garching (Germany). Apart from providing the necessary support for the observatory in Chile, Garching is a major research facility in its own right. It plays an ever-increasing role in fostering cooperation between European astronomers, by providing, for example, free access to plate measuring devices and image-reduction facilities (ESO will also host the European Coordinating Facility for the Space Telescope). In addition, what you describe as "a cluster of slightly smaller telescopes" is in reality an impressive array of 13 fully operational telescopes with a total collecting area well in excess of that of the telescopes at Cerro Tololo. All ESO telescopes are heavily oversubscribed, but observers on the hundreds of research proposals who are allotted telescope time every year get their trip from Europe paid for, all from the budget mentioned above. And yes, this includes the three-hundred-mile air trip from Santiago to the observatory in a chartered (and cramped) Cessna 402 (not a de Havilland); transportation on the mountain is in Renault 4s, a utility vehicle not imported in the US.

You wrongly cited the ESO as a prime example of the high cost of scientific research in Europe. In reality, ESO provides a high-quality observing facilities in a very cost-effective manner.

JAN KOORNNEEF  
Space Telescope Science Institute  
Baltimore, Maryland

11/83

The brief column "Observing in the High Andes" is remarkable for its

density of inaccuracy and misinformation:

► The plane leased by the European Southern Observatory is used to transport astronomers 600 km from Santiago to the foot of their site at La Silla. Cerro Tololo's Volkswagens are used solely for transportation on the mountain. In fact, most CTIO visitors travel from Santiago to La Serena by public bus (6-7 hours), which is more economical than flying, but also more tiring and time-consuming. CTIO also offers visitors the option of making the trip via domestic airlines.

► The name "Mayall" given to the Kitt Peak 4-meter telescope honors a former KPNO director. The Cerro Tololo 4-meter has no honorary name at this time.

► During eight years in Chile, I never heard any Chilean call anything "astronomy ridge." La Silla is located 180 km northeast of La Serena while Cerro Tololo is 80 km east. ESO operates 13 telescopes on La Silla, while CTIO operates 7. The largest ESO instrument is a 3.6-meter; the others are larger than or equal to their CTIO counterparts in size...

NOLAN R. WALBORN  
Greenbelt, Maryland

12/83

## Negative reaction

I grit my teeth when I read "Negative impact of computers" (October, page 121).

If a computer is dropped on a physicist's foot, that is an impact. If time is reversed and the physicist says "IhcuO," I might consider it a negative impact. Otherwise it is an adverse effect.

ROBERT ERCK  
Argonne National Laboratory  
Argonne, Illinois

10/82

## Change in language

Physicists use models to represent systems of observables; human language is also an abstract model whose formal rules represent some conceptual structure. As I do not expect people arbitrarily to change axioms in current mathematical models, I was distressed when reviewing the page proofs of an article which will appear soon in *The Physical Review* to discover that, twice, the first word of an independent clause following a colon had been capitalized by the editors. They confirmed in response to my telephone call that this had been done "for stylistic reasons." Language changes and evolves, to be sure, but whatever advantage the editors see in their decision is misguided. I

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## letters

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think, and a Pyrrhic victory. Am I alone in my distress? How do your readers feel about this?

BURTON BRODY  
Bard College

5/83 Annandale-on-Hudson, New York

## Errata available

My book, *Stochastic Systems*, (Academic Press, 1983), has some uncorrected errors on pages 232-233 that detract from the comparisons being made. The corrected solution by the decomposition method is  $y = 1 + t + t^2 + (\frac{4}{3})t^3 + \dots$  which makes the superior accuracy as well as the computability quite evident. A one-page errata sheet is available to all past buyers by writing to me at the Center for Applied Mathematics, University of Georgia (Tucker Hall), Athens, GA 30602. New purchases from Academic will contain the correction. I apologize to all buyers for the inconvenience.

G. ADOMIAN  
Center for Applied Mathematics  
University of Georgia  
Athens, Georgia

11/83

## Discovery of the neutron

In his "History of medical physics" (July, page 26) John Laughlin repeats an error concerning the discovery of the neutron that has been faithfully handed down for five decades. Although they are not named in the article, most readers familiar with the matter will recognize the "scientists at Giessen" to be Walther Bothe and Heinrich Becker, as the neutron story has been recounted in many papers on the history of nuclear physics, papers on which Laughlin presumably relied. Other attempts<sup>1</sup> to set the record straight have had no observable effect, but justice to an admirable man and skilled experimentalist compels me to make another attempt. Briefly, the conventional story of the neutron's discovery begins with Bothe and Becker bombarding Li, Be and B with alpha particles from polonium. Their efforts are rewarded by the discovery of a very penetrating radiation, which they identify as gamma radiation.<sup>2</sup> Irene Curie and Frédéric Joliot confirm these findings and observe that the radiation produces recoil protons,<sup>3</sup> which they attribute to extraordinarily high energy photons. James Chadwick then demonstrates that the penetrating radiation results from neutrons.<sup>4</sup>

Implied in this, and often explicitly

stated, is Bothe's failure to recognize neutrons when he encountered them. The truth is that Bothe never encountered neutrons, as reading his paper will disclose. His detector was a metal-walled, air-filled Geiger tube, which would have been insensitive to neutrons and would have responded to them in the same way as to gamma rays. Modern investigators know that distinguishing neutrons from gammas is still not trivial. What Bothe observed was the gamma radiation from the first excited state of  $C^{12}$ , produced in  $Be^9(\alpha,n)C^{12}(4.43\text{ MeV})$ , the most penetrating radiation that had been observed until then in a laboratory experiment, and which is produced in comparable amounts to ground-state neutrons.<sup>5</sup> Even if hydrogenous material had been incorporated into the detector, it is doubtful that he would have noted any recoil protons because his alpha source was very much weaker than those used by either Chadwick or Curie and Joliot. It was, in fact, a tribute to his observational skill that he was able to do the experiment at all.

## References

1. R. Fleischmann, *Naturwiss.* **38**, 465 (1951); **44**, 457 (1957).
2. W. Bothe and H. Becker, *Z. Physik* **66**, 289 (1930).
3. I. Curie and F. Joliot, *Comptes Rendus* **194**, 273 (1932).
4. J. Chadwick, *Nature* **129**, 312 (1932).
5. A. W. Obst, T. B. Grandy and J. L. Weil, *Phys. Rev. C* **5**, 738 (1972).

LOUIS BROWN  
Carnegie Institution of Washington  
Washington, DC

7/83  
THE AUTHOR COMMENTS: The revered memory of Walther Bothe needs no defense for any statement in my paper, but I do appreciate the intent of the communication from Louis Brown. As stated precisely in the paper, Bothe and Becker<sup>1</sup> did report radiation more penetrating than radium gamma rays. Since James Chadwick, in his announcement<sup>2</sup> of his discovery of the neutron<sup>3</sup>, cited the work by Bothe specifically, it is an historical necessity to refer to Bothe's work. In fact, the first sentence as well as other comments in Chadwick's short article announcing the neutron (less than one page in *Nature*) were directed to Bothe's experiments. Chadwick had the advantage of working with Ernest Rutherford in his laboratory and had the benefit of his insight. Rutherford had postulated the existence of neutral nucleons in 1920 in his Bakerian lecture.<sup>4</sup> Chadwick also employed an ionization chamber and an amplifier that distinguished between the pulse heights of electrons and heavier particles. When Irene Curie and Frédéric Joliot had repeated Bothe's experiment previously, they did add the use of



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