

letters

the semiclassical theory violates (in principle) basic quantum mechanics, that is, the uncertainty principle. The effect mentioned by Ohanian is extremely small indeed, for the influence of any atom on the total self-consistent field is miniscule $[O(1/N)]$, where N is the number of atoms. Sure, the semiclassical approach involves approximations but they are so good that for many (in fact most) purposes we need not bother with the considerably more complicated fully quantal description. Failure on Ohanian's part to distinguish between valid approximation and "fraud" is a serious failure indeed, for the art of the physicist is surely his use of approximation.

In view of Forrest Strome's comments, it seems well to reiterate our position concerning the semiclassical theory of the photoelectric effect. We maintain, simply, that this treatment provides a quantitatively correct operational recipe for calculating expectation values of the physical observables, i.e., the energy spectrum and rate of photoelectron ejection. In particular, Strome comments on the uneasy feeling one might have concerning possible energy conservation violation associated with a single photoelectron ejection. If we demand the conservation of (microscopic) energy in this process the "photon" seems to be implied. However, as Strome correctly notes, quantum mechanical predictions do not refer to a single event, but rather to an ensemble. Furthermore, the early workers in quantum mechanics considered dropping microscopic energy conservation. Hence although various possible interpretations consistent with the conservation of microscopic energy have some philosophical appeal, they are not strong arguments for the abandonment of the semiclassical in favor of the quantized field theory. So why motivate the quantum theory of radiation (and therefore the photon concept) on the turbulent sea of philosophical argument when the firm footing of theoretical prediction and experimental verification is available? Our central theme is that the quantized theory of radiation is a logical and compelling extension of the quantum theory of matter from many points of view, that is the uncertainty principle, spontaneous emission, Lamb shift, fluctuations in the blackbody spectrum, and so on, but the photoelectric effect does not deserve a place in this list.

Concerning Strome's second point, recent measurements by Hyatt Gibbs⁴ at Bell Telephone Laboratories have used the self-induced transparency technique to test the semiclassical versus quantum field theoretical treatment of spontaneous emission. He

finds that the quantized field results are in better agreement with experiment than the semiclassical.

Finally, Strome's third point is incorrect. Any normally ordered operator has the same quantum statistical ensemble average as its classical counterpart, that is,

$$\int d^2\alpha P(\alpha) \langle \alpha | \sum_{n,m} c_{nm} (a^+)^n a^m | \alpha \rangle =$$

$$\int d^2\alpha P(\alpha) \sum_{n,m} c_{nm} (\alpha^*)^n \alpha^m$$

since $a|\alpha\rangle = \alpha|\alpha\rangle$. However, most operators are not naturally in normal order, and, in particular, the square of the number operator ($n \equiv a^+a$) is not:

$$n^2 = a^+aa^+a = a^+a^+aa + n[a, a^+]$$

that is, the sum of a *two* normally ordered products. This bit of operator algebra is explicitly carried out in Eq. 21. It is precisely because the commutator $[a, a^+] = 1$ (that is, the quantum character of the field is involved) that we obtain the contribution Einstein attributed to the particle nature of light.

References

1. R. H. Dicke, J. P. Wittke, *Introduction to Quantum Mechanics*, Chap. 9, esp. page 148-9.
2. J-M Levy-Leblond, *Commun. Math. Phys.* **6**, 286-311 (1967).
3. Theodore A. Welton, *Phys. Rev.* **74**, 1157 (1948).
4. H. M. Gibbs, VII International Quantum Electronics Conference, Paper #P2 Digest of Technical Papers, page 72 (1972), and private communication.

MARLAN O. SCULLY
MURRAY SARGENT III
The University of Arizona

On unions

The letter of Cedric Rogers in the May issue (page 50) says that physicists tend to lose in disputes both with their bosses and with their technicians, because of having no union—that we need something like the AMA.

The fact is, we have it, as of relatively recently. It is called American Physicists Association (address: Box 19343, Washington, D. C. 20036). It is excellently managed, its goals are realistic, its campaign at a low key; it does all the right things: lobbying in Washington, campaign contributions. The reason physicists still lose is simply that the APA is still young and weak. It needs more members. It is aching for money. The very fact of Rogers's letter shows that not every physicist knows about it.

But it exists and it is growing!

CHARLES R. LEGENDY
CNR Laboratory
Arco Felice (Naples)
Italy

continued on page 15

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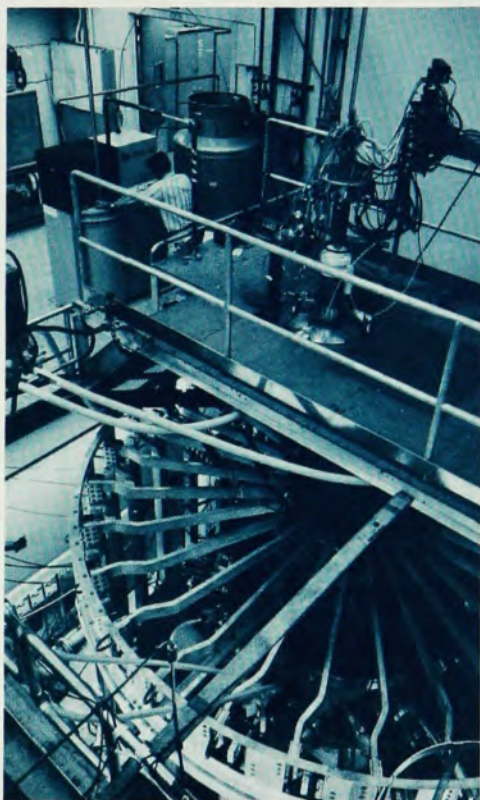
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What Rogers fails to mention is that most union leaders are legalistically undesirable, and that the unions are monopolistic and in restraint of trade, and tend to undermine the economy of a country, as in the case of his beloved England. What more is there to say?

MICHAEL RETTINGER
Encino, California

From the tone of the letter it appears that your correspondent is feeling a little of the chill wind that struck the scientists and engineers of Parsons in May 1970. Maybe some indication of the progress of the dispute would be of interest.

Those people threatened with sacking because of their refusal to join D.A.T.A. (now known as T.A.S.S.) were given one month's notice of dismissal by the company. An appeal to the High Court resulted in a ruling that Parsons was perpetrating an unfair industrial practice and that the period of notice for such senior staff was totally inadequate. Under further pressure from TASS the company issued new dismissal notices giving up to three month's notice. During this period the Industrial Relations Act came into force and the people affected asserted their rights under the Act, leaving the company with no alternative but to withdraw the notices. TASS, not recognizing the act, applied sanctions including 'blacking' of those who would not join them and also those who took advantage of the Act to leave a union repugnant to them.

The matter is now in the hands of the Industrial Relations Court and the Commission, the Commission being engaged at the minute in interviewing and distributing questionnaires to the technical staff. Their findings should be available shortly.

None of this concerted action would have been possible without the help of United Kingdom Association of Professional Engineers. This union and the newly formed Association of Professional Scientists and Technologists are pledged to defend our interests both professional and ethical, there obviously being a need for help not only in dealing with employers but as protection against our more militant "brothers." One should also bear in mind the necessity of cooperation between these unions and their respective institutes so that a standard for any action can be formulated.

So may I advise the formation of similar bodies in the United States,

which if formed in time could prevent the occurrence of similar events on your side of the Atlantic.

M. SHEEHAN
Grubb Parsons
Newcastle upon Tyne, UK

THE AUTHOR COMMENTS: The continuing events at the British Company, C. A. Parsons, illustrate well the present threat to professional scientists. The days are over when a company owner really owns anything or a manager is free to manage without interference. It seems that C. A. Parsons changed its course of action about four times under pressure from all directions. In this case the scientists are lucky to have government concerned for their well being.

Government and unions can together create an intolerable situation for the professional. A union devoted to one trade does seem logically the group to advise the government on regulations for such a trade. Thus they are able, under the guise of safety regulations, to provide themselves with added job security. Medical doctors too have used this trick. In England, for example, I was taught to give myself injection treatment for hay fever; in the United States I would have to pay a doctor weekly to do this.

Scientists have no such pressure groups. When schedules run behind because of the scarcity of union labor, the professional man works unpaid overtime to keep things going. The manager finds him the only one left who can be managed. The owner has found the scientist the only person left to be "owned." What scientist can get a job without first signing away his right to make a profit on all his original thoughts? A union with strength is sorely needed to protect our rights.

CEDRIC G. ROGERS
Hudson, Mass.

Corrections

Following are corrections I have received to my review of Pimenov's book (April 1972):

Einstein did not find differential geometry "ready for him." He had re-invented half of it before hearing of its existence.

Signals may propagate in Pimenov's semi-Riemannian spaces with arbitrarily high velocity, never "instantaneously."

The index for which "the work pleads" was present in the original Russian.

Pimenov's imprisonment is not the result of any publication but merely of preliminaries to publication.

DAVID FINKELSTEIN
Yeshiva University
New York

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