

.01 % GAUSSMETERS



For DC Magnetic Field Measurement and Control

These gaussmeters have a degree of accuracy and resolution far surpassing anything previously available in a general purpose device. They use the same rotating coil principle with reference generator for null balance that is used in our 0.1% gaussmeters. Every effort has been made to extend the accuracy to the fullest extent, and to provide a rugged unit with long operating life.

Wide Range of Measurements with Complete Linearity.

Can be used from zero to maximum field with uniform resolution over the entire range. After balance point is determined, readings are taken from a transformer type divider with five decade dials and meter for interpolation. Dial indications are directly in gaussses.

Resolution Comparable to NMR Types.

High resolution (approaching one part per million at full scale) is obtained by a high gain transistor amplifier with narrow band filters for low noise. Balance indications are on a high quality Rawson meter, reading directly in gaussses.

Measure Non-Uniform Fields

The rotating coil principle is not limited to uniform fields. You can use it for complete field plots including stray field measurements. It can be used all the way down to zero field or up to very high fields where NMR cannot be used because of non-uniformities.

For Electromagnet Control

A high level DC differential output signal is available for control or recording purposes. This signal goes through zero at whatever value of field you set on the dials and is ideal for power supply control. Stability of a few parts per million can be obtained.

Construction Features

New stronger motor for more reserve power. Temperature control for reference generator. Magnetic shielding of both motor and generator. Rigid mounting with vernier phase angle control. Indicator in handsome walnut cabinet, or can be rack mounted.

Specifications—Transverse field types:

Type	Tip Diam.	Max. Field Gaussses	Meter Resolution (gauss/div.)
923-943	1/8"	111,110	1
920-940	1/4"	111,110	0.2
924-944	1/2"	11,111	.02
922-942	3/4"	1,111.1	.005
926-946	1 1/4"	111.11	.0005

An axial field type may be available soon with same range as 920-940. Prices, \$975 probes alone, \$2775 for complete gaussmeters.

Write for new bulletin.



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Association. His evidence included e/m (the ratio of charge to mass) for cathode rays (5×10^7 coulombs per gram), ultraviolet light corpuscles (7.3×10^7 C/g) and incandescent carbon corpuscles (8.6×10^7 C/g), and the charge e for Röntgen-ray ions (2.2×10^{-19} coulombs) and ultraviolet light corpuscles (2.3×10^{-19} C).

Thomson concluded that the first three kinds of particles were identical and had the same e/m . Having determined e for the UV corpuscles he necessarily attributed the same specific charge to the other two. Townsend had shown the same charge on the hydrogen ion in electrolysis (page 113).

Even the variation of e/m with the energy of the corpuscles was known at about that time, and a paper by Sir

Ernest Rutherford and A. G. Grier, communicated to the American Physical Society in April 1902, noted the conclusion from this theory (by then current) that "a portion of the effective mass is electrical in origin." The paper was published in the September 1902 issue of *Philosophical Magazine*.

Discovery of the electron did not wait for Millikan, who showed that ions changed the charge on oil drops by simple multiples of $\pm e$ and allowed the electric charge in the conducting plates to distribute as in a continuous electric fluid. His measurements were regarded as accurate, but unfortunately they contained greater errors than he suspected.

W. B. Lewis

Atomic Energy of Canada Limited
Chalk River, Ontario, Canada

Campus democracy

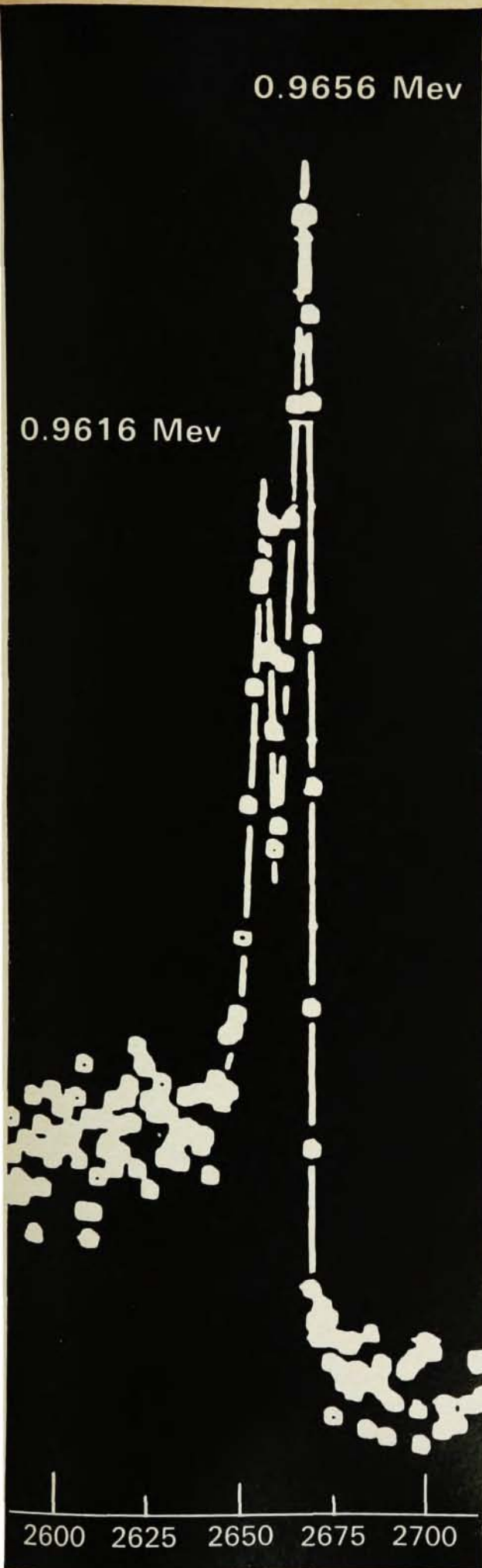
I read with great pleasure the answers given by several prominent scientists to your questions about evaluation of physics teaching ("Should Students Grade Professors?", *PHYSICS TODAY*, Jan. 1966, page 64). I couldn't agree more with the general opinion that evaluation of a teacher by his students is not only commendable but indispensable. Therefore I feel that further comment is needed regarding a few of the ideas expressed by one of the interviewed professors.

Professor Arnold Arons is quoted as saying, "I do not believe that a sound educational institution, with high academic standards, can possibly operate as a democracy. To see the chaos and debilitation that result from too much deference to student opinion, one has only to look at some of the Latin American universities that have been unfortunate enough to let student feedback take the form of student voice in university government."

I believe the ultimate proof that a particular university is a sound educational institution and has high academic standards is its ability to operate as a democracy since its prime goal is not to teach mathematics, biology or law, but to educate human beings to live in a democratic society.

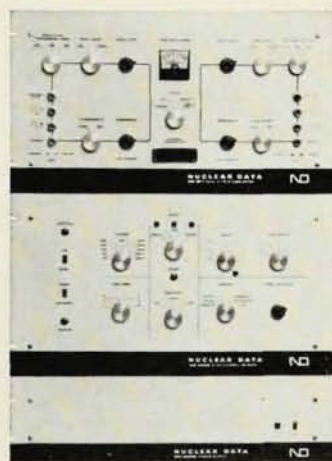
When Professor Arons talks about "too much deference to student opinion," it seems to me he implicitly postulates that students don't have a natural right to express their opinions about internal university problems and that it is the faculty's deference and benevolence that give students a voice in such matters. Professor Arons seems to forget that in the ultimate analysis the students are the university—or at least the most important part of it. If their natural right to a voice is not recognized we may very easily fall into the paradox of having students who, as citizens, are considered old and mature enough to go to the polls and vote for the man they want to be President of the United States, but too young and inexperienced to know what may be good or bad for their small community, the university.

I was a student for seven years in Argentinian universities and a teacher for more than two years, and I can say that Professor Arons's remarks about Latin American universities are, unfortunately, true. But they are not the whole truth: the other side of the coin is that when the universities were ruled through a vertical structure, and the voice of the students not only was not heard



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but was often silenced by violent means, the universities in Argentina reached their lowest academic standards and their poorest level of teaching.

I earnestly hope that PHYSICS TODAY's questionnaire to leading physics teachers is just the beginning of an exchange of ideas about the whole science of teaching, which, to my belief, has been too much neglected.

Angel M. R. Ferrari
Tennelec Instrument Co., Inc.
Oak Ridge, Tenn.

Reply from Arons

In a brief interview it is difficult to introduce all the qualifications that are needed to ensure wide understanding of what one is saying. In asserting that a sound educational institution, with high academic standards, can not possibly operate as a democracy, I was using "democracy" in a very literal sense—referring to a situation in which students would actually have a voice and a role in decision-making and government in *academic* matters.

A student's connection with an educational institution is a *voluntary* association, not a forced one. Implied in this association is a willingness on the part of the student to submit himself to a kind of discipline: that which resides not only in the learning process but also in the criticism and evaluation of his work by more experi-

enced scholars. That many students will eventually surpass the attainments of their teachers is one of the glories of the process and does not negate my contention. Most students need this criticism and evaluation in their formative years, and a formal student voice in academic matters inevitably undermines the levels and standards of this process. Under such circumstances, high standards of demand and performance simply can not be maintained. Mr. Ferrari acknowledges this impossibility by reference to his own experiences.

I would be the last person to contend that student opinions should not be heard, and I would be horrified at any activity being put down with violence. I believe strongly that students not only should be heard but should have a high level of participating *responsibility* in the government of nonacademic aspects of a university. When it comes to academic matters, however, I believe that although students should be able to express opinions to their hearts' content, they should be excluded from decision-making processes. This mode of operation is not democratic, and I categorized it accordingly. I assure you that I had no more intention of attacking or disparaging democracy than of attacking motherhood.

Arnold Arons
Amherst College

The metric system

The points made in your editorial "Meters for America" (PHYSICS TODAY, Feb. 1966, page 120) were well taken. I believe that a good presentation of the International System of Units (SI) would serve a useful purpose if included in PHYSICS TODAY.

As you point out, "the change isn't always easy. . . ." Now backing up to the second of your suggestions, that "the millimicron is better than the angstrom": the nanometer has replaced the millimicron.

I. R. Neilson
Loma Linda University

I applaud your editorial "Meters for America." I could not help being

amused that in the same issue of PHYSICS TODAY, on page 62, we have a 1250-pound solar observatory that is flying 21,600 miles; on page 65 we have a 65-ton electromagnet enclosing 30-inch dees; and on page 67 the solar wind varies from .67 up to 2 million miles per hour, with probes measuring 35 by 37 inches weighing 140 pounds being orbited into a band 40 million miles wide. Half a dozen more examples on the same page show that it is really going to be difficult for nonengineering types to make a complete conversion.

John V. Kline
Colorado School of Mines