Measuring G

Pascual A. Colavita, and J. W. Beams

Citation: Physics Today **24**, 12, 11 (1971); doi: 10.1063/1.3022460
View online: https://doi.org/10.1063/1.3022460
View Table of Contents: http://physicstoday.scitation.org/toc/pto/24/12
Published by the American Institute of Physics

Origin of the Black Hole

The priority for the concept of the black hole (January, page 30) must be claimed, it seems, for the fantastic novelist from Vienna, Gustav Meyrink (1868–1932), a former banker. In his formerly well known collection *Des deutschen Spiessers Wunderhorn* (The German Philistine's Enchanted Horn) (Munich, 1913) we find a story "The Black Ball."

A group of sages from Sikkim in the Himalayas travels through Europe and demonstrates glass tubes filled with a white powder, probably iodides. Whenever one thinks hard enough next to a tube, the object of one's thoughts appears within the tube. Thus fabulous Indian scenery, beautiful women and other good things are seen.

In the end, however, a professional army officer tries his luck. Thereupon there was some curious noise, and a black velvety sphere appeared. "The thing made the impression of a yawning hole, and indeed it was nothing else than a hole . . . Anything that bordered on it was forced to fall into it, was transformed there likewise into Nothing, and disappeared without a trace." This was even the fate of the officer's sabre, with which he touched the sphere. So gradually the whole world will be swallowed by the Black Hole, and this will be the end of the world.

The Indian sages regretted having travelled West, and so having risked the world that had been created by Brahma, maintained by Vishnu, and attacked by Siva.

E. Broda
University of Vienna
Austria

Physics 400 years ago?

The present stagnation in high-energy physics, and perhaps in physics in general, can be best understood by historical analogy. If the present mechanisms for funding research and for publication of scientific information had existed 400 or so years ago when the laws of planetary motion were being discovered, *The Physical Review* would have been full of such papers as "A Ten Epicycle Fit to the Orbit of Mars" and "A Fifteen Epicycle Fit to the Orbit of Jupiter." Copernicus and Kepler may well have had their papers rejected by the referees as being contrary to present scientific knowledge or as simply "too speculative."

The astronomical telescope would not have been invented yet, and it is doubtful that Galileo would have been able to obtain funding for the development of such an unconventional device. However, the Astronomical Exploration Commission (AEC) would be spending 250 million thalers on the National Astrolabe Laboratory (NAL), which would consist of an astrolabe one mile in diameter and its supporting equipment. While younger astronomers would complain that the expenditure of such an enormous sum on a single piece of equipment was depriving them of support and even of employment, the populace would be reassured by the "leading" (that is, well funded) astronomers of the day that such a device was absolutely necessary for the progress of planetary science since it would enable one to determine the position of a planet to a thousanth of a second of arc and hence determine the parameters in the epicycle fits to five more decimal places. Several years later, Isaac Newton, an undergraduate at Cambridge, having heard that there are no jobs in physics would decide to go to law school.

Robert J. Yaes
Illinois Institute of Technology
Chicago

Roentgen at Giessen

Your correspondent, Harald W. Straub, correctly points out in your July issue (page 62) that Roentgen discovered x rays at Wurzburg and not at Giessen. However, Roentgen was a professor at Giessen for six years (1879–85) before going to Wurzburg, and Giessen is sufficiently proud of the association to have erected a monument to Roentgen in the city park.

The monument is made of steel rods and a block of stone, designed to suggest the passage of x rays through matter. The accompanying snapshot was made in June 1971.

B. D. Cullity
University of Notre Dame
Notre Dame, Indiana

Measuring G

In his review on past attempts to measure G, J. W. Beams (May, page 35) failed to mention a resonance method due to Josef Zahradnicek (Phys. Zeits. **34**, 126, 1933) which I believe is of importance not only for the completion of the review but mainly because it is the first published method where accumulative effects of the gravitational action between masses is used.

Briefly, Zahradnicek's apparatus comprises two coaxial torsion balances. One, the outer balance, is an inverted U-shape beam supported at its midpoint by a steel suspension wire; at the lower terminals of the inverted U-beam, heavy lead weights are attached. The other, inner balance, is smaller and its axis lies vertically below that of the former. Its beam is a light horizontal bar with small equal lead spheres at its ends and is supported at its center by a fine torsion wire. Each of the balance suspensions carries a small mirror so that oscillations may be recorded photographically on a drum camera. The rest positions of the balances are adjusted to be in the same vertical plane.

The two balances are coupled by gravitational forces between the lead weights and, in particular, the small balance will be markedly affected by the much larger outer balance. The experimentor adjusts the period of the outer balance until resonance occurs; that is, when the amplitude of the small balance compared with the larger one is a maximum. The amplitudes and the logarithmic decrement of the inner balance determined by the photographic record, together with measurable dimensions including the moment of inertia of the small balance and its period in the absence of the outer balance, allow the calculation of G. Zahradnicek's value (1932) was:

$$G = 6.659 \pm 0.02 \times 10^{-8} \mathrm{cm^3 gm^{-1} sec^{-2}}$$

Pascual A. Colavita
Facultad de Ciencias FQM-UNC
San Luis, Argentina

The author comments: In my paper entitled "Finding a Better Value for G," only a relatively brief and incomplete history of the various methods of measuring G was attempted. As a result, just a few of the experiments described in the rather voluminous literature on the subject could be discussed. I certainly agree with Pascual

Colavita that any comprehensive history should include a discussion of the ingenious and carefully carried out experiment of Zahradnicek. A discussion of the work of Zahradnicek and of several others can be found in the references given in my paper. See F. C. Champion and N. Davy, *Properties of Matter*, Blackie, Glasgow (1959).

J. W. Beams
University of Virginia
Charlottesville

More ancient cathedral

The comments by Leon Cooper (July, page 62), concerning the "humble cathedral" of physics, recalled a preface to an earlier (by almost a half century) text on thermodynamics by Lewis and Randall.[1] In their preface they invoke the metaphor of thermodynamics as an ancient cathedral in which "the curious visitor speaks of serious things, with hushed voice, and as each whisper reverberates through the vaulted nave, the returning echo seems to bear a message of mystery." These authors go on to point out, however, that "in these loftier monuments of scientific thought a tradition has arisen whereby the friendly usages of colloquial speech give way to a certain severity and formality. While this may sometimes promote precise thinking, it more often results in the intimidation of the neophyte. Therefore we have attempted to temper the customary severity of science insofar as is compatible with clarity of thought."

I think Cooper is to be commended for seeking the same objective as that of Lewis and Randall, even though they express it in the somewhat flowery language of an earlier but, perhaps, more innocent age of science.

Reference

1. G. N. Lewis, M. Randall, *Thermodynamics*, McGraw Hill, New York (1923).

James T. Bergen
Armstrong Cork Company
Lancaster, Pa.

People half lives

In May 1970 (page 32) Walter Jordan published a list of death rates or risks that went as follows (in deaths per 10^6 hours of exposure): mountain climbing, 40; riding a motor cycle, 6.6; flying scheduled airlines, 2.4; smoking cigarettes, 1.2; disease and old age, 1.0; private cars in the US, 0,95; railroads and buses, 0.08; and radiation (5 rem per year) 0.05.

It is interesting to turn these into half lives or times by which half the people would be expected to have died *if* they exposed themselves to these risks continuously. Our risk table would look like this:

	Half life
Mountain climbing	2 years
Riding motorcycle	12 years
Flying scheduled airlines	35 years
Smoking cigarettes	63 years
Disease and old age	79 years
Private cars in US	84 years
Railroads and buses	994 years
Radiation (5 rem per year)	1600 years

These figures are not the whole story but do give a better perspective.

Paul H. Baldwin
University of Pittsburgh at Johnstown

Science and mysticism

It was unfortunate that the statement, "It should be especially useful in helping to win the struggle among today's youth between science and mysticism," appeared in your August editorial (page 88), implying that one must choose between the two. While it is difficult for scientists to accept some forms of mysticism, it is by no means certain that all mysticism must be rejected. Many scientists believe science and mysticism are incompatible, but this is a matter of belief, not accepted by all, and preferably not be put forth as necessary dogma. If science has no place for a person with mystical beliefs it will be much the poorer, in my opinion, and may indeed lose many in the struggle to be accepted as worthwhile.

If you are using the word "mysticism" to be synonymous with "astrology," then I would disagree with your use of the word.

George Ioup
Louisiana State University in New Orleans

More physics for people

I read with interest the recent letter of Kenneth W. Ford (September, page 9) wherein he calls on physics professors to rise to their responsibility to educate undergraduates who do not have professional goals in physics. At Sonoma we have come to recognize the validity of Ford's admonition at a relatively early point because the far majority of our 5000-member student body does not elect to major in the natural sciences. After much discussion and consultation with students we have begun this year a program of courses leading to a minor in physics that we believe reflects our obligation as physicists to educate people (as Ford emphasizes) as to the character of our science and its relation to their lives. Every student begins the program with a semester of descriptive physics or astronomy in which the subject is portrayed in a form consonant