books

The making of a cosmologist

My World Line: An Informal Autobiography

By George Gamow

178 pp. Viking Press, New York, 1970. $5.95

Reviewed by Ralph A. Alpher, Robert Herman

George Gamow generated a very broad world line with his fundamental contributions in nuclear physics, astrophysics, cosmology and biology, and with the glimpse of the fun and wonder of science that his popular books gave to a generation of young people. He has left behind many friends, in and out of science, whose lives have been enriched by their associations with him. Something of the pleasure and excitement in science and of the importance of personal relationships to Gamow emerges from his autobiography. For those who would better understand Gamow, for those who interpreted as egotism his drive, interest and enthusiasm for science, for those who misunderstood his immature desire to live his life as though he were immortal and for those not familiar with his impact on science, we recommend this autobiography most heartily.

The book is introduced by Stanislaus Ulam, who oversaw its publication, and whose foreword is an excellent review of the book itself. By far the largest part of the book is concerned with Gamow's life prior to 1934 when he first came to the US. There are many gaps in the early story and the post 1934 period is sketchy indeed. If he had time to flesh out the more recent history, not only would it have been fascinating reading but it would have made the entire book a most valuable document in the "Sociology of Science." As limited in scope as the book is, it is nevertheless rich in accounts of Gamow's interactions on a personal level with many of the greats of physics during the "golden twenties and thirties."

Somehow Gamow's life in those aspects peripheral to his scientific activities displayed a richness of almost unbelievable incidents, and his recollections of his life before 1934 recounts many of these. For example, his grandfathers were a Metropolitan and a Czarist army colonel, respectively, and his father was a schoolteacher whose students included Leon Trotsky. His early inquisitiveness included a microscopic comparison of sacramental and nonsacramental bread and wine, with consequences for his life-long attitudes towards formal religion.

Other fascinating incidents include his commission as a Red Army colonel at age 20, which made it possible for him to teach at a Soviet military school and caused him some problems with security clearances later on; his stories of his first drink (absolute alcohol in a lab); his love for literature and especially poetry, and his amazing ability to recite poetry at great length from memory—particularly Pushkin's privately printed verse; his difficulty with the French verb "baiser;" his escape from Russia during the early 1930's (by itself so fascinating as to have been reprinted in *Saturday Review*)—the list goes on and on. The book contains

In Copenhagen, November 1930. Left to right: Lev Landau, Aage Bohr, George Gamow, Eric Bohr and Edward Teller.

an almost equal number of charming anecdotes directly related to Gamow's scientific activities, as well as a selection of interesting photographs from his album.

There is an equally rich core of incidents during the last 30 years of his life of which, unfortunately, only a small number are recounted in the book. We hope that many will read this book for the insights it provides into the life of a great physicist and fascinating human being.

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Both reviewers worked with Gamow at the Applied Physics Laboratory, in Silver Spring, Md., around 1950 on the calculation of the expected abundances of the atomic species when the universe was formed. Alpher is now with the General Electric Co and Herman with General Motors research Laboratories.

Demonstrations in Physics

By Julius S. Miller
444 pp. Ure Smith, North Sydney, Australia, 1969. $5.50

Lecture demonstrations have an uneasy reputation nowadays. We are told that students learn by what they do, not by what they watch, even if the demonstrations are entertaining. But doing physics is both performing experiments and thinking. And demonstrations, if accompanied by questions, can stimulate much thinking. In that, they are often better than work in the laboratory, where many teachers find it difficult to replace explanations by questions.

This book has hundreds of "demonstrations"—most of them as easy for a student to do as for a professor to show—and thousands of questions.

Readers who know Miller's enthusiasm might expect to find a rapid stream of simple, striking experiments tearing across every page—each quickly described, then on to the next. Instead, this is a book of *questions*, offering much food for thought introduced by simple experiments. The experiments are simple and clearly described: some of them old friends, some of them striking new ones—as I would expect. But the meat is in the questions. Here are some samples:

An early page is headed "Experiments on Static Forces" and among many experiments:

IV. Ice Tongs

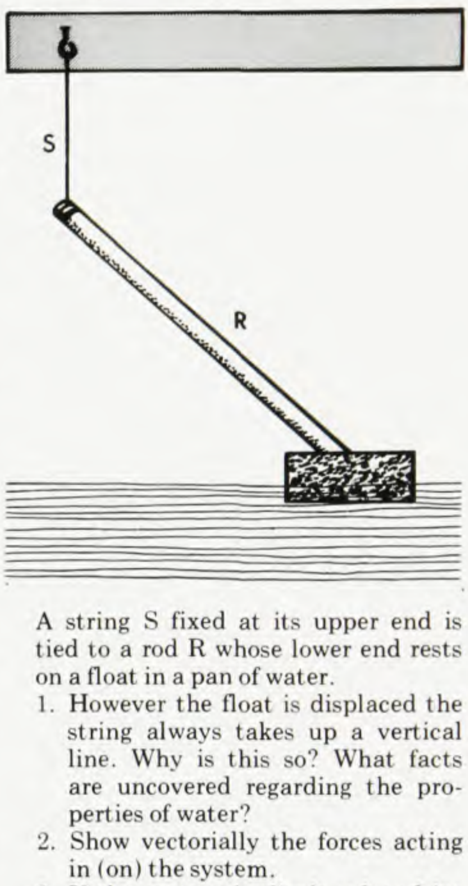
Borrow one from your ice-man or fashion one from two rods appropriately bent and pinned.

[*Shown by sketch*]

1. The ice-man cometh! Assign some appropriate dimensions to this device and find the normal force with which the points of the tongs dig into the ice.
2. Devise an *experimental* set-up to determine the normal force which the prongs provide.
3. Show how it is that this device works even when only one handle is held. Show the forces which arise.
4. With one handle held what position does the system take?

and before that:

I. String, Stick and Float in Water



A string S fixed at its upper end is tied to a rod R whose lower end rests on a float in a pan of water.

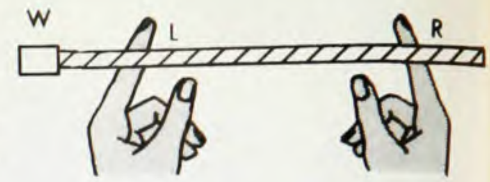
1. However the float is displaced the string always takes up a vertical line. Why is this so? What facts are uncovered regarding the properties of water?
2. Show vectorially the forces acting in (on) the system.
3. If the system is displaced and let go it returns to the equilibrium position (string vertical) but overshoots it. Discuss why this is so. Discuss the oscillatory motion which ensues.
4. Suppose we used, instead of water, a liquid like oil or molasses. Explore the consequences. How about mercury?

And then on to the meter-stick resting on two fingers, sliding. That leads to a dynamical question much later:

I. Meter Stick and Block on Two Fingers

A meter stick (or any rod) rests on two fingers L-R. On one end rests a block W.

1. If *both* fingers are suddenly removed (by moving them down swiftly, say) the stick clings to the block and they fall together. If, however, L alone is suddenly re-



moved the stick is effectively hinged at R whereupon the end of the stick bearing W *falls away* from the load. Explain all this.
2. Would it alter things if the supports were put asymmetrically?
3. How would things go if the stick were not uniform?

and on to center of percussion.

The "Galileo" experiment of letting two unequal balls fall freely has 26 questions; among them are:

17. Explore the problem of a body falling from an infinite distance (called the velocity from infinity) and discover that it would reach the earth with a velocity of about 7 miles/second [$V_\infty = (2GM/R)^{1/2}$] This is also the 'escape velocity' for the earth.
18. Beginners have the 'feeling' that a body falling to the earth from infinitely far must have an infinite velocity acquired in infinite time. Argue this for a beginner.

Among many surface-tension experiments are:

The Double-bubble Paradox

A T-tube arrangement with small funnels permits the simultaneous blowing of two bubbles A and B.

[*Sketch*]

3. Blow bubble B much larger than A. Close valve V. The bubbles are now connected with each other but not with the atmosphere. What do you think will happen? Why do you say this?
4. Having observed what *does* happen what must you now say?
6. Prove that the pressure in a *bubble* (more exactly, the pressure difference across the film surface) is inversely as R. ($\Delta P = 4T/R$).
7. Consider blowing up a toy balloon. Is this the same problem?
8. Show that for a liquid drop (which has only one surface film) the difference between the pressure of the liquid and that of the outside air is $\Delta P = 2T/R$.
9. *A certain toy whistle is excited, that is, made to sing, by blowing up a toy balloon which 'blows' the whistle when it, the balloon, deflates. It is observed that the pitch of the whistle is *higher* when the balloon gets *small*. Does this not seem contrary to expectations? Explain it.