CONICAL SNOW

THE writer has read with much interest recent articles in SCIENCE, treating of conical snowflakes. Every late autumn and early spring there occurs at Jericho, in northern Vermont, and of course at other similar localities, several falls of such snow, and also an occasional one in winter. It comes only out of cumulo-nimbus clouds, and more commonly when the surface temperature ranges from 34° to 44° F. Conical snowflakes have a granular texture and are built up mainly from countless undercooled cloud droplets that have frozen loosely together. Their greatest diameter ranges from one sixth to one third inch. The writer assumes, from a longtime study of this form of snow, that the nuclei usually, if not invariably, consist of branching tabular crystals.

It is of much interest to consider the conditions within a cumulus cloud that conspire to make the undercooled droplets so arrange themselves upon a tabular snow crystal as to form a granular snow cone. It is certain that, owing to its lightness, a tabular branching snow crystal within a cumulo-nimbus cloud is first wafted upward and about by turbulent air currents. This causes it to become thickly coated on both sides with frozen cloud droplets or granular snow. It now begins to fall with the denser side turned downward, and since it falls faster than the cloud droplets, light granular material then rapidly collects on (is caught by) the under face, thereby destroying the former gravitational equilibrium of the mass and causing it to upset, whereupon the granular snow is caught exclusively, or nearly so, by the new underside, and thus the whole converted into a more or less well-defined double cone with its abutting bases on the opposite sides of the initial tabular crystal. It is conceivable, given a cumulo-nimbus cloud of sufficient thickness, that additional upsettings might occur and thus cause the double cone to become more nearly symmetrical about its basal plane than it otherwise would be.

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[1] An obituary note of Mr. Bentley will be found in the present issue of SCIENCE.

RELATIONS BETWEEN FUNDAMENTAL PHYSICAL CONSTANTS

IN an article with the above title, J. E. Mills[1] gives a number of numerical coincidences, such as $(2\pi\, c)\, m_0{}^6 = 10^{-151}$, $(2\pi\, c) h^{3/2} = 10^{-28}$, $(2\pi\, c) e^{6/7} = 10^{23/7}$, where c = velocity of light, m_0 = mass of electron, h = Planck's constant, e = electronic charge. Since the numerical values of the constants that he quotes are those suggested by me in 1929[2] I may perhaps be permitted a few words on the subject.

It seems necessary, from time to time, to call attention to the fact that the *numerical* value of any constant, or combination of constants, is entirely arbitrary if the constant, or combination, possesses dimensions. The value in such cases depends directly upon the unit adopted for each dimension. Mills uses values in the C. G. S. system, and these values accordingly depend upon the arbitrarily chosen units of length, mass and time—the cm. gram and second. It is almost inconceivable that there should be an accidental theoretically significant relation between these three units, whose origin is too well known to restate. All the combinations of constants given by Mills have dimensions, and all are equated to 10^n, where n is an integer or fraction.

It is only in the case of dimensionless combinations that the numerical value can have theoretical significance. The two most famous combinations of this character are the fine structure constant α $(= 2\pi\, e^2/hc)$ and the ratio of the mass of the proton to that of the electron. There are in the literature several articles discussing the possible theoretical significance of these two pure numbers (approximately 1/137 and 1840, respectively). As a much more striking example of the type of numerical coincidence found by Mills, one may quote the known values, mass of electron $= 9.035 \times 10^{-28}$ gram, angular momentum (spin) of electron $= 9.02 \times 10^{-28}$ erg. sec (see, for instance, Pauling and Goudsmit, "Structure of Line Spectra" page 54). But one can not equate grams to erg. sec any more than one can equate horses to oranges—to use a homely but correct analogy.

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[1] SCIENCE, 75: 243, Feb. 26, 1932.
[2] *Physical Review Supplement*, 1, 1, 1929.

SPECIAL CORRESPONDENCE

THE PHILADELPHIA INSTITUTE FOR MEDICAL RESEARCH

MEDICAL service is about to receive an important addition through the creation of the Philadelphia Institute for Medical Research. The institute will begin its work next fall. Dr. Leonard G. Rowntree, now director of clinical investigation of the Mayo Clinic, Rochester, Minnesota, and professor of medicine in the University of Minnesota, has been appointed director.

This institute will center its activities in the great Philadelphia General Hospital. Here, in so far as medical research is concerned, it will afford a common meeting place for all medical school services centered in the Philadelphia General Hospital. In addition, however, the new institute will hold itself ready to cooperate, aid and foster medical research by collaboration or affiliation with any or all medical and allied institutions desirous of establishing such a relationship.

Why, one may ask, is so much emphasis placed upon the need for medical investigation? Because experience has shown that progress in the past has come largely through this channel and because it is realized that investigation is essential for the better understanding of disease, its prevention and cure and for the better care of the sick. These various considerations constitute the sole object of the Philadelphia Institute for Medical Research.

Research in medicine in the past has come largely through contributions from universities, medical schools, their hospitals and clinics. More recently, because of urgent need, special institutions of research have been created in certain of the great cities in Europe and this country, the best known being the Pasteur Institute in Paris, the Rockefeller Institute for Medical Research in New York City, and one of quite recent date, the Thorndike Laboratory in the Boston City Hospital. All these institutes have made tremendous and permanent contributions to medicine, and added much to the welfare of mankind.

The Philadelphia Institute for Medical Research will occupy a somewhat analogous position to the Thorndike Institute and will concern itself with what is termed clinical investigation, *viz.*, the study of the sick and the diseases from which they suffer. Research will be made for methods of value for the prevention of disease, for improvements in methods of its study, and of diagnosis and treatment of disease, more especially in the earlier stages. Research will be prosecuted also in the fundamental branches of science underlying medical knowledge.

A pioneer feature of this new institute is the attempt to center and foster research through affiliation and collaboration with all medical institutions in Philadelphia, centering its efforts in the Philadelphia General Hospital.

In 1922 a group of Philadelphia physicians, realizing the supreme importance to humanity of research in medicine, arranged a centenary celebration of the birth of Pasteur, which led to the foundation of the Philadelphia Institute for Medical Research, the charter members of which were: Dr. William Duffield Robinson, Admiral William C. Braisted, Dr. Judson Daland, Dr. Frances X. Dercum, Dr. McCluney Radcliffe, Provost Edgar Fahs Smith, Dr. Charles A. E. Codman, Hon. Hampton L. Carson, Joseph Carson, Esq.

In establishing an institution of this kind, it is of the utmost importance to find a man to act as director, possessing the necessary knowledge, enthusiasm, training and proven ability to lead, in all questions concerning medical research. Such a man was found in the senior medical consultant and director of clinical investigation of the Mayo Clinic, Rochester, Minnesota, Dr. Leonard G. Rowntree, who will assume the duties of director at the opening of the institute in the fall of this year.

Plans are under way for the organization of the personnel of the institute.

A site, on the grounds of the Philadelphia General Hospital, has been assigned by the city council for the erection of a new building, at such time as funds become available. In the beginning, however, the institute will occupy temporary quarters in a new building now under construction, at the Philadelphia General Hospital, and will function in conjunction with the staffs of that hospital.

JUDSON DALAND,
President

PHILADELPHIA

QUOTATIONS

ON THE RELATION BETWEEN THE EXPANSION AND THE MEAN DENSITY OF THE UNIVERSE[1]

IN a recent note in the *Göttinger Nachrichten,* Dr. O. Heckmann has pointed out that the non-static solutions of the field equations of the general theory of relativity with constant density do not necessarily imply a positive curvature of three-dimensional space, but that this curvature may also be negative or zero.

There is no direct observational evidence for the curvature, the only directly observed data being the mean density and the expansion, which latter proves that the actual universe corresponds to the non-statical case. It is therefore clear that from the direct data of observation we can derive neither the sign nor the value of the curvature, and the question arises whether it is possible to represent the observed facts without introducing a curvature at all.

Historically the term containing the "cosmological constant" λ was introduced into the field equations in order to enable us to account theoretically for the existence of a finite mean density in a static universe.

[1] Article by Professors A. Einstein and W. de Sitter in the *Proceedings* of the National Academy of Sciences for March. Communicated by the Mount Wilson Observatory, January 25, 1932.