problem 8 it was asserted that a dynamical flow is necessarily conservative; in problems 9 and 10 that, certain cases aside, not only are the periodic motions everywhere dense but *the stable periodic motions are everywhere dense and dense on themselves.* Here a stable periodic motion was defined purely topologically as any periodic motion in whose infinitesimal vicinity lie other complete motions. A partial converse is known to hold through results obtained by D. C. Lewis and the lecturer.

Problem 11 was of a nature intermediate between the case of an abstract space $R$ and a space $R_n$ of $n$ dimensions, and was the only problem not stated in complete form. It called for the appropriate generalization to a gas of certain remarkable results for the famous three-body problem due to Sundman, and extended by the writer and Hinrichsen to $n > 3$ bodies and to a more general law of force than that of Newton.

Problem 12 called for an example to show that in the case of a continuous (non-conservative) flow in a space $R_n$ of $n \geqq 3$ dimensions, the ordinal series of "wandering motions" leading to the central motions need not always terminate in $n$ or fewer steps.

In problem 13 it was conjectured that essentially the only 3-dimensional discrete flows which are "regular" in the sense of Kerékjártó are (1) combined rotations of three circles into themselves; (2) combined rotations of circle and surface of a 3-sphere into themselves; (3) rigid rotation of a 3-dimensional hypersphere into itself.

Problems 14 and 15 were closely related. The first of these asserts that a 1–1 direct analytic area-preserving deformation of the surface of a sphere into itself which has two fixpoints, and is such that iterates of the transformation have no other fixpoints, is a pure rotation from a topological point of view. Considerable evidence was adduced for this conjecture. The second problem embodied an analogous conjecture concerning a plane circular ring.

The last two of the announced problems (problems 16, 17) will perhaps excite the most interest, since they embody conjectures which in a certain sense yield a kind of complement to the famous "last geometric theorem" of Poincaré, announced as probably true by Poincaré shortly before his death and established subsequently by the lecturer. Suppose that there be given a ring-shaped part of the plane bounded by two concentric circles. Suppose that this ring is deformed into itself in any way so that the areas of small figures are conserved, while the points on the two circles are advanced by angular distances $\alpha$ and $\beta$. If $\alpha$ and $\beta$ are distinct, Poincaré's theorem leads at once to the conclusion that there are infinitely many periodic sets of points under the indefinite repetition of this deformation. But if $\alpha$ and $\beta$ are equal, his theorem is not applicable. The conjecture was made that the same result (as well as other more specific ones) will hold in the case $\alpha = \beta$, provided that some nearby points of the ring become separated widely in an angular sense by sufficient repetition of the deformation, as clearly happens when $\alpha$ and $\beta$ are unequal. This conjecture was proved in the very important special case when the given conservative deformation can be expressed as the product of two involutoric deformations.

In consequence, for the classic restricted problem of three bodies treated by the American astronomer G. W. Hill, so long as there exists a "surface of section," either there exist infinitely many periodic motions (for a given value of the "constant of Jacobi") or all possible motions of the "infinitesimal body" (the Moon in the Earth, Moon, Sun case) will necessarily have the same mean rate of synodical advance of perigee about the near-by finite body (the Earth), per synodical revolution. It was also pointed out how the absence of infinitely many periodic orbits would indicate that a new *qualitative* integral exists, in addition to the usual analytic integral of Jacobi.

The problems presented and discussed by the writer will be likely to receive attentive consideration from other mathematicians inasmuch as they embody challenging conjectures concerning important open questions in the actively advancing field of theoretical dynamics.

# OBITUARY

## ELMER SAMUEL IMES

IN the death of Elmer Samuel Imes science loses a valuable physicist, an inspiring personality and a man cultured in many fields.

Professor Imes was born on October 12, 1883, in Memphis, Tennessee, the son of Home Missionary parents. His father, Benjamin A. Imes, a graduate of Oberlin College and Theological Seminary, was among the pioneers in educational and church work in the southern field of the American Missionary Association.

Imes taught for many years in the American Missionary schools, principally in Albany Normal School, Albany, Georgia, before he pursued his ultimate and highest interest, the field of physics and its educational and commercial adaptations.

He was graduated from Fisk University in 1903, and did graduate study both there and in the Uni-

versity of Michigan, from which institution he received his Ph.D. degree, his thesis having to do with infra-red spectra, a subject on which he has acquired an international reputation. Prior and subsequent to receiving his degree he was a research and consulting engineer and physicist. For ten years, ending on his death on September 11, 1941, he was professor of physics and head of the department of physics at Fisk University, Nashville, Tennessee, where he created a highly efficient organization.

He leaves a mother, Mrs. Elizabeth W. Imes, and two brothers, Albert L. Imes, of Cincinnati, Ohio, and the Reverend William Lloyd Imes, pastor of St. James Presbyterian Church, New York City.

It was the writer's privilege to become acquainted with Professor Imes in his graduate student days at the University of Michigan, where his research laboratory was a mecca for those who sought an atmosphere of calm and contentment. Peacefully smoking his pipe, Imes could always be relied upon to bring to any discussion an atmosphere of philosophic soundness and levelheaded practicalness. Gifted, moreover, with a poetic disposition, he was widely read in literature, and a discriminating and ardent appreciator of music. He had a delightful sense of humor and a skill in repartee, which he always used, however, with the kindliness and consideration so characteristic of his sensitive nature. In his passing, his many friends mourn the loss of a distinguished scholar and a fine gentleman.

W. F. G. SWANN

BARTOL RESEARCH FOUNDATION
OF THE FRANKLIN INSTITUTE,
SWARTHMORE, PA.

## MAX KRISS
1894–1941

PENNSYLVANIA STATE COLLEGE lost one of its leading scientists as Dr. Max Kriss died from coronary embolism on November 16 after an illness of two weeks.

During twenty-three years as a member of the staff of the Institute of Animal Nutrition, Dr. Kriss became one of the world's leading authorities on the energy metabolism and ventilation requirements of domestic animals, the net energy values of feeding stuffs and the influence of nutrient compounds, especially amino acids, on the heat production of animals.

Born on May 15, 1894, at Ostropol, Russia, the son of Joseph Kriss, a scribe, and his wife Fannie, Max Kriss came to the United States in 1910. He earned his own way through Pennsylvania State College by labor and by teaching Russian and Hebrew. Being graduated in 1918, he became a member of the staff of the Institute of Animal Nutrition under the direction of Dr. Henry Prentiss Armsby, and at the time of his death held the rank of professor of animal nutrition.

At Pennsylvania State College, Kriss received the degree of master of science in 1920, and at Yale University the degree of doctor of philosophy in 1936.

He was the author or co-author of more than 50 scientific papers dealing with animal nutrition. Always a modest, kindly and charitable gentleman he gave great pleasure to his associates during discussions of scientific problems because of his fair and scholarly disposition.

He leaves a wife and one son, Joseph, who is a student at Yale University School of Medicine.

E. B. FORBES

PENNSYLVANIA STATE COLLEGE

## DEATHS AND MEMORIALS

DR. ELSIE CLEWS PARSONS, president of the American Anthropological Association, died on December 19. She was sixty-six years old.

PROFESSOR ROLLIN LANDIS CHARLES, head of the department of physics at Franklin and Marshall College since 1922, died on December 13 at the age of fifty-six years.

DR. PAUL HENRY HANUS, professor emeritus of education at Harvard University, died on December 14 at the age of eighty-six years. An important advance was made in 1891 when Dr. Hanus was appointed assistant professor of education at Harvard University through the influence of President Eliot.

DR. FRANK CONRAD, assistant chief engineer of the Westinghouse Electric and Manufacturing Company of Pittsburgh, died on December 11 at the age of sixty-seven years.

DR. VLADIMIR J. FEWKES, archeologist, research associate of the museum of the University of Pennsylvania, died on December 11 in his forty-sixth year.

A BUST of the late Dr. William H. Nichols, donor of the Nichols Chemistry Building of New York University, acting chancellor of the university in 1929, was unveiled at an informal ceremony in the Nichols Building on December 19. The bust was given to the university by Mrs. Madeline Sharp, daughter of Dr. Nichols, and was accepted by Dr. John P. Simmons, director of the Nichols Laboratory. Other speakers were Dr. Harry Lindwall, chairman of the department of chemistry of the University College of Arts and Pure Science; Dr. Henry J. Masson, chairman of the department of chemical engineering of the College of Engineering, and Dean Thorndike Saville, of the College of Engineering.