Society" had been formed in the meantime and these two became merged in 1769, after prolonged negotiations, with a new name that has since become familiar, "The American Philosophical Society held at Philadelphia for Promoting Useful Knowledge."

The well-known "American Academy of Arts and Sciences," established in Boston, was incorporated in 1780. The "Academy of Arts and Sciences of the United States of America" was started about 1788 in Richmond, Virginia, but did not thrive very long.

In the presidential administration (1801–1809) of Thomas Jefferson, who was prominent in the American Philosophical Society and was in touch with the intellectual life of his period, was established the United States Corps of Engineers, which was a nucleus for the "United States Military Philosophical Society." The latter, which was apparently the first truly national American scientific society, died soon after 1810. The "Columbian Institute for the Promotion of Arts and Sciences," incorporated by Congress in 1818, soon passed into the "National Institution for the Promotion of Science," organized in 1840. That institution arranged a national congress of scientific men, held in Washington in April, 1844, to which were invited all other American scientific organizations and all individuals interested in the advancement of knowledge, but no other meetings of that kind were held and the National Institution finally went out of existence in 1861.

Under the leadership of Dr. John Collins Warren, a Boston group urged the desirability of forming an American association after the pattern of the British Association for the Advancement of Science, but they referred their proposal to the American Philosophical Society and received a discouraging reply in April, 1839. Meanwhile, the "Association of American Geologists" had been organized. It held its first and second meetings at Philadelphia (1840, 1841) and its name was changed to "The Association of American Geologists and Naturalists" at its third meeting, held at Boston in 1842. The last meeting of this organization occurred in 1847, also in Boston. At that meeting, in which Dr. Warren took part, it was voted that the "Association of American Geologists and Naturalists" should resolve itself into the "American Association for the Promotion of Science" and it was arranged that the resulting enlarged association should hold its first meeting at Philadelphia the following year. At the first session of that first meeting, on September 20, 1848, the name of the organization was changed to the "American Association for the Advancement of Science," and William C. Redfield was elected and installed in the afternoon of the same day, as the first president of the association. The association was incorporated by act of the Senate and House of Representatives of the Commonwealth of Massachusetts in March, 1874.

An account of the history of the American Association, by Dr. Herman W. Fairchild, presented at the seventy-fifth anniversary meeting, at Cincinnati, in December, 1923, was published in SCIENCE, Volume 59, 1924.

Besides the chapter on background and origin, this last volume of Summarized Proceedings contains much interesting information about the recent activities of the association. A graph shows that the paid-up membership increased rather steadily from 10,002 in 1920 to 18,269 in 1931, after which it decreased to only 15,728 in 1933, but it increased to 16,429 in 1934. The volume reports annual meetings held at Des Moines, Cleveland, New Orleans, Atlantic City and Boston, and the intervening summer meetings, with the usual lists of officers and references to notes and addresses that were published in SCIENCE. It contains the complete list of sustaining and life members and the very useful Directory of Fellows and other Members, corrected to June, 1934.

For the first time, the value and usefulness of the directory are greatly enhanced by the addition of an 82-page geographical index, which shows the section enrolment of every member. By means of this index, it is easy to ascertain exactly which members reside in any locality and to classify them according to the branches of science in which they are engaged.

Copies of the book may be obtained from the office of the American Association, Smithsonian Institution Building, Washington, D. C., the postpaid prices being $3.00 (cloth binding) or $2.50 (paper cover) to those whose names occur in the directory, and $4.00 or $5.00 to others.

BURTON E. LIVINGSTON

## REMARKS ON SULAIMAN'S THEORY OF RELATIVITY

IN view of the interest aroused in Sir Shah Sulaiman's new theory of relativity[1] by Professor Shapley's characterization of it in SCIENCE for November 16, 1934, as one of the "high-lights of astronomy during the past year," the following considerations may be of interest.

Sulaiman bases his theory of gravitation on "gravitons," fine particles "at present beyond the range of our perceptions." It appears, from the brief statement in his first paper, that this hypothesis is essentially the same as that put forward by LeSage in 1764 as an explanation of gravitation.[2] Also, both

[1] *Proc. Acad. of Sciences, U. P., India*, Vol. 4, Part 1, pp. 1–36, 1934.

[2] Cf. *Enc. d. Math. Wiss.*, Band V–1, pp. 57–64 or, more briefly, Lorentz, *Lect. on Theor. Phys.*, vol. 1, pp. 151–155.

theories lead to a shifting forward of the direction of attraction between two relatively moving bodies, a phenomenon exactly analogous to the aberration of light.

The effect of this aberration on the planetary orbits was first discussed by Laplace. He found that the resulting tangential acceleration of the planets had no effect on the longitude of perihelion, but introduced secular perturbations in the semi-major axis and eccentricity of the orbit and in the mean longitude of the planet in the orbit.

According to Jenneck,[3] calculations based upon Laplace's theory and upon the unexplained secular variations of the semi-major axis of the moon's orbit give as the lower limit of possible values for the velocity of propagation of gravitation about $10^8$ times the velocity of light. Chazy[4] makes the following statement:

> Si l'on admet comme résultat des observations que l'accroissement séculaire de la longitude ne peut dépasser 2″ pour la Terre et 0.5″ pour Mercure, et si l'on cherche à expliquer par l'hypothèse précédente [Laplace's hypothesis] une accélération de la Lune de 2″ au plus par siècle, on obtient trois limites inférieures de la vitesse $V_1$ [velocity of propagation of gravitation] voisines respectivement de 6 millions, 600 millions et 30 millions de fois la vitesse de la lumière.

Sulaiman introduces, in effect, a slight modification of Laplace's theory in changing the magnitude of the attracting force (which Laplace kept unchanged from the Newtonian law) by the factor $\left(1-\frac{v}{D}\right)^3$, v being the radial velocity and D the velocity of propagation of gravitation, assumed by Sulaiman to be nearly equal to the velocity of light. The net result of this change is to introduce an advance of the perihelion close to the desired value in the case of Mercury. However, nothing is accomplished toward removing the objectionably large secular perturbations of Laplace's theory; on the contrary, the perturbation of the eccentricity is doubled.

To be specific with regard to this last point, calculations based upon Sulaiman's formulae (calculations which he apparently has not carried out) give for the secular logarithmic perturbations, in one earth year, of the semi-major axis and eccentricity, respectively, of Mercury's orbit the values .009643 and .01275. Tisserand,[5] quoting Newcomb's "Fundamental Constants of Astronomy," gives in the case of the eccentricity the discrepancy between Newtonian theory and observation (reduced here to a period of one year) as $(-4.3 \pm 2.5) \times 10^{-8}$—of opposite sign from the change predicted by Sulaiman's formula. In the case of the eccentricity of Venus, Earth and Mars, Newcomb and Sulaiman agree as regards sign; but to bring the values calculated from Sulaiman's formula into agreement with Newcomb's figures, it is necessary in using Sulaiman's formula to give D values ranging from $6 \times 10^4$ times the velocity of light (Mars) to $2 \times 10^6$ in the case of the earth.

The absurd size of Sulaiman's perturbations may be realized from the fact that the above calculated perturbation in Mercury's eccentricity is equivalent to an absolute yearly increase of .0026 in the eccentricity. As the eccentricity increases this of course does not remain constant; but taking it as a constant for the sake of illustration, Mercury's eccentricity would in 300 years reach unity and the planet would go off in a parabolic orbit!

Sulaiman's theory, in so far as it relates to gravitation, would seem, then, to founder on the same rock as Laplace's mathematically analogous theory and the modified forms of LeSage's physically similar theory. Neither are valid unless to the velocity of propagation of gravitation is assigned enormous values from $10^5$ to $10^8$ that of light; and aside from the objections to this, if this is done in Sulaiman's case, the desired advance of the perihelion is reduced to a negligible value and the theory accomplishes nothing in gravitational phenomena.

I take this opportunity to make acknowledgment of my indebtedness to Professor H. P. Robertson, of Princeton University, who suggested this investigation and gave valuable assistance in the pursuit of it.

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[3] *Enc. d. Math. Wiss.*, Band V–1, p. 49.
[4] Chazy, "La Théorie de la Relativité," vol. 2, p. 134.
[5] Tisserand, "Mécanique Celeste," vol. 4, p. 535.

## LAST CALL FOR CULTURE METHODS

THE committee of American zoologists, commissioned to compile and issue a compendium of culture methods for invertebrate animals, desires to express its appreciation of the cordial cooperation already received and to issue a last call for further contributions.

The committee met in Pittsburgh on December 26 and went over the large number of valuable manuscripts already received, making note of others promised and of the many gaps still remaining. The month of June, 1935, has been set as the latest date for the receipt of further contributions. It is the hope of the committee that the volume containing these contributions may be ready for the printer in September.

The committee is receiving articles on culture methods and lesser notes on the "tricks of the trade" from those who have had experience. These will be as-