seconds of arc per century. But this value of m, namely 1.50 kms., depends entirely upon the choice of the fundamental units of length and time. For, in celestial dynamics, mass is a derived unit and involves the units of time and distance. This relation is well known and is given by Eddington in the form:

$$m = v^2 r,$$

where r is the distance of any planet from the sun and v is the velocity of the planet in its orbit.

This expression for the mass of the sun will become linear when v is expressed as the ratio of velocities, is expressed in terms of some arbitrary unit of velocity. The numerical value of m will, therefore, vary according as to what is assumed as 'unit velocity." But unit velocity is the distance travelled in unit time, and hence "unit velocity" depends upon the system of units adopted for length and time.

In ordinary astronomical convention, the unit of length is the distance of the earth from the sun and the unit of time is the *mean solar day*. Using this system of units, the mass of the sun, expressed linearly, becomes:

$$m = 44{,}800 \text{ kms.}$$

With the ordinary system of units of the physical laboratory, in which the *centimeter* is the unit of length and the *second* is the unit of time, this linear value of the mass of the sun becomes:

$$m = 13.5 \times 10^{20} \text{ kms.}$$

The relativity system of units, adopted by the relativists, is adjusted so as to make the velocity of light "unity": in this system, therefore, the unit of length is the *kilometer* and the unit of time is the *1/300,000th part of a second*. And in this system of units, the linear value of the mass of the sun is expressed by:

$$m = 1.50 \text{ kms.}$$

as given by Eddington.

Now, when these various values for the "linear mass" of the sun, or for the constant m of relativity, are substituted in the formula for the motion of the apse-line, the respective motions of the perihelion of Mercury in one century become:

For astronomical units,	this motion becomes 357°, or very nearly a complete revolution.
For physical units,	this motion becomes 3×10^{16} complete revolutions: or the orbit is revolving at the rate of 9.5×10^{6} complete revolutions *per second*.
For relativity units,	this motion becomes the celebrated 43 seconds of arc.

Thus, if the m in the relativity formula for the motion of the perihelion represents the *"gravitational mass of the sun,"* as stated and claimed by the relativists, then the relativity motion of a planetary orbit depends entirely upon the system of fundamental units adopted for measuring length and time; depends absolutely upon what is called "unit velocity." Can such a motion, a motion which changes with the units employed, represent a physical fact? Is it not, rather, purely a mathematical illusion, due to an erroneous interpretation of an equation?

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COLUMBIA UNIVERSITY,
May, 1924

WAXY ENDOSPERM IN NEW ENGLAND MAIZE

THE peculiar type of endosperm texture in maize, familiar to geneticists as "waxy," which has previously been found only in isolated localities in China, Burma and the Philippines,[1] has recently appeared in a New England variety grown at the Connecticut Agricultural Experiment Station.

Waxy seeds were found by Dr. D. F. Jones in the fall of 1922 on two hand pollinated ears of Sanford's White Flint which were segregating in the proportion of 3 starchy: 1 waxy. Both of these ears are the progeny of a single open pollinated ear which had been received in a lot of 25 ears of this variety obtained from a farmer near Kent, Connecticut, in the spring of 1922.

The recessive seeds from one of the segregating ears were planted in 1923 and crosses were made with a waxy strain secured from Mr. G. N. Collins, of the Bureau of Plant Industry, who had obtained this type originally from Shanghai, China. When pollen from the Chinese waxy was applied to the silks of the New England waxy, only pure waxy seeds resulted, proving that the two strains are genetically identical in their type of endosperm.

As far as is known the only waxy maize ever grown in Connecticut is the Chinese strain, which has been used in genetic investigations on the experiment station farm for a number of years. No corn of any kind has ever been sent from the station to the locality from which the ears of Sanford's White Flint were obtained, and it is scarcely possible that the appearance of waxy endosperm in this variety is due to previous crossing with the Chinese waxy. Nor is there any indication that the strain in which waxy has appeared has undergone recent crossing with such a widely different sort as the Chinese strain. Sanford's White Flint is an old and well-

[1] G. N. Collins, "Waxy maize from Upper Burma," SCIENCE, N. S., Vol. LII, No. 1333, pp. 48–51, July 16, 1920.

established New England variety and the strain which carries the waxy endosperm is typical of the variety in type of plants, ears and grain.

The origin, in an American variety, of this peculiar endosperm texture, previously found only in several isolated Asiatic localities, will probably remain a matter for speculation. It may have arisen by mutation within the past few years, or it may have been carried by the stock as a hidden recessive for centuries. In any case its appearance may be regarded as a further bit of evidence against the theory of a pre-Columbian distribution of maize outside of the American continent. Nor would it be surprising if a thorough investigation, by the process of inbreeding, should bring to light waxy endosperm in a number of additional American varieties.

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THE METRIC SYSTEM

SCIENCE for June 13, 1924, contains a letter advocating the metric system. I can not see how the metric system can be of any greater value to the ordinary person than the present system. The decimalists are too fond of overrating their own exploits. Even with the coinage I find after 12 years residence in Canada that the money system is no simpler than the pounds, shillings and pence of England and I find with constant trading with the United States that the rate of exchange does away with any advantage which a common money system may have. And how is it that the "quarter" is so popular? It surely should not have a place in a decimal system. In my opinion a decimal system may be all right for an ignorant and unlettered community and possibly here the advocates in the United States may make a big claim for its use.

It is amusing to see Mr. McAdie claim that scientific men the world over champion and use the metric units. Apparently engineers and the engineering profession in general are not scientific. Why, even a cook[1] may be more scientific than a meteorologist. Mr. McAdie does not see that although it may be an advantage for those who "analyze" to use a decimal system such a system is of no importance to those who "manufacture." For the latter—and they are the useful people in this world—a binary system or a duodecimal system is much better.

I have been teaching physics in Toronto for the last twelve years and have introduced the English units more and more as the years have gone on because I find the students understand them better. Especially is this true in mechanics. I note what the writer of the letter says about the questions in the school arithmetics. I always imagined that they were inserted to give the pupils practice in arithmetical manipulation. I never thought that they would be used to condemn the English system. You might as well condemn Christianity because it is a hard faith to live up to.

The trouble with men like Mr. McAdie is that because they like a thing they think all the world must agree with them. They never see the other side.

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[1] Mr. McAdie is rather scornful of the cook who measures by cups.

PERMANENT PHOTOGRAPHS

DR. CLARENCE H. KENNEDY'S experience with platinum photographs as told in the issue of SCIENCE for July 11 is another confirmation of the permanence of this printing process. In the *British Journal of Photography* of December 24, 1909, was an account of some platinum prints recovered in October of that year from the wreck of a war vessel, after having been under the sea for more than five months. The cardboard mounts were disintegrated, and the surface paper, to which the prints still adhered, was ruined by the water. But the prints themselves were bright and clean as if freshly made.

Present day photographers, spoiled by the ease and convenience of modern photographic processes, may think platinum printing difficult, but it used to be regarded as very simple and easy. The paper is partially printed by daylight or electric arc, and developed in a solution of potassium oxalate and potassium phosphate. It is then passed through three acid baths, and finally washed in water for 15 minutes, the whole procedure of developing, fixing and washing taking only about half an hour. The resulting picture is, Dr. Kennedy says, as permanent as the paper on which it is printed. If the print has not been properly "cleared" in the acid baths, the paper may in time turn yellow, but the discoloration is easily removed with a bleaching solution of acidified hypochlorite without affecting the platinum image. The chief drawback to the use of platinum paper is its high price.

CHARLES MACNAMARA

SCIENTIFIC BOOKS

Galapagos: World's End. By WILLIAM BEEBE. G. P. Putnam's Sons, New York and London, 1924, xxii + 443 pp., with 24 colored illustrations by Isabel Cooper and 83 photographs, mostly by John Tee-Van. Published under the auspices of the New York Zoological Society.

SINCE the publication of "The Voyage of the