Letters to the Editor.

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Light-Year *versus* Parsec.

THERE comes a time in every science when merit is acquired by the introduction of a new unit of measurement, and all will admit the occasional necessity of such in a world of expanding physical sciences. Does astronomical science need another unit of stellar distance ?

It would seem that, in general, any new unit should satisfy some or all of the following conditions :

(1) It should be urgently needed, to express a magnitude of an order not adequately represented in the existing system of units.

(2) It should be a logical unit, in that it follows customary formation for units of its type ; it should depend directly upon other units or dimensions of fundamental nature.

(3) So far as possible, it should be easy of comprehension by men of science who are not specialists in its particular province.

(4) Where it is suggested as a replacement for a unit sanctioned by long usage, it must be in every way a better and more convenient unit. Age does not imply sanctity ; it does, however, demand an improvement.

Does the word 'parsec' meet the requirements outlined above ? From the viewpoint of the purist, nothing could well be worse than this hybrid, but the nomenclature of science includes a few other verbal monstrosities, and this, in itself, is no argument against the term.

(1) The 'parsec' is equal to 3·26 times the customary unit known as the light-year ; it does not indicate a magnitude of an order different from the older unit.

(2) The light-year is a highly logical unit. In mechanics, our best definition of a length is still given by $s=vt$; that is, a length equals a certain velocity multiplied by the time. This is precisely the construction of the unit known as the light-year, and it rests upon two other units, the velocity of light, and the length of the year, which are regarded as highly fundamental.

(3) The light-year is a unit the significance of which is instantly grasped by the layman, or by the man of science in unallied fields. Which is the easier (and the more logical) ? Is it the concept of a star at such a distance that light needs 159 years to make the journey therefrom, or the concept of a star at such a distance that, as seen from the star, the semi-major axis of the earth's orbit subtends the 48·7th part of the 1,296,000th of a circumference ?

(4) While long usage does not necessarily give authority, the fact that the concept of visualising stellar distances by the time of light travel goes back at least to the year 1740, deserves thoughtful consideration. The actual term, light-year, is not nearly so old.

Aside from its ease of comprehension and its logical structure, we lose historical 'side-lights' of great interest and value by abandoning the light-year. The fact that a distant Milky Way, apparently a replica of our own stars in its integrated light, is to us as it actually was three million years ago, adds a genetic datum which is utterly lost in the distance of one million 'parsecs.'

But the term 'parsec' was introduced to make computations easier. The skilled computer will smile at this ; he cares little whether he has to take a reciprocal, or to add in any one constant log. as against any other. In fairly representative computations involving parallax and distant spiral nebulæ data, I have never yet had to use the 'parsec' unit.

The trigonometric method of determining star distances has given undue prominence to the angle subtended by the semi-major axis of the earth's orbit, an importance which will inevitably be greatly diminished by the further application of the methods of spectroscopic and dynamical parallax determination. Such probable progress will further diminish the excuse for a unit like the 'parsec.' Why use it at all ?

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Base Exchange and the Formation of Coal.

IN an article entitled "Base Exchange and the Formation of Coal" (NATURE, Sept. 24, 1927) I discussed the probable influence of base exchange between the roofs of coal seams and sodium chloride solutions on the formation of bituminous coal. I suggested that base exchange might form the connecting link between the coal seams of various geological formations. Since writing the article, I have had an opportunity of examining the roofs of bituminous coal seams of Jurassic, Cretaceous, and Tertiary ages, and they agree with those of the Carboniferous age in showing evidence of base exchange and hydrolysis. It appears, therefore, that bituminous coal always occurs under a roof which has undergone base exchange and which contains sodium as the main replaceable base. The final stage in coal formation appears to have been the bacterial decomposition of the accumulated plant material under alkaline anaerobic conditions.

The base exchange theory of coal formation affords a method by which the 'drift' and 'in situ' theories may be reconciled. If drifted material accumulated in the sea, the characteristic roof constituent would be sodium-clay. If the material accumulated by drift in fresh water and the roof were deposited in fresh water, base exchange could take place by submergence in the sea. If the material accumulated 'in situ' on land or in fresh water, a slight alteration in land level, such as geologists maintain occurred at intervals during the coal-forming periods, could result in base exchange taking place with capillary solutions of sodium chloride raised from subsoil water containing this salt. It follows, therefore, that whether the material accumulated by 'drift' or 'in situ,' the same final roof conditions have been present.

Base exchange appears also to have a bearing on the formation of petroleum. Petroleum-bearing strata are usually overlaid by shales. The fossil evidence indicates that the material from which the shales have been formed was deposited in salt water. Base exchange between the material covering the petroleum-bearing strata and solutions of sodium chloride must therefore have taken place. The subsequent hydrolysis of the sodium-clay would provide alkaline anaerobic conditions for the bacterial decomposition of organic matter.

An investigation of the bacterial decomposition of fats under a roof which has undergone base exchange and hydrolysis is now in progress. The result of such a decomposition is shown in Fig. 1.

The fat was distributed through a sand layer at