AN institute of natural sciences will be held at Bowdoin College early in 1931. This will be the fifth institute in the series begun in 1923, the first four having covered the fields of modern history, literature, the fine arts and the social sciences.

THE Twenty-fourth Annual Convention of the Illuminating Engineering Society is to be held in Richmond, Virginia, from October 7 to 10. Present plans contemplate sessions to be devoted to lighting practice, natural lighting, lighting service, ultra-violet radiation, lighting education, light in architecture and decoration, as well as the usual business sessions on the opening day. The committee on lighting service is also planning to hold a pre-convention meeting on the day immediately preceding the opening of the convention, which will be devoted entirely to subjects of interest to central-station lighting service engineers. This will be held on October 6.

SIGMA PI SIGMA, honorary physics fraternity, has granted petitions for charters at the University of Washington, Park College and William Jewell College. Chapters at these institutions will be installed about the middle of May in connection with the installation of several other chapters at institutions where petitions are now under consideration.

AN Associated Press Dispatch reports that the Massachusetts General Hospital, the Boston Museum of Fine Arts, the Massachusetts College of Pharmacy and several other institutions will share to the extent of several millions of dollars in the estate of the late Mrs. Harriet J. Bradbury. The estate is valued at between $12,000,000 and $15,000,000.

MORE than a quarter of a million dollars has been subscribed to the centennial memorial building fund of the Medical Department of the University of Georgia for the erection of a building to commemorate the one-hundredth anniversary of the founding of the medical school by Dr. Milton Antony in 1823. The sum of $40,000 still remains to be subscribed.

MR. JOHN D. ROCKEFELLER, JR., has offered to contribute $250,000 to an endowment fund of $2,000,000 which is being raised for the International Y. M. C. A. College at Springfield, on condition that $1,750,000 be received in cash from other sources before July 1, 1935.

OHIO WESLEYAN UNIVERSITY has received a bequest of $50,000 by the will of Frank E. Stuyvesant, of Cleveland, Ohio.

THE nineteenth Annual Report of the Brooklyn Botanic Garden contains a résumé of research that has been in progress during 1929, including studies of the diseases of cereal grains, beardless iris project, forest pathology, systematic botany and genetics; also a summary of the educational activities. Over 1,127,000 visitors were recorded at entrance turnstiles, and study material including living plants and petri dishes with sterile agar were supplied to 6,457 teachers for the instruction of 282,000 pupils. Over 795,000 packets of seeds were supplied to school children for planting in school and home gardens and 38 exhibits were installed in the public schools of Brooklyn and other boroughs. Numerous gifts are also recorded.

DISCUSSION

COSMICAL MATTER AND STELLAR EVOLUTION

IN his address before the British Association for the Advancement of Science at the recent meeting in Cape Town, as given in SCIENCE of July 26 last, Lord Rayleigh touches on what would be called in Spanish countries a "palpitating question" in astronomical problems of to-day.

The importance of the underlying cause of the spectral conditions which he discusses can not be overestimated. But there are some points in connection with the nebulae especially in which it seems to me a diversity of opinion is permissible.

Interest in the relation of nebulosity to early-type activity, although not in the same sense as Lord Rayleigh appears to favor, was stated in an article on the cause of stellar spectral differences.[1]

[1] *Ap. Jour.*, 47: p. 305, 314, 1918.

It has been a profound mystery to me why so obvious a source of energy and one so efficacious as cosmical matter has been ignored—not simply unrecognized, for it has been found everywhere, but just ignored. Clouds of it, great and small, abound in the Milky Way; the great nebulae such as Orion, Trifid, Eta Argus and M8 show it; all the spiral nebulae large enough to show detail reveal it; the meteors in our atmosphere, the corona and zodiacal light about our sun are other examples. We also find many variable stars and novae enveloped in clouds which are best explained as such. Comets are doubtless nothing but clouds of such matter, and the asteroids are believed to have a similar constitution.

The Pleiades are enveloped in a great cloud of such matter, and a great many early-type stars have clouds either attached or near.

From the evidence which exists it would be more justifiable to assume that the effects of cosmical matter in some form are universal than that they are negligible.

At this point I would emphasize the criticisms which have been made of the too ready acceptance of anything which is largely mathematical formulas. No one will deprecate the value of mathematics as a tool, but there is entirely too great a tendency to ignore the material upon which the tool is used. Instances are familiar to all; among them may be cited the work on the internal constitution and spectral conditions of the stars and of the distances of the Cepheid variables, globular clusters and spiral nebulae. To these may be added in a lesser degree the parallaxes of the more distant stars determined directly.

Recent happenings point to a drastic revision of distances of the Cepheids, and in consequence, of all the objects based upon them, hence this case need not be pursued. There is still the case of the direct determinations of the parallax which is more obscure and not generally understood. In passing it may be said that the error in question appears to arise from the effect of spectral type on magnitude and consequently distance which has been ignored because unnoticed.

Regarding the first case, my criticism applies particularly to the work which has been done upon the internal conditions of the stars as an explanation of spectral conditions in general.

The spectral condition of a star is essentially a surface condition. It is undoubtedly affected by internal conditions but to what extent is entirely unknown, and in my opinion to place all the responsibility on conditions as hypothetical as internal ones is highly speculative, to say the least. It is even possible to reconstruct Herschel's frozen-cored sun with just as much reason and scientific basis as some of the theories proposed in the past half century. We have in the large meteorites evidence of possible frozen cores and in the existence and effects of cosmical matter a means of producing almost any surface condition as evidenced by the novae.

I am not arguing for frozen-cored suns, merely pointing out the weakness of any theory based wholly on conditions so purely speculative as internal ones.

If there were no other course it might be justifiable.

But there is direct and weighty evidence that much of the spectral condition of the stars, at least the early types, is due to external causes alone. Internal conditions furnish no explanation whatever of the preferences of all these early-type objects including the gaseous nebulae for the Milky Way.

I maintain the thesis that only some sort of external condition or conditions are adequate and logical to cause such preferences and demand the production of evidence to the contrary or that internal conditions alone will account for these preferences.

My object in touching so strongly on the question of the cause of the spectral condition of the early-type objects is to prepare the way to oppose what I understand to be the general attitude toward that problem. Lord Rayleigh focuses the matter when he emphasizes the intimate relation of the central stars of the planetaries to the surrounding gaseous nebulosity. About that fact there can be no reasonable difference of opinion. It is with the underlying assumption that the central star is the exciting cause of the gaseous nebulosity that my criticism lies, but even more with the assumption that the gaseous nebulosity is the starting-point of stellar evolution.

Lord Rayleigh is more physicist than astronomer and therefore is presumably more interested in the purely physical side. He does not definitely so state but I understand his statement that ". . . the source of excitation in the bright line nebulae no longer appears inexplicable" and that "the cases of some of the central nuclei of the planetary nebulae are specially satisfying from the definite relation of the star to the nebula and the adequate character of the star itself" to mean that the central star is considered to be the exciting cause of the nebulosity. Such is almost certainly *not* the case. The evidence favors the hypothesis that *both star and nebulosity have been excited by a common cause.*

In the novae we have what is the only analogous course known and one which appears to satisfy the conditions of formation of these planetary nebulae also. Indeed the only essential difference appears to be in the rapidity in which the novae pass through the different stages. In a few weeks or months the nova passes successively through the spectral conditions A, B, O and gaseous nebulosity. And to complete the analogy some of the brighter novae have presented expanding disks in the nebulous stage.

Not only have we that evidence, but unpublished investigations indicate that the planetary nebulae may be in different stages of expansion and contraction. This is shown both by their radial velocities and their appearances.

If this were not enough we have the further supporting condition that in the O-type stars those showing emission (Wolf-Rayet stars) appear to be expanding whereas those showing only absorption have predominantly positive radial velocities indicating contraction, atmospheric probably.

If such are the conditions in the planetary nebulae and O-type stars strength is lent to the hypothesis

that some of the excess of positive velocity in the B-type stars may be due also to contraction. Upon these hypotheses all the early-type activity can be accounted for, even the outstanding and discordant large radial velocities of the planetary nebulae which have been a stumbling-block to the proper location of these bodies in any otherwise logical course of change.

The course followed by these early-type objects, as indicated by the above conditions, may be summarized as follows:

Stellar (or perhaps other) bodies in the galactic regions where cosmical matter is sufficiently plentiful encounter such matter in the form of clouds of varying conditions as to size and motion.

The effects of such matter begin to be noticeable in the A type, and probably also as short-period variables in the F, G and K types which show a marked preference also for the galactic regions. These preferences become progressively stronger through the B-type stars until we find those of O type confined to a narrow belt along the plane of the galaxy.

These encounters will in general reduce the motions of the original stars due to the combination of different motions of the star and cloud and perhaps also to a general retardation by widely distributed matter which appears to have little or no system motion in many cases. This would account in part for the generally small motions of the early-type objects.

Strong evidence has recently been encountered, however, that the great brightness of the early B-type stars is due to a brightening up of stars whose proper motions were originally small, due probably largely to distance.

The sequences of change in both spectral type and temperature accord with increasing amounts of cosmical matter encountered which first produces an apparent excess of positive radial motion or contraction in the B-type spectrum which increases in the late O-type and then changes to negative or expansion when the emission appears in the early subdivisions.

The planetary and large extended gaseous nebulae are the results of encounters with single stars and groups respectively in which the climax appears to have been produced, resulting in gaseous nebulosity and probably radiations of shorter waves which are not observable with our present means.

Incidentally it may be pointed out that encounters of solid bodies with clouds of cosmical matter furnish an explanation of the large meteorites, these being the pieces of small solid bodies disrupted by the sudden heating of such encounters much as the meteorites themselves are disrupted in passing through the earth's atmosphere.

If such a course is the correct interpretation of the phenomena observed in these early-type objects the nebulosity is not being maintained by "excitation" of a central star or other source but is the *result* of the primitive originating encounter and is simply a stage more or less transitory in stellar evolution, broadly considered.

Indeed the phenomena of the novae and especially the planetary nebulae raise the question whether the secondary bodies of our solar system may not be the later stages of the outer portions of a planetary nebula. The physical appearance of these bodies which show predominating positive velocities is such as to suggest condensation.

As these objects and the novae all show strong preferences for the Milky Way the question naturally presents itself as to what causes the activity in them, activity which appears to increase from A- to B- and O-type and to culminate in gaseous nebulosity in the planetary and large irregular nebulae as well as the novae.

Here is where cosmical matter intrudes itself as outlined above. Together with gravitation it furnishes a natural and satisfactory explanation for this early-type activity, and so far it is the only one. I have hunted diligently for objections but thus far have found none. One object in raising the point is to invite discussion and to uncover contradictory evidence if it exists.

As yet this question is not one for mathematical formulas except incidentally but for broad common sense.

C. D. PERRINE

OBSERVATORIO NACIONAL
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PSITTACOSIS EPIDEMICS AND PLEOMORPHIC PROTOPLASM

THE note in the issue of March 7 on the etiology of parrot disease and the possibility of a filterable virus suggests that laboratory workers in New York State, and perhaps the scientific world generally, may be unfamiliar with the work done during the epidemic of 1917 in Pennsylvania. At that time, Dr. A. T. McClintock, a young Wilkes-Barre pathologist and diagnostician, trained in Vienna and Berlin, carried on extensive researches with cultures obtained from three affected parrots and from the bloods, sputa and feces of eleven patients. He used mice and rabbits for inoculation, checking his results through the experimental induction of similar disease pictures by means of cultures derived from the feces of normal parrots.

His tentative conclusions are suggestive, though in a dozen years laboratory technique has doubtless undergone manifold refinements. While identifying the epidemic as psittacosis, he failed to associate with it Nocard's bacillus (a stout motile Gram nega-