ponents are appreciable. The former alternative may be disregarded since the profiles do not suggest any self-reversal effects.

An interesting feature is the development of intense violet edges immediately after the primary and secondary minima. All the $HeII$ lines develop such a violet edge and this pattern is followed by the HeI lines at $\lambda\lambda 5875$ and 4471 . It is difficult to observe this effect in the violet wing of $\lambda 6560$ since the 103a-F emulsion used has a dip in sensitivity in this wave-length region.

HD 193576. Well-widened spectra in the blue region for this star have been used in the determination of equivalent widths for $HeII$ 4860, $HeII$ 4686, Nv 4603 and NIV 4058. When plotted with phase the lines $HeII$ 4686 and NIV 4058 have negligible eclipse effects at primary minimum. $HeII$ 4860 and Nv 4603 have minimum intensities at primary minimum, in the latter case probably caused by its own intense violet edge coupled with the violet edge of $\lambda 4619$ of Nv .

HD 193928. Large scale variations in the emission-line intensities of the violet edges of HeI 4471 and Nv 4603 are easily noticeable. At certain phases $\lambda 4860$ as well as $HeII$ 4686 develop humps on the long wave-length side of the profile.

In the case of *HD 214419* we find that the increase in brightness at primary and secondary minima is shared by all the emission lines measured. In *HD 193576*, $HeII$ 4860 and Nv 4603 do not share the behavior of $HeII$ 4686 and NIV 4058. It would be of great interest to obtain photoelectric light curves of this star in the light of $HeII$ 3206 and NIV 3483.

One of us (Bappu 1951) has suggested that the increase in intensity of the emission lines in *HD 214419* could be explained on the basis of a common envelope model. Such a situation would demand that the abnormal behavior be shared by all the emission lines together, a phenomenon that we have found to exist in *HD 214419*. The validity of the common-envelope hypothesis would cease to exist in those systems that are not close binaries. Verification of this hypothesis might therefore be made by carrying out programs of emission line photometry in Wolf-Rayet binary systems having different periods.

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Baum, W. A. What are elliptical galaxies made of?

Large elliptical galaxies are very common objects in the universe and they constitute a very

homogeneous class with respect to integrated properties. Direct information about the nature of the contents of large ellipticals is rather scanty, but attention is called to some interesting implications of their integrated properties. These integrated properties include spatial distribution of luminosity, spectral energy distribution, spectroscopic features, and mass-luminosity ratio.

Two possible models for large elliptical galaxies appear to merit consideration. One model which can be described as modified population II, represents the currently popular view; it is made up of stars having the same chemical composition as those in globular clusters but it necessarily includes a much greater representation of dwarfs, or subdwarfs. The other model, which can be described as old population I, is a proposed alternative; it is made up partly of stars having the same chemical composition as the predominant population in our own galaxy and partly of undisturbed gas. The possibility of gas in ellipticals has also been discussed by others, including Kraft. It was assumed that neither model contains stars younger than several billion years. The H-R diagram for the population II model is, of course, identical with that for globular clusters, but the luminosity function in the main-sequence region needs to be radically different. The H-R diagram for the old population I model has a main sequence which, like that of population II, has been consumed down to $M = +3$; stars which have recently evolved from this main sequence are assumed to live in the normal giant region around $M = 0$ instead of climbing to $M = -3$ and lingering afterward along a horizontal branch.

The relative proportions of the various ingredients required by the two models were computed by fitting data for the spectral energy distributions and mass-luminosity ratios of the ingredients to similar data for the spectral energy distribution and mass-luminosity ratio of large ellipticals. The goodness-of-fit achievable, together with certain implications of the other integrated properties, provided an estimate of the acceptability of each model. Although the results are not decisive, old population I including its gas appears to be a more acceptable model than modified population II. The computations were based largely upon data already in the literature, such as those by Stebbins and Whitford and by Schwarzschild.

The proposed predominance of old population I in large ellipticals would not preclude a minority representation of ordinary population II, and

perhaps various intermediate compositions. This is consistent with the resolving of red giants at $M = -3$ in M 32; in fact, a rough comparison of the resolved population with the total surface brightness in M 32 seems to confirm its minority role.

The old population I model also provides an acceptable evolutionary explanation for the red excess of remote galaxies. Light from M 32 can be compared, for example, with light which set out on its journey a half billion years ago from the cluster of galaxies in Corona Borealis. The difference between them suggests that giants contribute about 7 per cent less of the total light in ellipticals today than they did a half billion years ago, and that the mean spectral type of the giant representation has shifted from late K to middle K during the same interval.

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Baum, W. A. and Hall, John S. Present status of the joint image-converter project.

In February 1954 the Carnegie Institution of Washington initiated an exploratory program for the development of photoelectric image tubes to increase the ranges of telescopes. A committee set up by President Vannevar Bush for this purpose includes M. A. Tuve of the Department of Terrestrial Magnetism, chairman, W. A. Baum of the Mount Wilson and Palomar Observatories, John S. Hall of the U. S. Naval Observatory, and L. L. Marton of the National Bureau of Standards. The fundamentals of the problem were outlined earlier by Baum (1954).

Initial experiments under this project (Hall, 1954) were carried out by E. S. Dayhoff at the Bureau of Standards during 1954; they pertained mainly to the properties of image orthicons and vidicons.

More recently, the authors have been working on a line of attack involving commercially-made image converters of a special design. These tubes have a very thin film stretched across the end where the phosphorescent screen would otherwise be located. The photoelectron beam can pass right through this film but gas molecules cannot; consequently, the thin film permits the electronic image to be formed outside the tube while the high quality vacuum inside the tube is preserved. When a photographic plate is placed behind the thin film, the impinging electrons create a latent image just as in Lallemant's system (1951). Laboratory experiments of a similar nature have

also been carried out by Hiltner and collaborators.

The Farnsworth Electronics Company and Radio Corporation of America are both cooperating with us in the experimental production and testing of these new tubes. The present model is about 5 inches long and it comes complete with photocathode, electron optics, and thin film. Since the thin film would be ruptured by atmospheric pressure, the tube is supplied during manufacture with an evacuated glass cap covering the rear end. A stock of spare tubes can thus be kept on the shelf until needed.

When a tube is put into operation, it is installed in a vacuum plate changer. This device provides a rough vacuum around the rear end of the tube so that the protective glass cap can be safely removed from behind the thin film; it also provides a means for getting photographic plates in and out of the system without breaking the vacuum. We hope that this technique will eventually enable astronomers to obtain plates with image tubes in a fashion as routine as that already achieved in electron microscopy.

The primary remaining problem concerns finding the best procedure for producing thin films having optimum characteristics. Many experimental films have been made by Dayhoff at the Bureau of Standards, and similar exploration is now being carried out at the Naval Observatory. The present specifications require that the thin film be self-supporting across a circular aperture 18 mm in diameter, that it withstand a differential pressure of 10^{-5} atmosphere, that gas leakage through it be negligible, that attenuation of the electrons be less than 10 kv, that the loss of resolution due to electron scattering in the film be minimized, and that the film be undamaged by the baking processes required in commercial tube production.

As a second line of attack, an attempt is being made to develop a special type of thin-film converter capable of withstanding full atmospheric pressure, thereby avoiding the complications of the vacuum plate changer described above. In this case the aperture covered by the thin film can be only a narrow slot, but such a slot would be sufficient for many spectroscopic applications. A film of dural 700 A thick was found to withstand atmospheric pressure when mounted across a slot 0.1 mm wide by 12 mm long. Although the scattering of 15 kv electrons by this film was two or three times the desirable maximum, these preliminary results have convinced us that there is