of the low density medium through which it is moving. The ionized debris will collect around the star but the star will move away faster from the debris. It is doubtful if a substantial fraction of O stars would have such high peculiar velocities. If the star has a low velocity (20 km sec^{-1}) the ionized debris will collect more efficiently and the unit density H II region will form around the O star and the entire pattern will move with the stellar velocity. Depending upon the stellar velocity and the material density O stars with peculiar velocities may contribute to the ionization of the intercloud medium.

Elmergreen has also considered regions of the Galaxy where the O star density is sufficiently high so that a cloud in such a region is exposed to a uniform background of ionizing radiation. The lifetime of a remote cloud in such a situation may equal or be greater than the stellar lifetime. Where the stellar density is sufficiently high the lifetime of a cloud may be as low as $1 - 4 \times 10^6$ yrs and intercloud ionization by O stars would indeed be possible but for the ionized cloud debris which will still prevent the Lyc flux to flow to and cause ionization of all the neutral material in such regions. In any case such special situations cannot explain the very general problem of ionization of the ICM.

All this may be substantially modified if supernova shocks periodically clear away the cloud-expelled material from the ICM to produce new clouds. In the absence of such a sweeping mechanism by another agent the onus of maintaining the ionization in ICM has to rest on B stars and nuclei of planetary nebulae. Since these weaker agents are such less effective in destroying clouds through ionization and acceleration, the clouds in turn will not affect the ICM ionization so drastically as in the case of O stars.

The analyses reported by Elmergreen have involved many assumptions and many features of the ionization of the interstellar medium have yet to be explained. The pulsar dispersion measures and the diffuse Hα background may correctly be explained by postulating ionization by the less luminous stars. A wealth of ultraviolet data has been collected in the recent years and they need to be fully understood in the framework of such a theory. Dust will conceivably play a very major role and theoretical investigations are needed to study phenomena in a dusty ISM. Observations of weaker emission lines in the so-called unit density H II regions will certainly improve our understanding of the ionization mechanisms. Last but not the least is the question of the electron temperature of the clouds and the ICM and we hope that future investigations will address themselves to determining values of this quantity in the various components of the ISM.

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TWO KINDS OF BL LAC TYPE OBJECTS ?

Among the new kinds of celestial objects recognized during the nineteen sixties are the BL Lacertae type objects named after their prototype, the variable star BL Lacertae, which was suggested as the optical identification for the radio source VRO 42.22.01 (Schmidt, *Nature*, **218,** 663, 1968; Macleod and Andrew, *Ap. Letters*, **1**, 243, 1968). The distinguishing characteristics of this class of objects, also known as Lacertids, are (Strittmatter et al., *Ap. J. Letters*, **175**, L7, 1972; Pollock, *Ap. J. Letters*, **198,** L53, 1975; Usher, *Ap. J. Letters*, **198**, L 57, 1975) :

(a) Continuous, featureless optical spectra or weak or transient line optical spectra,
(b) flat or centimetre excess radio spectra,
(c) rapid variations in intensity at radio, infrared and visual wavelengths

and

(d) strong and rapidly varying polarization at visual and radio wavelengths.

Altschuler and Wardle (*Nature*, **255,** 306, 1975) define a BL Lac type object as one that exhibits strong and rapidly varying nonthermal radiation at optical wavelengths and has a very small line to nonthermal continuum ratio.

These objects have been presumed to be extragalactic although no certain distance determination to any of these objects has been possible till 1974. However, the determination of the redshift of 0.07 of BL Lac by Oke and Gunn (*Ap. J. Letters*, **189** L5, 1974) and its confirmation by Thuan, Gunn and Oke (*Ap. J.*, **201**, 45, 1975), and also by Kinman (*Ap. J. Letters*, **197**, L49, 1975) seems to indicate that the BL Lac objects may be extragalactic.

Perhaps, suggesting that all BL Lac type objects are extragalactic on the basis of the redshift of BL Lac may be too much of a generalization. Recently, Webster and Ryle (*M.N.R.A.S.*, **175**, 95, 1976), on the basis of a series of observations made at the Mullard Radio Astronomy Observatory of the variable radio source, CL4, in the direction of the Cygnus Loop with their 5-km and one-mile telescopes find that this source exhibits properties which are remarkably similar to BL Lac. According to these authors,

(a) Both (i.e. BL Lac and CL4) have spectra increasing with frequency to 3 GHz and constant at higher frequencies.

(b) The variations of flux density above 3 GHz: Both show a quasi-periodic variation of amplitude of about 25% on a time scale of a few months, superimposed on long period variations. At lower frequencies the variability becomes less marked.

(c) Neither source is strongly linearly polarized.

and

(d) Both sources are associated with compact optical objects having power law optical spectra rising steeply to the red. Neither is known to be an X-ray source, and the spectra from radio to optical frequencies are similar.

Although the two objects have these similarities, Webster and Ryle find from their measurement of the 21 cm absorption spectrum of CL4 made with the Half-Mile telescope that CL4 lies within the Galaxy. Because of this they suggest reexamination of the sources labelled 'BL Lac type' for any 'CL4 type' objects.

Kinman (*Ap. J.*, **205**, 1, 1976) gives a list of 33 possible BL Lac objects. Following the suggestion of Webster and Ryle search for 'CL4 type' objects among these should be made.

The question is : Are there two kinds of BL Lac type objects ? or, as Kinman (*Ap. J.*, **205**, 1, 1976) observes, is it likely that such objects are merely extreme examples of a broad distribution rather than a physically distinct class ?

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EVOLUTIONARY STAGES OF STARS EXHIBITING NONRADIAL PULSATIONS

Theoretical studies of the problems of nonradial oscillations of stellar models gained importance in astrophysics when it was realized that it might be possible to explain certain aspects of the observed phenomena of stellar variability on the basis of nonradial oscillations. Pekris (*Ap. J.*, **88,** 189, 1938) derived the fourth order linear differential equation which determines the adiabatic nonradial pulsations of a compressible self-gravitating gas sphere and obtained numerical solutions for the case of constant density. Since then several investigators have explored the different aspects of the problem of nonradial oscillations of stars. The results of these investigations have shown what the two important factors which vitally influence the spectrum of the modes of nonradial oscillations of a stellar model are :

(i) The behaviour of Schwarzschild criterion of convective stability given by $A = \frac{d}{dr}(\log(\rho P^{1}/\gamma))$, ($\rho$ being the density, and P the pressure of an element at a distance r from the centre, and γ the ratio of specific heats at constant pressure and constant volume. $A > 0$ at a point implies convective instability and $A < 0$ implies convective stability).

(ii) The central condensation parameter $\rho_c \ / \ \bar{\rho}$, (ρ_c and $\bar{\rho}$ being the density at the centre and the mean density respectively).

We have also been investigating the theoretical aspects of the problems of stellar oscillations (Prasad and Mohan (*M.N.R.A.S.*, **141,** 389, 1968; **142,** 151, 1969; **144,** 179, 1969), Mohan (*M.N.R.A.S.*, **150,** 137, 1970, *Pub. Astr. Soc. Japan*, **24,** 133, 1972). Singh (*Ph. D. Thesis, Roorkee University*, 1975) has studied certain theoretical aspects of the problems of nonradial oscillations. He has investigated the effect of the above two parametres on the modes of nonradial oscillations of stars by studying the nonradial oscillations of certain series of composite models.

An analysis of the available results on nonradial oscillations leads one to conclude that the stellar models with low central condensation and in which the convective-stability parameter A maintains same sign throughout the stellar model show a systematic spectrum of the modes of nonradial oscillations. Such models always exhibit a mode called the fundamental mode of oscillation whose eigen functions have no nodes. The eigen functions of the other modes of oscillations have gradually increasing number of nodes. On the other hand stellar models with larger central condensations and in which the convective stability parameter A changes sign once or more than once exhibit complex patterns of the modes nonradial oscillaons with the eigen functions of each mode showing large number of nodes. In such models one does not get any mode whose eigen functions are free of nodes.

Now the stability considerations reveal that the existence of a great number of nodes even for the modes of low order i.e. the existence of a short wave length, favours a strong radiative damping. This was shown for the Cepheid model studied by Dziembowski (*Acta, Astron.*, **21,** 239, 1971). It thus appears that the less centrally condensed models in which A does not change sign have greater chance of exhibiting nonradial oscillations as a regular feature. On the other hand models with large central condensations in which A changes sign a number of times are less suited for nonradial oscillations. The nonradial oscillations of such stars are likely to be damped out easily. Ottlet (*Ann.* d' Astrophysique, **23,** 2, 1960), Owen (*M.N.R.A.S.*, **117,** 1957) and Singh (*Ph. D. thesis, Roorkee University*, 1975) considered the problems of nonradial oscillations of some very highly centrally condensed models such as Roche-model, the polytrope of index 5, and the inverse square model respectively. Their results have shown that the general mathematical eigen value problems of nonradial oscillations of these highly centrally condensed models involve irregular singularities and these models are incapable of performing nonradial oscillations.

Now we know that the stellar models with low central condensation and in which Schwarzschild criterion of convective Stability A maintains the same sign throughout are the young stars in early stages of evolution. They can also be the stars which have reached the end of other evolutionary process such as white dwarfs. As evolution proceeds off the main sequence towards giant and super giant stage central condensation increases and the star also develops more and more alternating zones of convective and radiative equilibrium. We may thus conclude that the stars which are exhibiting phenomena associated with nonradial oscillations are either still young stars in early stages of evolution or have reached the white