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 $A = \frac{d}{dr}(\log(\rho P^{1/\Upsilon}))$, ($\rho$ being the density, and P the pressure of an element at a distance r from the centre, and Υ 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 oscillations 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 dwarf stage. Stars in advanced stages of evolution such as giant or super giant stage are unlikely to exhibit observed phenomena associated with nonradial oscillations. In such stars nonradial oscillations if excited will be short lived. These will either get damped out or will lead to the explosions of the star itself.

In this context it may be mentioned that Chandrasekhar and Lebovitz (*Ap.J.*,**136**, 1105, 1962) had considered the possibility of explaining the variability of Beta Canis Majoris type stars on the basis of resonance between the radial and nonradial modes of oscillations. Theoretical investigation of this possibility had also lead them to conclude that if the variability of Beta Canis Majoris type stars is to be explained on the basis of resonance between the radial and nonradial modes of oscillations, then these stars must be having low central condensations and be the young stars in early stages of evolution.

The recent observations of the Sun by Severny, Kotor and Tsap (*Nature*, **259**, 87, 1976) and Brooks, Isaak and Van der Raay (*Nature*, **259**, 92, 1976) have also some relevance in the present context. The observations of these two independent groups of observers have lead astronomers to conclude that perhaps Sun is performing global oscillations with a mean period of $2^h\,40^m$. Michalitsanos (*Bull. Astron. Soc. India*, **4**, 14, 1976) has discussed the implications of these global oscillations. If it is assumed that these oscillations are radial, then theoretical considerations lead one to a spherically homogeneous model of the Sun. But if it is assumed that Sun is a homogenous sphere, then the temperatures and pressures near the centre of the Sun cannot be so high that the nuclear reactions of the pp chain may be taking place. It will then require some fundamental changes in the present day concepts of the theory of stellar structure to account for the huge amounts of energy being released by the Sun. The other alternative to account for the observed global oscillations of the Sun as suggested by Dalsgaard and Gough (*Nature*, **259**, 87, 1976) is that these oscillations might correspond to nonradial pulsations of the solar sphere. Such nonradial pulsations are consistent with a nuclear burning pp chain core and are thus not at variance with current theories of stellar structure. The second alternative if confirmed by subsequent investigations will lend further support to the idea that young stars in early stages of evolution are more suited to exhibit phenomena associated with nonradial oscillations as we know that Sun is still a young main sequence star.

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REPORT ON A SYMPOSIUM ON INFRARED AND SUBMILLIMETRE ASTRONOMY

This symposium was jointly sponsored by COSPAR/IAU/URSI and was held at University of Pennsylvania, Philadelphia between June 8-10, 1976. It was attended by more than 75 delegates representing all parts of the world and was mainly devoted to presentation of observational data in the field of Infrared Astronomy obtained using telescopes both ground based as well as those flown on aeroplanes, balloons, rockets and satellites. The major part of the symposium time had been allotted for presentation of invited papers. As part of the symposium a panel discussion on the Infrared Astronomy Satellite (IRAS), to be launched in 1981 had been arranged under the Chairmanship of G. Neugebauer.

F. Low reviewed the performance of infrared telescope systems carried aloft in aircraft, on balloons, and sounding rockets and pointed out that they fall far short of the performance to be expected from instruments now being developed for satellite and space shuttle programs. He classified the infrared objects so far observed using a wide range of techniques into 8 categories viz: stars, planetary nebulae, H II regions, molecular clouds, diffuse emission, galactic nucleus, galactic nuclei and QSO's. The brightness of these objects was reported to range from 0.04 Jy to 10^6 Jy.

S.D. Price presented information on survey carried out for IR sources at 4 μm, 11 μm and 19 μm using a cryogenically cooled telescope flown on rockets launched from Woomera in Australia. The number of unassociated sources detected increases with wavelength and was attributed to the interaction of cosmic rays in the detector material. S.G. Kleinmann reported ground based searches at 4 μm and 11 μm using narrow beams and raster scanning to obtain more accurate position of objects in AFCRL catalogue, using an instrumental sensitivity capable of detecting objects 1 magnitude fainter than those listed in the AFCRL catalogue. The main findings of this survey are : 1) sources are concentrated in the galactic plane and are brighter than a 100 $\odot$'s, if assumed to be in the spiral arms, 2) spectra of the 67 stars studied indicate continuum radiation on which absorption and emission features are superposed including silicate features, 3) about half the AFCRL sources are red giants, 4) many AFCRL sources exhibit CO features, 5) discovery of 8 new water masers all of which are variable.

A summary of ground searches of sources in AFCRL catalogue are as follows :

	4 μm sources	11 μm sources
New*	799	657
Confirmed	3	87
Not confirmed	27	281

*Sources not listed in the AFCRL catalogue.