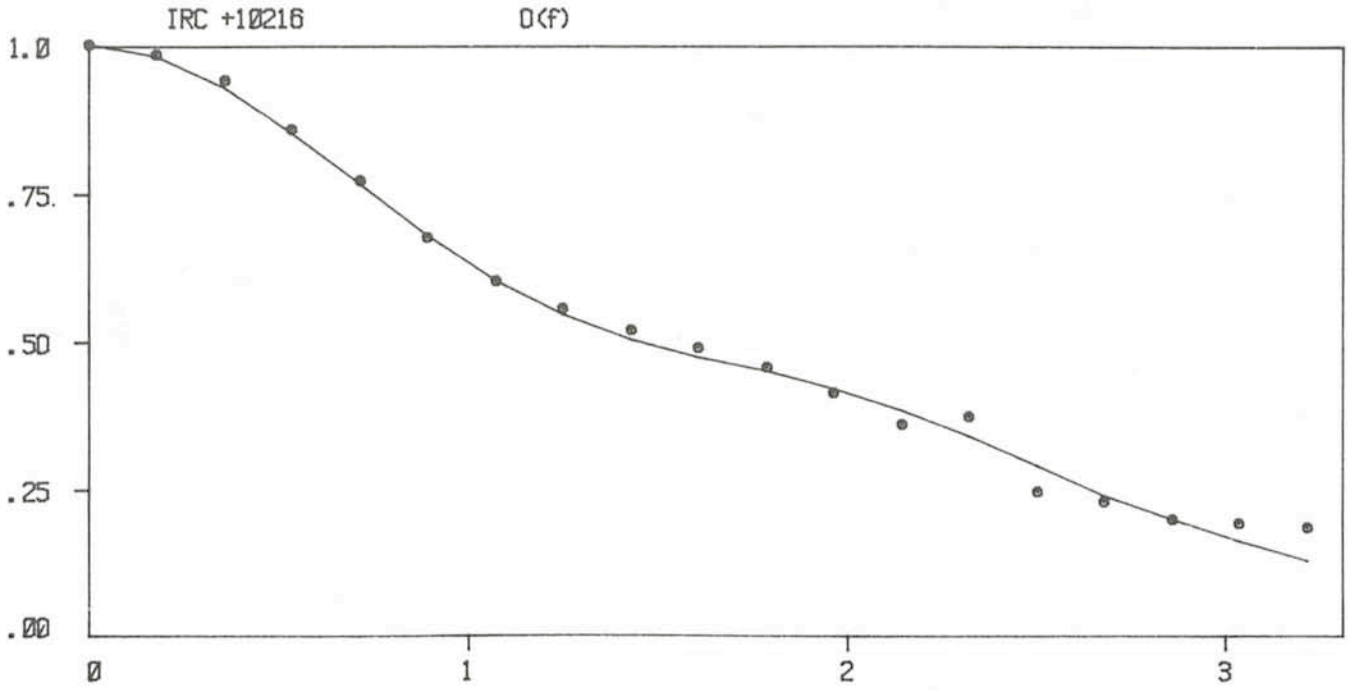

Fig. 4: *Spectrum modulus of IRC + 10216 (normalized at origin, versus spatial frequency in arcsec^{-1} at L(3.5 μ). Scanning direction is east-west. The full line represents a model composed of two disks of 0.36 and 1.2 arcsec respective diameters.*

Seeing Variations

The critical step in the "image modulus" restoration process is to determine the atmospherical coherence length, parameter correlated to the seeing and theoretically retrievable from the data themselves. This parameter appears to be of prime importance when one corrects the reduced data from the point-spread function as measured on a point-like source, hence with other seeing conditions than with the object. But this task is increasingly difficult as the source becomes fainter because it makes the computation less and less reliable. The only way to avoid this artificial limitation to a correct restoration is to measure the seeing independently through a "seeing monitor" centred on a field star.

As evidence has been given that such an instrument should be included in a more general seeing study (R. Wilson, 1980, ESO internal report on dome seeing), we have good hope to add a prototype soon into the speckle system.

I wish to thank A. Moorwood and P. Salinari for the introduction to the new IR photometer and the ESO electronic staff of La Silla for the repetitive support they gave to transform an unorthodox project into reality.

Photometric Classification of Pulsating Variables with Periods between One and Three Days

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The MESSENGER contains many articles referring to exciting celestial objects of more or less "exotic" nature. In this note the description of the photometric behaviour of only a small group of stars is presented, which nevertheless have proven to be important in the quest for measuring distances, and which may hold keys for the theory of stellar evolution. These stars show periodic variations of their apparent brightness due to a radial pulsation instability of their outer atmospheres. Commonly they have been divided into two major subgroups, the RR Lyrae stars whose periods lie between a few hours and roughly one day, and the Cepheid variables with periods of more than one day. While the first – also called cluster-type variables – are considered to be members of the oldest stellar population of our Galaxy, the latter are thought to belong primarily to the younger stellar population.

It has been shown during the first decennia of this century, that the RR Lyrae stars all have roughly the same intrinsic brightness, while the Cepheid variables satisfy a proportionality between their absolute magnitude and the logarithm of their period. These facts render them powerful distance indicators within our own galaxy, at least on our side of the galactic nucleus and in some cases even to our nearest neighbour galaxies.

The division of the two major subgroups at a fixed period is quite arbitrary and not supported by any physical considerations. In fact, some overlap in the period interval between one

and three days has been found long ago. A simple method to distinguish the members of the two groups is therefore desired.

Classification

With this aim in mind, an investigation of all the available photoelectric lightcurves was undertaken, and in a number of cases, new photometry was secured. Very useful in this investigation were the measurements obtained by Dr. K. K. Kwee and Dr. G. A. Tammann in recent years at the ESO 1 m telescope on La Silla. These data proved to be of excellent quality and showed that simple UBV photometry yields an unequivocal classification scheme. As it turned out, no less than five different types of pulsating variables with periods between one and three days can be observed. These five subgroups are illustrated in Figure 1 by the V lightcurves of one representative of each subgroup; a short description of the main lightcurve characteristics is as follows:

(1) RR Lyrae stars: The rise from minimum to maximum takes only about one tenth of the period. The overall variation is very smooth with only a small hump before minimum light. Very typical is the fact that the U-B curve shows a decrease while the V brightness is increasing. According to these criteria UX Nor with a period of 2.4 days is the longest-period RR Lyrae star known.

(2) "CW" stars: A secondary hump of considerable amplitude – in the order of one third of the whole amplitude – is found prior to the primary maximum. The representative of this class with the shortest known period is HQ CRA (P = 1.415).

(3) BL Herculis stars: The main feature of this subclass is the existence of a hump on the descending branch of the lightcurve, which leaves the impression of a "flat-topped" or "shouldered" curve. In the period interval 1–3 days only 5 galactic representatives of this class are known.

(4) Classical Cepheids: The lightcurve is very smooth, but the rising portion covers a larger fraction of the period than the one for RR Lyrae stars. There seems to exist no star in this group whose period is less than two days; in fact the galactic Classical Cepheid with the shortest period known is BB GEM (P = 2.308).

(5) Sinusoidal Cepheids: As implicated by the name of this subclass, its members show almost sinusoidal variations with only a small amplitude. This subgroup contains the brightest stars in the present sample, which is mainly due to a selection effect.

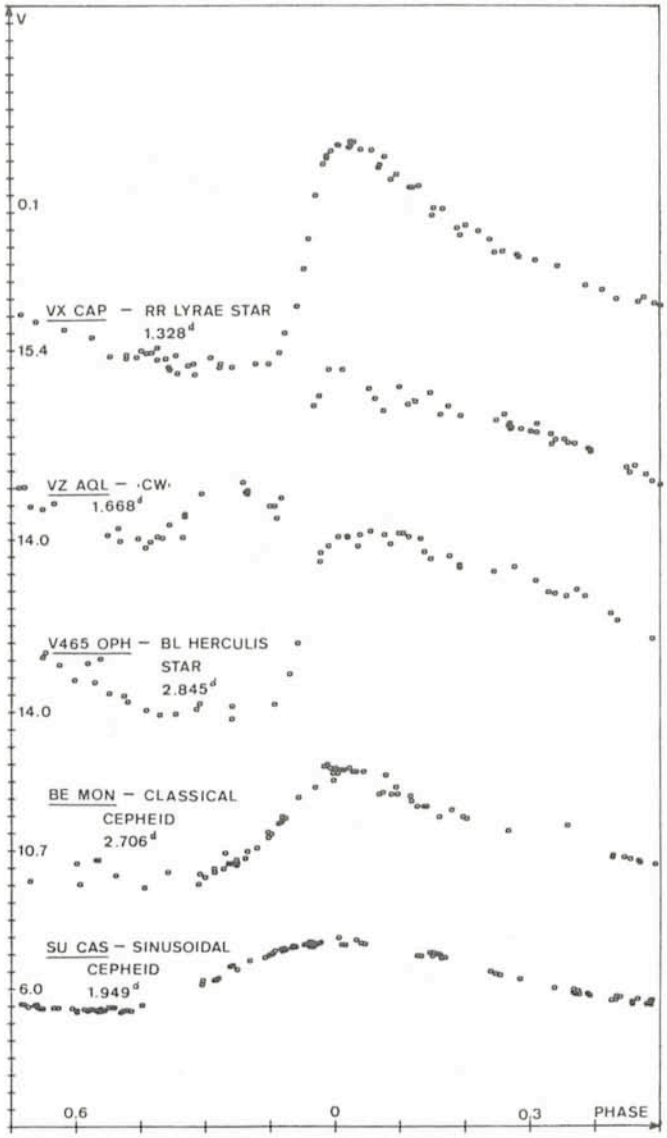

Fig. 1: *Examples of V lightcurves of the five proposed subclasses of Cepheid variables with periods between one and three days. Observations were obtained by K. Kwee* (AA Suppl., **2,** *77, and private communication) for VX CAP, VZ AQL and V465 OPH; by G. A. Tammann (private communication) for VZ AQL and V465 OPH; by Buchancowa et al. (IBVS 727) and by Szabados (Mitt. Stw. Ung. Akad. d. Wissensch., Nr. 70) for BE MON and finally for SU CAS by Milone (IBVS 482).*

Conclusions

The galactic pulsating variables with periods between 1 and 3 days and with sufficient photometry can all be assigned to one of the above subgroups. The classification scheme is further supported by the different behaviour of these stars in the (U-B) versus (B-V) plane during their light cycle, and it is compatible with the spectroscopic data so far available. This does not necessarily call for a physically meaningful division of these stars. However, their distribution in the Galaxy, the occurrence of some of them in globular clusters, their counterparts in the Magellanic Clouds as well as other observational and theoretical investigations, all support the view that the present classification separates real physical differences. As to the nature of the different subgroups the following conclusions are indicated:

(a) RR Lyrae stars are old, metal-deficient, low-mass stars and their distribution and kinematical properties prove them to be members of the halo population.

(b) BL Herculis and "CW" stars are closely related to the W Virginis stars of longer periods. The distribution of the members of the two groups in our Galaxy is different. "CW" stars are more concentrated towards the galactic plane and seem to be confined to the galactic centre region. They must be considered as intermediate, respectively old disk population constituents. The differences in their lightcurves are probably due to different chemical composition, mass and hence evolutionary history.

(c) Classical Cepheids and sinusoidal variables are young, massive disk objects. While the Classical Cepheids vary in their fundamental pulsation mode, the Sinusoidal Cepheids are pulsating in the first overtone mode. The theoretical period ratio

between fundamental and first-overtone pulsations is 1 : 0.71 for Cepheids; the observed short-period cutoff at P = 2.3 days (BB GEM) and P = 1.95 days (SU CAS) respectively, is therefore in good agreement.

For pulsating variables the period interval from 1 to 3 days is a twilight zone, where distinctly different types of variables coexist. Their observational separation is a necessary first step for a deeper understanding of their physical parameters and their evolutionary status.

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ALGUNOS RESUMENES

ESO fue seleccionada para alojar el servicio de coordinación europea del telescopio espacial

La "National Aeronautics and Space Administration" (NASA) de los Estados Unidos intentará lanzar un telescopio espacial de 2.4 m hacia fines de 1984. En este proyecto participa la Agencia Espacial Europea (ESA), y los observadores de los países miembros de esta institución obtendrán por lo menos un 15% del tiempo total de observación con el telescopio espacial.

El día 26 de junio ESO fue elegida por ESA para alojar el servicio de coordinación del telescopio espacial.

Las tareas más importantes del servicio de coordinación serán:

- dar informaciones sobre programas de observación a posibles observadores;
- coordinar el desarrollo del software para el análisis de los datos y crear software adicional para responder a las demandas de la comunidad europea del telescopio espacial;