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PERSONNEL MOVEMENTS

STAFF

ARRIVALS

Europe

JANSSON, Jill, S, Secretary, 1.2.1981
BAUDET, Loic, F, Optical Technician, 1.4.1981
BUZZONI, Bernard, Optical Technician, transfer from Chile to Europe, 1.4.1981
BIEREICHEL, Peter, D, Software Engineer, 1.4.1981
COIGNET, Gilbert, F, Electronics Technician, 1.4.1981
DIETL, Ottomar, D, Maintenance Technician, 1.4.1981
STEC, Frédéric, F, Electronics Technician, 1.4.1981
VERSCHUREN, Rita, B, Secretary, 1.4.1981
MÜLLER, Karel, DK, Adm. Assistant (Accounting), 1.5.1981
LJUNG, Bo, S, Electronics Engineer, 16.5.1981
WIRENSTRAND, Hans, S, Systems Programmer, 11.5.1981

Chile

ROUCHER, Jacques, F, Electronics Technician, 1.2.1981

DEPARTURES

Europe

GRIP, Rolf, S, Technical Assistant (Mech.), 31.5.1981
WENSVEEN, Martinus, NL, Optical Technician, 28.2.1981

Chile

BECHMANN, Erling, DK, Foreman (Electro-mech.), 31.3.1981

ASSOCIATES

ARRIVALS

Europe

GAHM, Gösta, S, (part-time) 1.1.1981

DEPARTURES

Europe

CHINCARINI, Guido, I, 15.1.1981

FELLOWS

ARRIVALS

Europe

MOTCH, Christian, F, 1.1.1981
LUND, Glenn, New Zealand, 15.3.1981

The Ionized Gas of M33 as Seen with a 6 m, F/1 Telescope

G. Courtès and J.P. Sivan, Laboratoire d'Astronomie Spatiale, CNRS, Marseille, and J. Boulesteix and H. Petit, Observatoire de Marseille

With few exceptions, the ionized hydrogen regions in a galaxy are extended sources emitting only a few lines of very faint intensity. The use of a narrow interference filter (to select one of the most intense lines) in combination with a focal reducer design (to increase the illumination of the focal plane) at the focus of a large telescope is the best way to obtain deep photographs of the ionized hydrogen features in nearby galaxies (Courtès, G.: 1973, *Vistas in Astronomy* **14,** 81). It should be noted that in this optical arrangement, the filter is not set in the small f-number beam of the focal reducer, but in the lower aperture beam of the telescope, thus making possible the use of very selective interference filters (which accept a very narrow angular field). This method has been extensively used for several years by Courtès and his co-workers at the 1.93 m telescope of Haute-Provence Observatory, at the Palomar 200 inch telescope, and, more recently, at the 3.6 m telescope of ESO.

As previously discussed (Courtès, G.: 1965, IAU Symposium No. 27, A25), when an f/1 focal reducer is attached at the focus of a 2 m class telescope (for instance the f/5 Newtonian focus of the 1.93 m telescope of Haute-Provence), the illumination of the photographic emulsion is increased (by a factor of 25 in this example), but the spatial resolution is unavoidably degraded (a pixel size of 20 microns corresponds to 2.1 seconds of arc). On the contrary, when an f/1 focal reducer is used in combination with a 4 m class telescope or, *a fortiori,* with a larger telescope, the equivalent focal length becomes long enough for the minimum image diameter to be determined mainly by the seeing instead of by the resolving power of the emulsion. In the case of the f/8 Cassegrain focus of the ESO 3.6 m telescope (a project of such an instrument has been designed by M. Leluyer for the 3.6 m ESO telescope), the illumination of the detector is increased by a factor of 64 and the limiting angular resolution is near 1 second of arc for a pixel of 20 microns (Boulesteix, J., Courtès, G., Laval, A., Monnet, G., Petit, H.; 1974, Proceedings of ESO/SRC/CERN Conference on Research Programmes for the New Large Telescopes, 221).

One of the most important results that have been obtained when applying these techniques to the study of the ionized gas of nearby spiral galaxies, is the discovery of a general, diffuse Hα emission in the spiral arms and, sometimes, over the entire galactic disk. (Carranza, G., Courtès, G., Georgelin, Y. P., Monnet, G., Pourcelot, A., Astier, N.: 1968, *Annales d'Astrophysique,* **31,** 63; Monnet, G.: 1971, *Astronomy and Astrophysics,* **12,** 379). In our Galaxy also, the interstellar medium is ionized outside of the condensed, classical H II regions. The presence of a

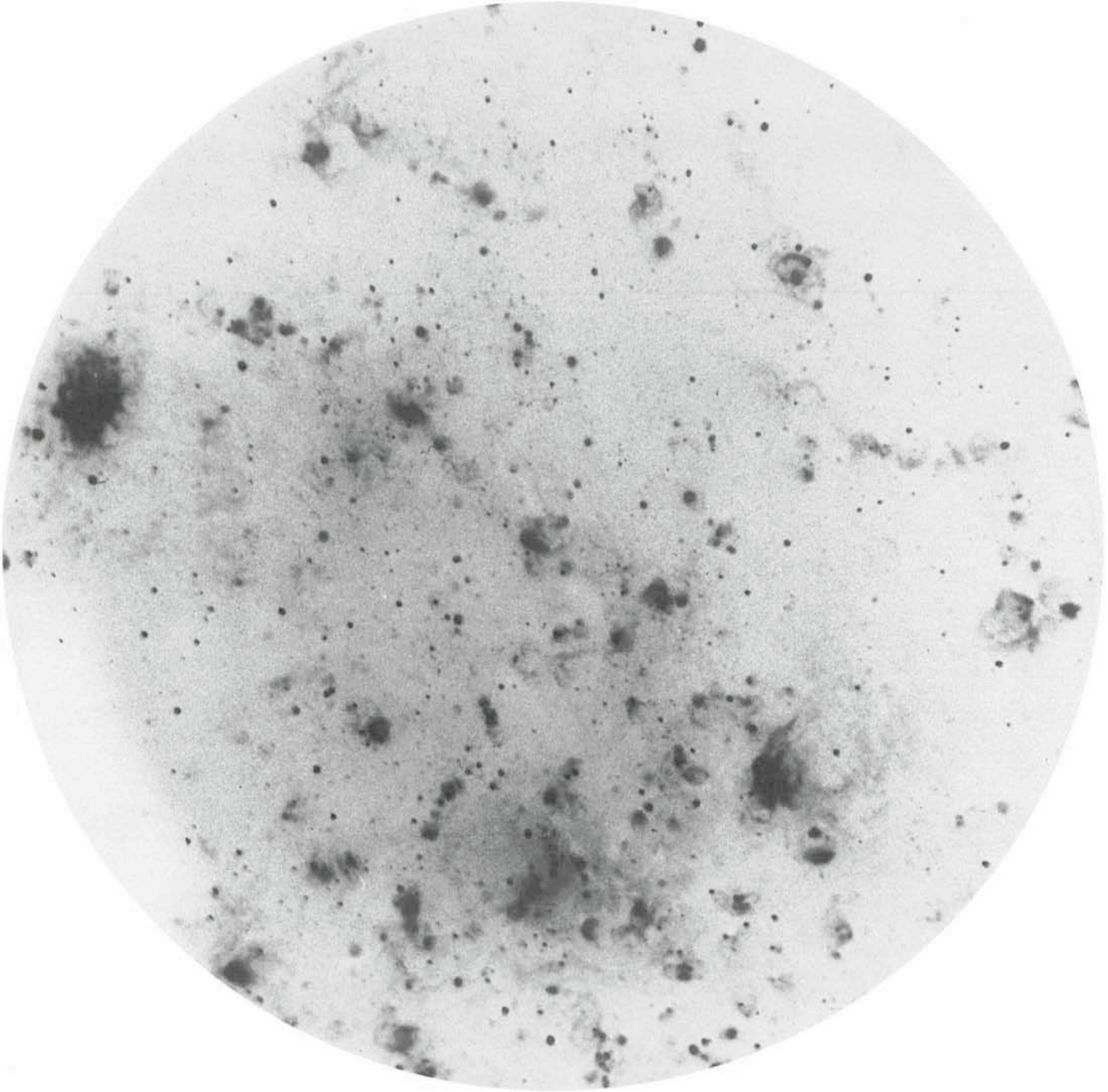

Fig. 1: *Hα photograph of the northern arm of the galaxy M33 taken with the f/1 focal reducer of Courtès attached to the prime focus of the Soviet 6 m telescope. This 153 min exposure photograph was obtained in September 1980 on pre-flashed 103-aE film through a 25 Å interference filter peaked at Hα. The field is 20 arcmin in diameter. North is on top.*

general Hα emission background throughout the Milky Way has been revealed by the photographic Hα survey of Sivan (1974, *Astron. Astrophys. Suppl.,* **16,** 163) whose southern part was carried out at La Silla, using a 60° field, interference filter, f/1 camera (Courtès, G., Sivan, J. P., Saïsse, M.: 1981, *Astron. Astrophys.,* in press). These observations are in good agreement with those of Reynolds, R. J., Roesler, F. L. and Scherb, F. (1974, *Astrophysical Journal,* **192,** L53); in addition, they show clearly that the general Hα emission from the arms of the Galaxy is not only diffuse, but faint filamentary structures as well as ring-like and arc-shaped features are seen in between the bright, classical H II regions. The most recent studies of the nearest spirals have not revealed such an appearance for the diffuse ionized gas. This is mainly for reasons of scale.

One of the galaxies best suited for this kind of investigation is the Triangulum galaxy, M33, thanks to its large angular extent (more than one degree) and its favourable inclination (close to face-on). It has been observed in Hα through a 25 Å filter, using the f/1 focal reducer of Courtès at the f/5 focus of the 1.93 m telescope of Haute-Provence (Boulesteix, J., Courtès, G., Laval, A., Monnet, G., Petit, H.: 1974, *Astron. Astrophys.* **37,** 33). A higher angular resolution survey proved necessary in order to investigate small and sharp structures in the Hα emission regions.

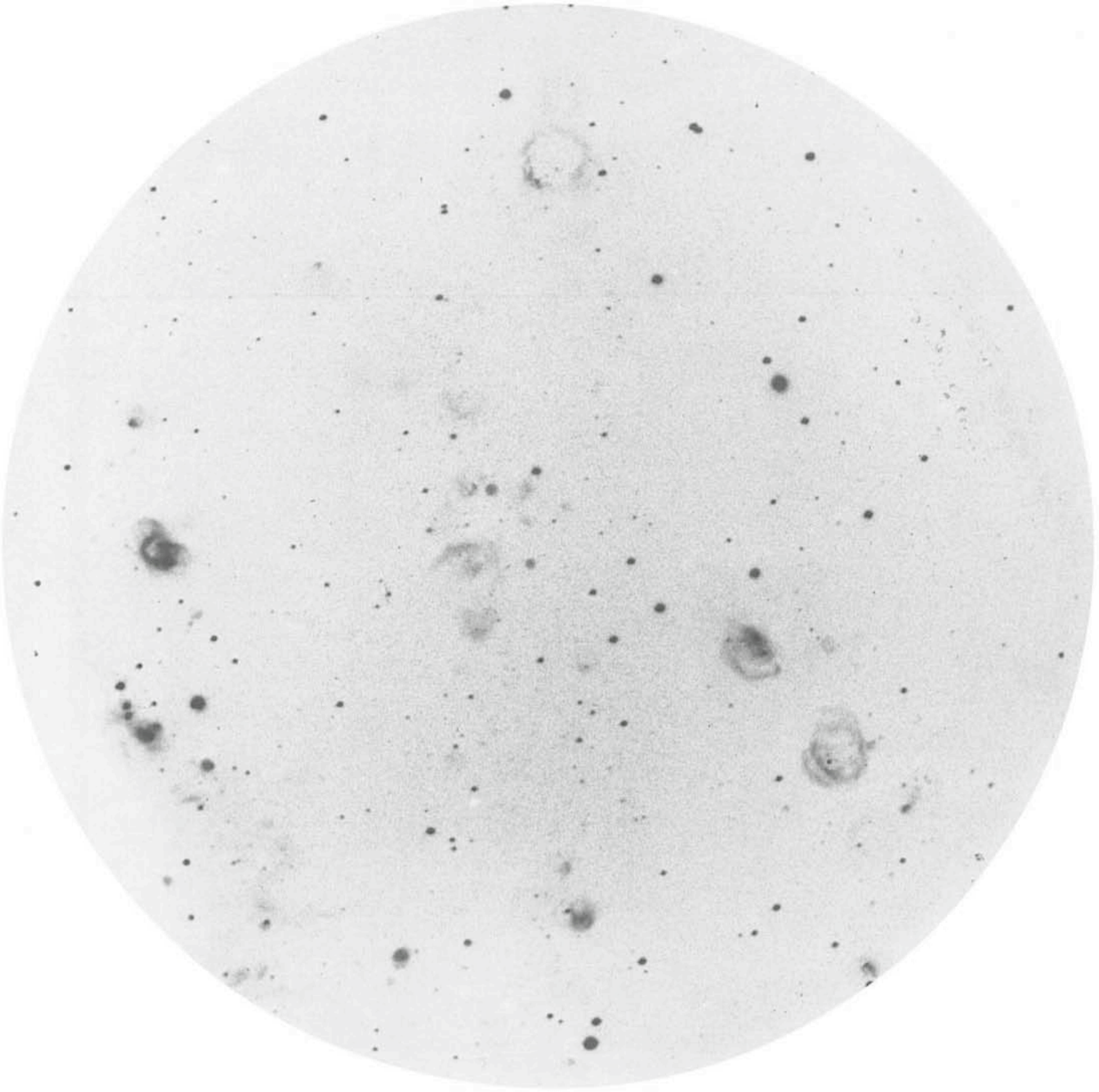

Fig. 2: Hα photograph of the northern part of the galaxy M33 taken with the f/1 focal reducer of Courtès attached to the prime focus of the Soviet 6 m telescope. The centre of the field is 24 arcmin distant from the centre of the galaxy. This 162 min exposure photograph was obtained in September 1980 on pre-flashed 103-aE film through a 25 Å interference filter peaked at Hα. The field diameter is 20 arcmin. North is on top.

This is the reason why we have adapted (simply by changing the field lens) the f/1 focal reducer to the f/4 prime focus of the 6 m telescope of the Special Astrophysical Observatory. This instrument is the largest optical telescope in the world, located at an altitude of 2100 m in the Caucasus mountain, near Zelentchuk (Soviet Union). The new survey of M33 we have conducted at the 6 m telescope uses the same 25 Å filter to isolate the Hα line and exclude the unwanted continuum from the stars and the atmosphere. The 15 cm diameter of the filter limits a 20 arcmin field, well suited for large-scale studies of extragalactic H II regions.

We show here two juxtaposed fields in the northern part of M33. By comparing these photographs with the ones previously obtained, one notes the fantastic gain on the structures of the H II regions. This is not surprising when one considers that any feature is recorded on the same photographic emulsion on a surface of information 9 times larger. One sees (Fig. 1) the details of this emission: it is far from being uniform and rich in abundant filamentary and arc-shaped structures. On the second photograph (Fig. 2), at the very end of the optical spiral arms, one sees with more details the bubble-like H II regions previously observed with the Haute-Provence 1.93 m telescope. The sharp structure suggests a good similarity with many features of the ionized hydrogen in the Milky Way, like the Barnard and

Cetus Loops and the Gum Nebula (Sivan, J. P., 1974), and with the giant Hα shells observed in the Large Magellanic Cloud (Davies, R., Elliot, K., Meaburn, J.: 1976, *Memoirs of the Royal Astronomical Society,* **81,** 89).

Further investigations (in particular spectroscopic observations) are required to understand the origin of the isolated ring-like structures shown in Fig. 2 as well as that of those observed in the spiral arms (Fig. 1). The energy released in the interstellar medium by supernova explosions and stellar winds may play an important role.

Cyclic Variations of T Tauri Stars

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During a photographic survey of the Chamaeleon T association in 1971/72, evidence was found by Mauder and Sosna (*Information Bulletin on Variable Stars,* 1049, 1975) for quasi-cyclic light and colour variations of three variable stars, members of this nearby group of young stars. They were classified by Hoffmeister (*Veröff. Sonneberg* **6**, 1, 1963) as T Tauri stars because of their light variations, and this type was confirmed with objective prism spectra by Henize and Mendoza (*Astrophysical Journal,* **180,** 115, 1973).

These three stars, SY Cha, TW Cha and VZ Cha, were observed in the UBV system in the year 1974 by Mauder and twice in the year 1979 by Kappelmann and Mauder, using the ESO standard photometer. Although it could be seen even in 1974 that these three stars show the assumed quasi-cyclic periods, the data of the year 1979 allowed us to confirm these periodic variations and to derive the periods with suitable analysis methods. We derived a period of 7.6 days for SY Cha, 8.6 days for TW Cha and 7.2 days for VZ Cha, and the figures 1, 2 and 3 show the corresponding lightcurves in V.

The colour variations are nearly in phase with the changes in V, and a large ultraviolet excess is found, as expected in T Tauri variables. Thus the photometric measurements not only show variations of the continuum level and the UV excess on time scales of hours or days, a characteristic of the T Tauris, but indicate variations with periods reproducible on time scales of years.

The next step was to confirm these periods with spectroscopic data, but because of the rather faintness of these three systems, with m_V between 12th and 14th magnitude, detailed spectroscopic investigations are difficult. Spectroscopic observations in the blue region were carried out in July 1979 by Mauder, using the Boller and Chivens Cassegrain spectrograph of the ESO 1.5 m telescope. The usable spectral range was about 3600–5100 Å and the spectra were recorded with a dispersion of 58 Å/mm. The observations were carried out on 3 and on 4 consecutive nights, separated by a gap of 12 nights. The spectra are dominated by bright emission lines, among which the strongest lines are H_γ, H_δ, H_8, Ca II K and the Ca II H + Hε blend. The spectra show the typical veiling, a continuous emission in the blue spectral range and exhibit little evidence for an underlying late-type spectrum. As reported by Appenzeller (*Astronomy and Astrophysics,* **71,** 1979), these three stars are members of the YY Orionis type, a subclass defined, among other things, by inverse P Cygni profiles. But we found no evidence for these typical profiles, neither in the Balmer lines, which can be

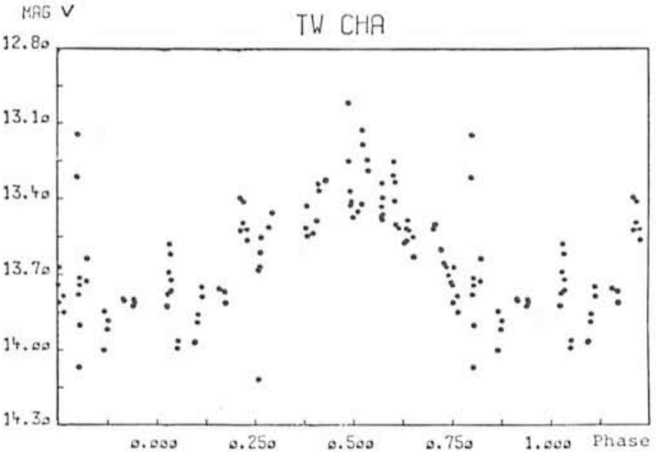

Fig. 2: *Lightcurve of TW Cha, plotted with a period of 8ᵈ6.*

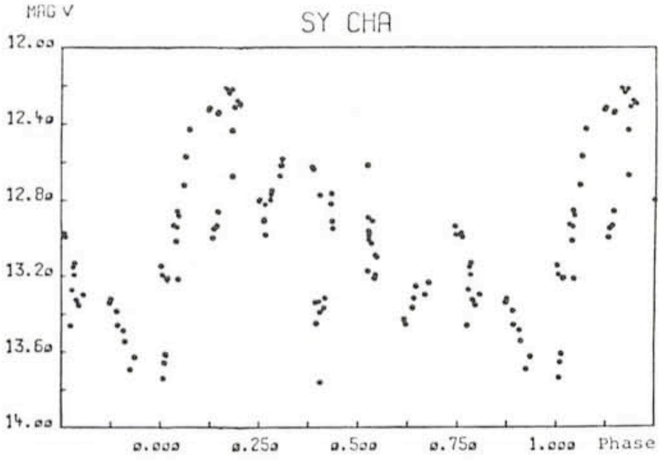

Fig. 1: *Lightcurve of SY Cha, plotted with a period of 7ᵈ6.*

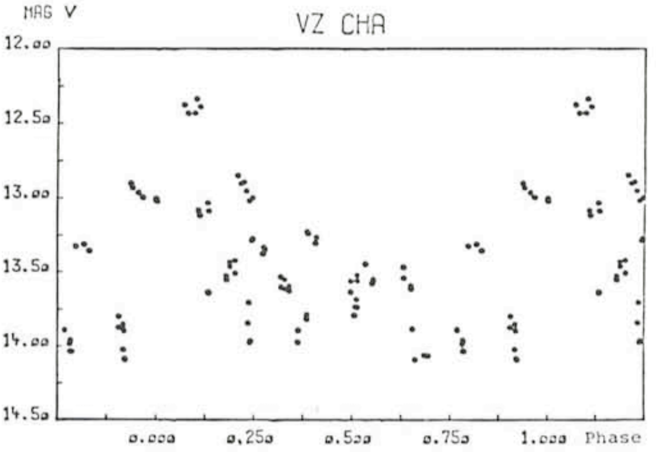

Fig. 3: *Lightcurve of VZ Cha, plotted with a period of 7ᵈ2.*