for performance tests suggests that the magnitude limits quoted for these bands may have been somewhat degraded by an additional sky noise component.

The new system also offers several other performance advantages which are less directly obvious. No significant chopping offset signals are generated for example and there is thus no baseline drifting due to telescope flexure during long integrations. The possibility of direct guiding through the dichroics avoids the loss of time required to find offset guide stars and the availability of an optically generated reference cross permits accurate optical centring independently of the electronic stability of the TV system. Some observational flexibility has also been gained by virtue of the fact that switching between detectors, changing the chopping amplitude and direction, etc. are now relatively easy operations from the control room.

A Word of Thanks

Many ESO staff have been involved in the project at various stages. For their technical support in Garching we would like particularly to thank D. Enard, G. Hess, G. Huster, B. Jensen, J.-L. Lizon, M. Moresmau, W. Nees, J. Paureau and G. Raffi. During the installation and test we were also ably assisted by the La Silla staff and are particularly grateful for the invaluable help given by T. Bohl, P. Bouchet, F. Gutierrez, G. Ihle, J. Roucher and K. Teschner.

Tentative Time-table of Council Sessions and Committee Meetings in 1985

May 20	Users Committee
May 21	Scientific Technical Committee
May 22–23	Finance Committee
May 30	Committee of Council, Berlin
May 30–31	Council, Berlin
June 4–5	Observing Programmes Committee, Zürich
November 12	Scientific Technical Committee
November 13–14	Finance Committee
December 11–12	Observing Programmes Committee
December 16	Committee of Council
December 17	Council

All meetings will take place at ESO in Garching unless stated otherwise.

AS 338 in Outburst, or How I Found my "Pet Symbiotic"

R. Schulte-Ladbeck, Landessternwarte Heidelberg-Königstuhl

Until some months ago, I used to envy those of my colleagues who were always talking and writing with tremendous enthusiasm about *their favourite object.* My recent observations of the symbiotic star AS 338 enable me now to tell an exciting story as well.

Did I Observe the Right Object?

Symbiotic systems contain late-type (bright) giants or Miras and, in addition, a hot radiation source. They are surrounded by gaseous and dusty envelopes. Therefore, their radiation should be polarized due to scattering in the atmospheres of the late-type stars and/or the circumstellar nebulae. In October 1983, I started a multifilter linear polarization survey of 16 symbiotic stars, using the 1.23 m telescope of the German-Spanish Astronomical Centre. Only four stars showed sufficiently large intrinsic polarization that could be separated from the interstellar component. These were such fashionable symbiotics as HM Sge, V1016 Cyg and R Aqr and, last not least, AS 338. The wavelength dependence of the polarization and the position angle of AS 338 as displayed in Fig. 1 show some interesting properties: a pronounced maximum of the polarization in the B-filter and a significant, sharp rotation of the position angle at H_α. In a forthcoming article in *Astronomy and Astrophysics* I shall show in detail that the polarization of AS 338 can be explained by two scattering regions: Mie scattering by solid particles in the extended atmosphere of the M star and Thomson scattering in an asymmetric circumstellar nebula (possibly an accretion disk around a companion star). Encouraged by this result I decided that AS 338 merits a more thorough investigation. Luckily, the low declination of AS 338 allows its observation from the southern hemisphere as well. In July/August 1983, I had observing time at ESO's 1.5 m and 50 cm telescopes for spectroscopic and photometric studies of southern symbiotic stars. During this observing run, I had already secured one IDS spectrum in the range 4500 to 6800 Å and UBVRI photometry of AS 338. Subsequently, I could convince my colleague F. J. Zickgraf of the importance of getting JHKL photometry of AS 338 during his own observing run at the ESO 1 m telescope in April 1984; and J. Bouvier, in July 1984, took another IDS spectrum at the 1.5 m telescope, covering from about 3650 to 8050 Å. The 1983 and 1984 spectrograms are presented in Fig. 2. They show strong emission lines of the Balmer series and He I and numerous weaker emission lines of singly ionized iron. Only a trace of the underlying late-type continuum is visible longward from H_α in the 1984 spectrogram. David Allen's recently published new "Catalogue of Symbiotic Stars" also contains a spectrum of AS 338, dated August 1978 (see Fig. 2). Even a quick look at this spectrogram shows it to be quite different from my own ones: In Allen's spectrogram, the Balmer lines and the He I lines are stronger and, in addition, there are emission lines of higer ionized species such as He II, [O III] and [Fe VII]. The M-type absorption spectrum is prominent with strong TiO bands. My surprise changed into fear when I recalled that, for identifying AS 338, I had not used a finding chart, but the description of its position given by P. Merrill and C. Burwell in 1950 (*Astrophysical Journal,* **112,** 72). Did I really observe the right object? Fortunately, during the observations, I had made a quick freehand drawing of the field around AS 338 as it appeared on the TV guider screen. A comparison of this "finding chart" with the one published now by Allen not only proves that I actually did observe the right object, but, in 1983, the star seemed to be much brighter compared to other field stars than on the POSS print used by Allen.

An Outburst?

The spectral changes and the brightening of AS 338 become explainable if we assume that it has undergone an outburst as sometimes observed in symbiotic stars. The published and new near IR data of AS 338 from 1974, 1980 and

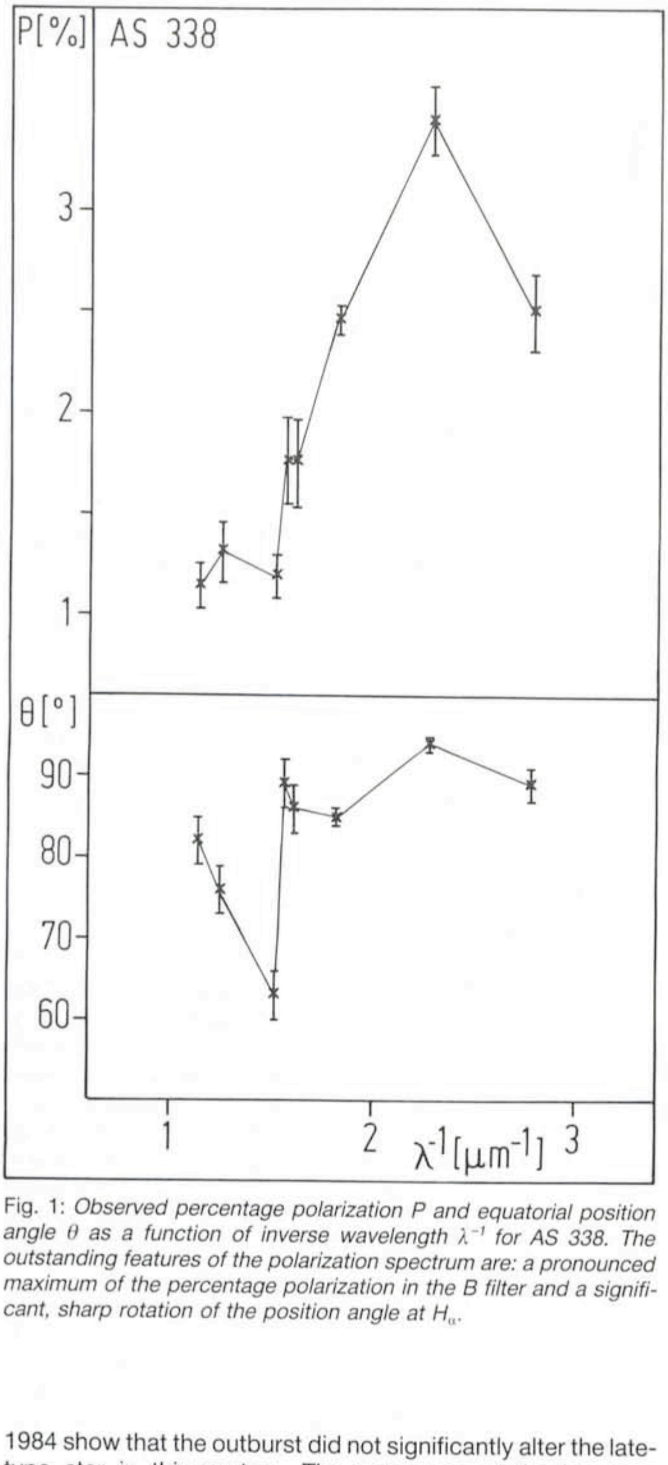

Fig. 1: *Observed percentage polarization P and equatorial position angle θ as a function of inverse wavelength λ^{-1} for AS 338. The outstanding features of the polarization spectrum are: a pronounced maximum of the percentage polarization in the B filter and a significant, sharp rotation of the position angle at H_α.*

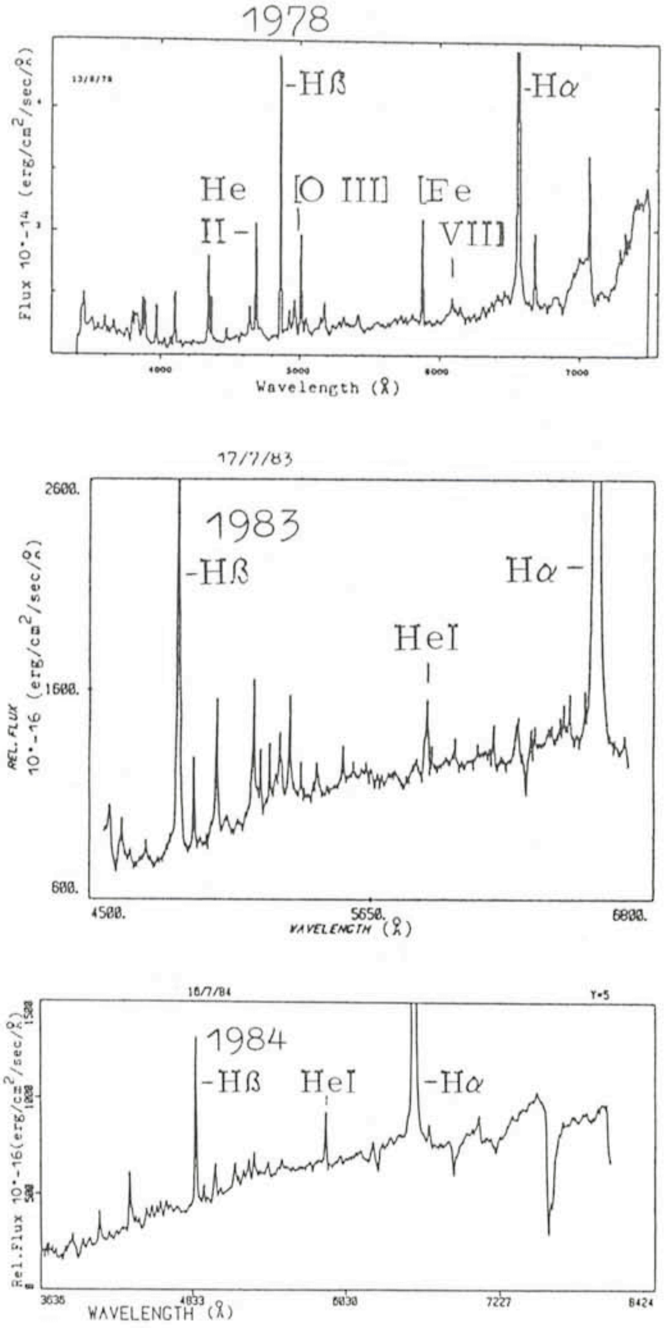

Fig. 2: *Available spectroscopic information on AS 338. Note the strong variability of the emission lines and the continuum. In the 1983 and 1984 spectrograms, the emission lines of He II, [O III] and [Fe VII] are missing.*

1984 show that the outburst did not significantly alter the late-type star in this system. The constancy of the late-type component therefore lends support to a binary model for AS 338. Binary models for symbiotic stars generally consist of three components: (1) a late-type giant or bright giant, (2) a hot component and (3) a surrounding gaseous nebula ionized by the hot component. I therefore supposed that three sources of radiation contribute to the observed flux distribution of AS 338 in the optical and near IR spectral range. The observed fluxes of AS 338 are displayed in Fig. 3 (solid line). As the M star remained constant, I combined the J, H, K, L measurements from 1984 with the U, B, V, R, I measurements taken in 1983. They have been dereddened using an E(B–V) of $0\overset{m}{.}77$. This value is in agreement with the one derived from the Balmer line ratio of the 1983 spectrum ($0\overset{m}{.}79$) and with the reddening of nearby field stars ($0\overset{m}{.}76$) in the Neckel and Klare field No. 264 at a distance of 7 kpc as given by Allen in 1980. The broadband fluxes are of course heavily contaminated by the strong emission lines. Therefore, an estimate of the contribution by the nebular spectrum has been made. The dashed line in Fig. 3 shows the approximate flux distribution of the continuum. The slope of this curve readily shows that it cannot be described by the radiation of a single blackbody. The question then raised whether *two* blackbody energy distributions – corresponding to the two energy sources of a binary system – would render an acceptable result. And indeed, reasonable fits could be obtained with a temperature of 8,250 to 10,250 K for the hot component and temperatures ranging from 2,750 to 3,500 K for the cool component. A typical fit with $T_h = 9{,}750$ K and $T_c = 3{,}250$ K is presented in Fig. 4 a. At a distance of 7 kpc for AS 338, the radii turn out to be 39 to 59 $R_\odot$ for the hot source and 151 to 206 $R_\odot$ for the cool source. Assuming that the two energy sources are stars, the derived temperatures and radii would lead to a spectral classification as A supergiant plus M giant. The most critical points of the model described here are the reddening and the distance. Other combinations of distance and E (B−V) are possible according to the Neckel and Klare fields No. 264 and 266. The use of these values of the fits inevitably led to radii for the cool component which were by a factor of 10 too small for a giant. But at least a giant is necessary to provide the circumstellar gas whose presence is observed in the strong emission lines. On the other hand, assuming that the model yields a fair description of nature, a consistent interpretation of all present data is readily at hand. During an outburst, the spectra of other symbiotic stars, like e.g. Z And, were observed to change from an M giant with a high-excitation emission line spectrum to an A−F supergiant with a shell-like emission line spectrum of HI and HeI. In AS 338 I observed the following characteristic outburst properties:

(1) The development of the emission lines as illustrated by Fig. 2, i.e. strong lines of HeII, [OIII] and [FeVII], are present at minimum, but absent at maximum.

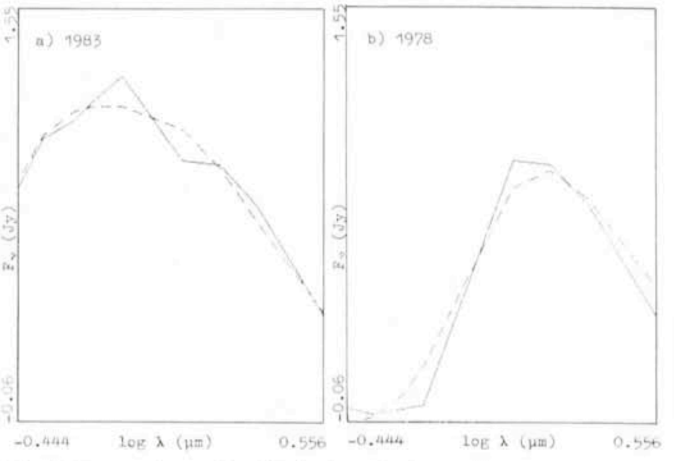

Fig. 4: *The continuum flux distribution of AS 338 during 1983 (4a) and 1978 (4b) is illustrated by the solid lines. The dashed lines are models. For details about the parameters of these models, see the explanations in the text. Note the strong variability of the continuum of AS 338 in the optical spectral range.*

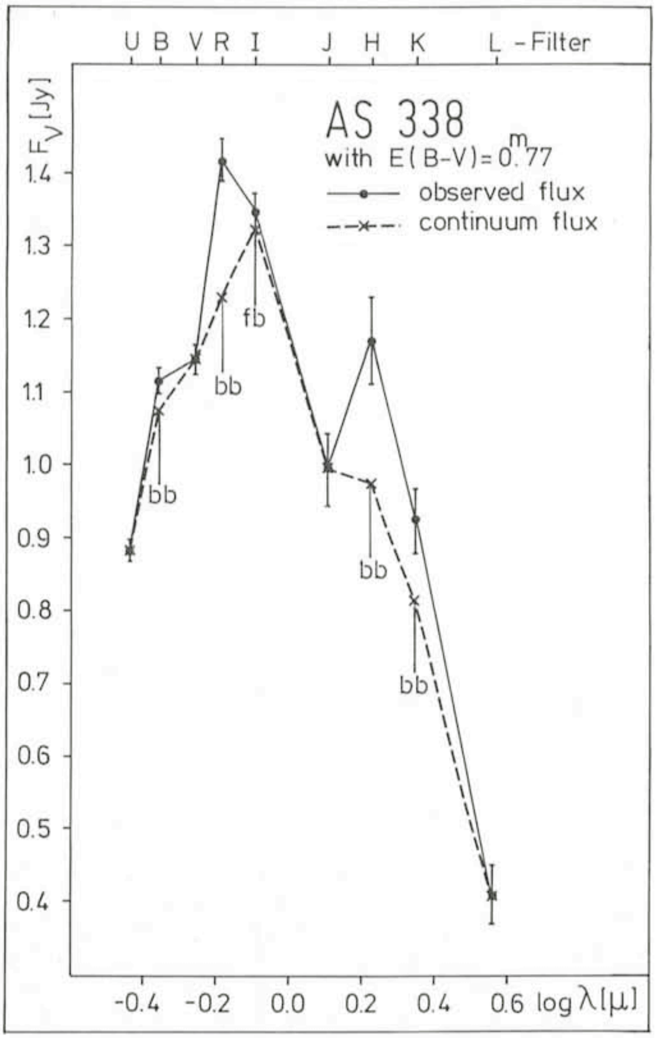

Fig. 3: *The dereddened flux distribution of AS 338. The solid line shows the observed flux, derived by combining the U, B, V, R, I photometry obtained in 1983 at the ESO 50 cm telescope with the J, H, K, L measurements, carried out in 1984 at the ESO 1 m telescope. The flux distribution has been dereddened using a value of E (B−V) = 0^m.77. An estimate of the contribution by the nebular spectrum has been made and the dashed line is believed to show approximate continuum fluxes.*

(2) The brightening by $\Delta V \approx 3^m.5$. The development of the emission lines furthermore indicates that AS 338 has undergone at least two outbursts during this century. The amplitude and the timescales of the outbursts also closely resemble those of Z And.

(3) The presence of an A supergiant continuum during 1983, when the high-excitation emission lines were absent.

A Little Bit of Theory

Since the late-type component in AS 338 has remained virtually constant, the outburst must be related to the hot component in the system. I have used the 1978 spectrophotometry published in the new Allen catalogue to derive approximate U, B, V and R continuum magnitudes. Evidently at this time, the star was close to minimum state. Again, these magnitudes have been combined with the J, H, K, L magnitudes measured in 1984. The resulting flux distribution of AS 338 close to minimum is presented in Fig. 4b. The A supergiant continuum is clearly absent here. Instead, reasonable fits could be obtained by combining the late-type star with a very hot (~ 100,000 K) and small ($\lesssim 1\ R_\odot$ companion. Such a star would emit most of its radiation in the UV spectral range and its contribution to the optical spectrum would be low.

There are two principal outburst models for symbiotic binaries: the thermonuclear outburst model (e.g. Paczyński and Rudak, 1980, *Astronomy and Astrophysics* **82,** 349) and the accretion event model (e.g. Bath, 1977, *Mon. Not. R. Astr. Soc.* **178,** 203). The basic requests to the outburst models are common to all. A late-type continuum has to be present in the IR during quiescence as well as during outburst. During outburst, the optical spectral range must simulate an A−F supergiant. The main differences between the proposed models are the nature of the hot components and the mechanisms which, during outburst, redistribute the radiation of the hot companion to optical wavelengths. According to the recently computed synthetic spectra from 0.1 to 3.5 μm (Kenyon and Webbing, 1984, *Astrophysical Journal* **279,** 252), the typical A−F supergiant continuum during outburst may be produced by either (a) a blackbody at $T_{eff} \approx 6{,}000-10{,}000$ K), (b) a white dwarf accreting matter at a rate above the Eddington limit ($\dot{M} > 10^{-5} M_\odot yr^{-1}$), or (c) a main sequence star accreting matter near the Eddington limit ($\dot{M} \sim 10^{-3} M_\odot yr^{-1}$). An observational diagnostic is proposed by these authors, which allows to discriminate among possible hot components in symbiotic systems. Obviously, the data required to apply this method are continuum magnitudes in the UV spectral range. Since the symbiotic star AS 338 is presently bright enough to make its continuum accessible to the IUE low-dispersion mode, I have applied for observing time with the IUE satellite, to make use of this opportunity. In addition, the observers of the Sterken group (*The Messenger,* **33,** 10) are going to monitor the optical brightness variations of AS 338, using one of ESO's photometric telescopes.

Although my story ends here, it is not at all finished. A hint in favour of the accretion event model is given by the polarimetric observations. But, for the time being, we have to wait for the ultraviolet observations to derive, as I hope, the nature of the hot component in my pet symbiotic system.

A Near Infrared Survey of the Southern Galactic Plane

N. Epchtein, Observatoire de Meudon

1. Infrared Sky Surveys

Beyond the photographic spectral range, three major infrared sky surveys have been performed till now: (i) the Two Micron Sky Survey (TMSS) achieved by Neugebauer and Leighton (1969) which provided a catalogue (IRC) containing about 5,600 sources brighter than K ~ 3.5 at declination north of −35°; (ii) the Air Force Geophysical Laboratory (AFGL) survey at 4, 11, 20 and 27 micron (Price and Walker, 1974), a rocket-borne survey covering large parts of the sky but suffering many gaps, mostly in the southern sky, and (iii) the Infrared Astronomical Satellite (IRAS) mission, mainly dedicated to a complete and deep sky survey at 10, 20, 60 and 120 micron whose results have just been released to the astronomical community.

The first two surveys, even though they were sensitivity-limited and incomplete, have led to a large amount of follow-up observing programmes in the optical, infrared and radio ranges. For many years, they have been the unique sources of homogeneous data on a large number of infrared objects. They revealed new important classes of dusty celestial objects such as the so-called OH-IR sources, an extreme class of late-type stars and the compact infrared objects, which are probably very young massive stars still embedded in their protostellar envelopes.

Mostly sensitive to cool stars (1,000–4,000 K), the TMSS has shown that the appearance of the sky in the infrared and in the visible are definitely different. It has revealed many extremely luminous, but invisible or optically very faint stars.

The reddest IRC sources (see list in Kleinmann and Payne-Gaposchkin, 1979), such as +10216, +10011, +10401, have been shown to be extreme late carbon or oxygen-rich stars surrounded by a dense cool (500 to 1,500 K) expanding envelope of dust and gas, revealed by the infrared spectral signatures of grains. Many of them are long-period variable stars and exhibit thermal and maser molecular emission lines in the millimetre range (see, e.g., Nguyen-Q-Rieu et al., 1983). They still deserve further observations to be fully understood and modelized.

Unfortunately there has been no attempt to complete the TMSS in the southern sky during the last 15 years. Even after the completion of the IRAS mission, which does not cover the near infrared spectral range, a large part of the sky still remains essentially unknown in the 1–10 micron range.

2. The Valinhos Survey

In order to partly fill up this gap, we have undertaken, in collaboration with astronomers at Instituto Astronomico e Geofisico (IAG) of the University of São Paulo (USP), a 2.2 micron survey of the southernmost part of the galactic plane. The primary aim of the project is to show up the brightest near IR point sources for future observations at longer infrared and radio wavelengths, which will be possible thanks to the developments of powerful infrared and millimetre telescopes and instrumentation in the southern hemisphere, more specifically at La Silla.

The achievement of a survey, even within a limited area, needs the availability of a telescope for a long period and a "staff" of observers, ready to spend many nights observing. By the beginning of the 80s, several opportunities were favourable to a completion of the TMSS in the south. I was involved in a joint programme with astronomers at USP and was told that this University was operating a modern 60 cm telescope at A. de Moraes Observatory located 80 km north of the large city, atop a 1,000 m high hill, above the small city of Valinhos.

An increasing amount of commercial and industrial lights around the observatory was making optical observations more and more difficult, and therefore this telescope was little used. Since infrared observations are much less sensitive to light pollution, the telescope could be almost full time dedicated to IR observations. Actually, owing to the Brazilian climate, observations were undertaken only during the (relatively) dry winter season, from May to October, which, fortunately, corresponds to the night transit of the galactic plane.

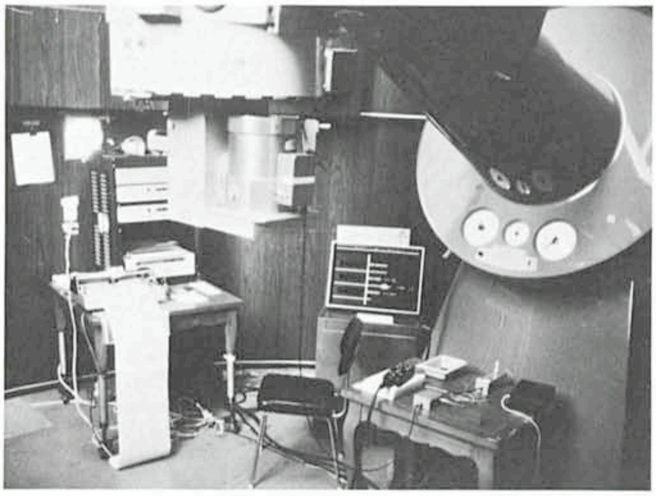

Fig. 1: *The large field infrared photometer installed at the Cassegrain focus of the 60 cm telescope of the University of São Paulo at Valinhos. This very simple device has been used since June 1982 to survey the southern galactic plane at 2.2 micron with a 3.5 arcminute diaphragm. So far, more than 1,500 sources have been detected.*