SECTION II:
POSTER PAPERS,
A BRIEF LIST OF CATALOGS,
AND INDEX

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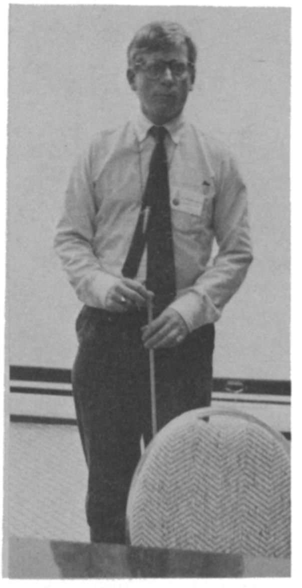
Poster-discussion
chairmen:

van der Hucht



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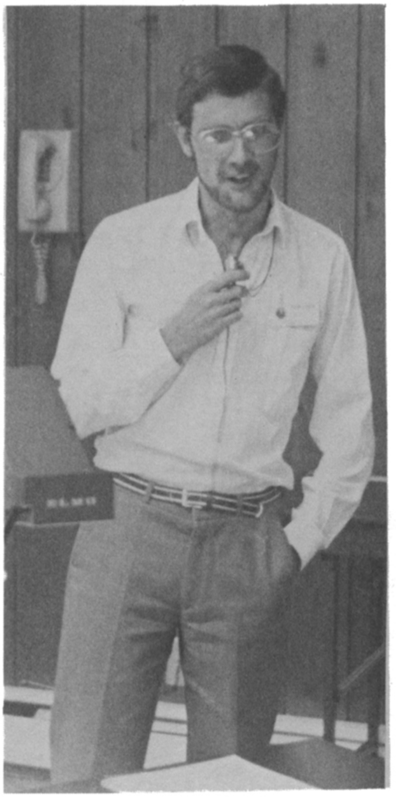
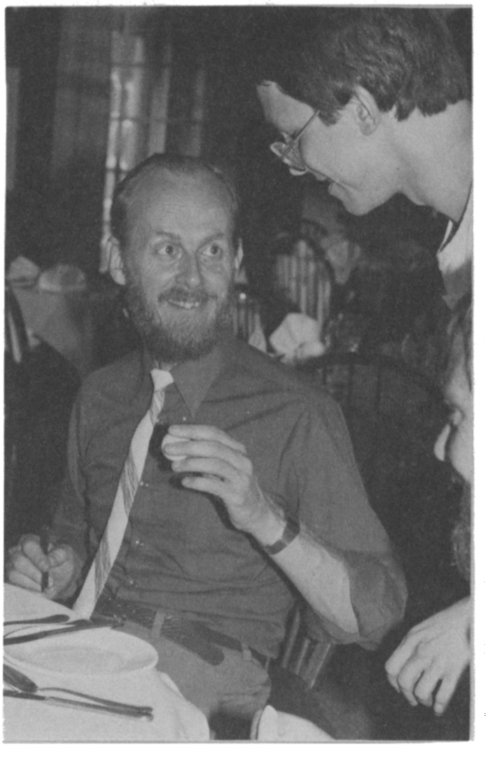


de Groot



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P CYGNI: THE STAR THAT STARTED IT ALL

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P Cygni was discovered in 1600 AD during an outburst when it reached 3rd magnitude. After another outburst in 1655 the star is now showing irregular photometric variations with an amplitude in *V* of ~ 0.2 magnitude. Because of these variations and of its peculiar spectral characteristics, P Cygni has been classified as anything between supernova and W UMa system. However, its light curve is unlike that of any other star and P Cygni could well be considered the first discovered LBV.

Over the last three years an accurate photoelectric light curve has been put together. It is based on observations made by a number of amateur and professional observers around the world and shows the following features:

+ Variations are irregular with maxima and minima every 1 - 2 months;
+ The brightness variations seem to show more scatter when the star is faint.

There are few simultaneous spectroscopic and photometric observations of P Cygni. In one reasonably well documented case (Baliunas *et al.*, preprint, 1987) there is an increase in the star's brightness while the Hα emission intensity decreases.

Radial-velocity variations, both at visual wavelengths and in the UV, show ejections of shells at semi-regular intervals. (Van Gent and Lamers, *Astron. & Astrophys.*, **158**, 335; Markova, *Astron. & Astrophys.*, **162**, L3).

Polarimetric observations of P Cygni also reveal the presence of anisotropic mass flows which vary in both direction and time (Hayes, *Astrophys. J.*, **289**, 726).

The above observations can be explained as follows:

+ P Cygni ejects shells at about two-monthly intervals. These shells increase the opacity in the star's envelope so that the bright photosphere is obscured and the star's brightness decreases.
+ The shells are "clumpy" so that during their presence, at minimum brightness, there are larger photometric variations than during their absence, at maximum brightness.

K. Davidson et al. (eds.), Physics of Luminous Blue Variables, 257–258.
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Note the following observed timescales of variations in P Cygni:

Radial velocities (UV)	60 - 75^d	Lamers *et al., Astron. & Astrophys.*, **149**, 29
Radial velocities (visual)	50 - 100^d	Van Gent & Lamers, *op. cit.* / Markova, *op. cit.*
photometry	25 - 60^d	*do.*/Percy *et al., Astron. & Astrophys.*, **191**, 248.
polarimetry	12 and/or 125^d	*do.*
rotation	$\approx 50^d$	

These can be compared to the expected time scale for non-radial pulsation: $\sim 28^d$ (Maeder, *Astron. & Astrophys.*, **90**, 311).

There is another star very similar to P Cygni: R81 in the LMC (Wolf *et al., Astron. & Astrophys.*, **99**, 351). Recently it was found to be an eclipsing binary with a period of 75^d (Stahl *et al., Astron. & Astrophys.*, **184**, 193). This is an excellent example of what can be achieved through long-term photometry of an interesting object.

P Cygni occupies a crucial position in the Hertzsprung-Russell diagram. A better understanding of this star will enable us to answer some very fundamental questions about the evolution of massive stars. E.g.: How does the mass-loss rate of a LBV vary with time? What mechanism is mainly responsible for the mass loss? Is it radiation pressure, binarity, non-radial pulsations, turbulent instability, or something different?

In order to identify the true (or most important) cause of P Cygni's mass loss we need more simultaneous photometry, spectroscopy and polarimetry.

This is a task for observers with regular access to these kinds of instrumentation. Many observers are already doing regular photoelectric UBV photometry. Those with regular access to spectroscopic equipment could obtain at least Hα profiles at a resolution of 0.25 Å or better. Polarimetry should be done as often as possible. In all cases, one good set of measurements per night will be sufficient to draw some very interesting conclusions.

So, let's have your observations, especially your spectroscopy, and your polarimetry. Contact the author at the above address for further details.

After nearly four centuries of discussing how interesting P Cygni is, it is time to become serious about more observations and unravel the mystery of its variations and find the clue to the secret of the evolution of massive stars !

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