PROFILE OF A STAFF ASTRONOMER'S PROGRAMME:

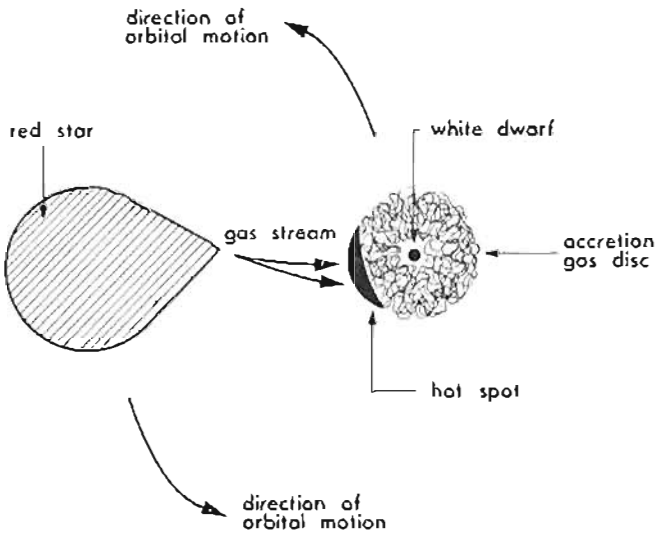
Dwarf Novae

Dr. Nikolaus Vogt, ESO staff astronomer in Chile, is a specialist in dwarf novae, and during the past years he has been busy improving our knowledge about these interesting objects. Here he reviews his programme:

Dwarf novae are small brothers of the X-ray binaries: an extended red star delivers gaseous material towards the second component, a white dwarf. The material arrives at quite a high velocity, accelerated by the gravity of the white dwarf, and does normally not hit the surface of the white dwarf immediately, but forms an accretion disc of hot gas which surrounds the white dwarf. This disc and especially its "hot spot"—i.e. the place where the gas stream from the red component falls onto the disc—are the most prominent light sources of the entire system. This model resembles that of the X-ray binaries, but the masses and dimensions of dwarf novae are much smaller, about one solar mass for each component. Nevertheless, soft X-rays were recently detected in one of the nearest dwarf novae, SS Cyg.

More than twenty years ago, Kraft detected the binary nature of dwarf novae on account of eclipses and other periodic variations in the light-curve and radial velocity. And it is more than 100 years ago that the first star of this class was detected, with its characteristics and spectacular behaviour: a normally very faint star brightens for a few days, 2-5^m above its normal magnitude. These outbursts occur at irregular intervals between ten days and several months. The eruptive behaviour resembles that of the novae, but the outburst amplitudes are smaller, thus the name "dwarf nova".

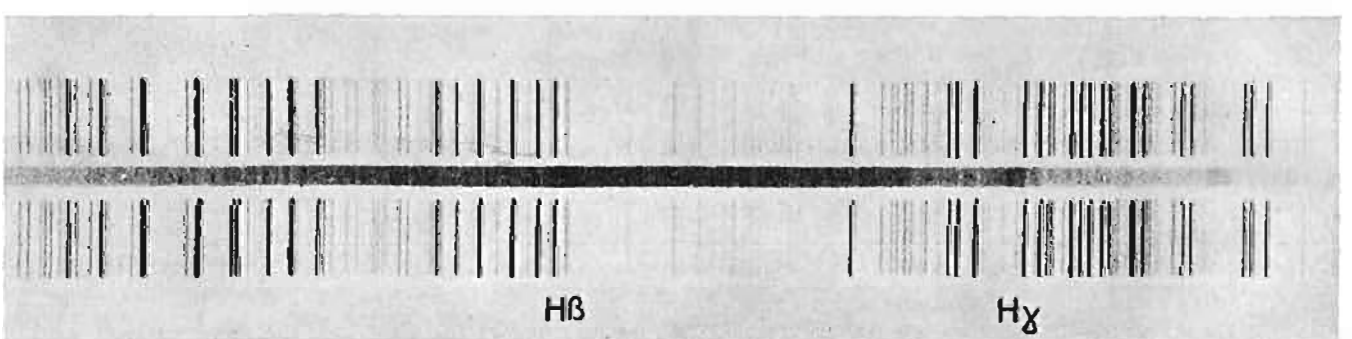
With these short notes we leave the field of certain knowledge. We do not know as yet which physical processes rule the observed properties. Even the location and origin of the spectacular outburst is still controversial: is the white dwarf responsible, due to a hydrogen-burning burst after accretion of hydrogen-rich gas onto its surface? Or is it the disc, or even the red component that creates the outburst? Doubts also arise if one tries to explain the oscillations with 15-30 sec. period which were observed in some of the dwarf novae. This could be white-dwarf pulsations, but they could also originate in the orbital motion of the innermost parts of the disc.



Dwarf nova model, schematic.

In order to improve the observational basis, N. Vogt has obtained photometric and spectroscopic observations of several dwarf novae since 1972. Occasionally, simultaneous observations were made with up to three telescopes at La Silla, as for instance in December 1974, together with visiting astronomers R. Häfner and R. Schoembs from Munich, or in April 1976 with J. Breysacher (ESO). The work concentrated especially on the three stars VW Hyi, EX Hya and BV Cen, for which long photometric and spectroscopic series were obtained with the best possible time resolution. It is fascinating to observe these stars, and every observing night is full of surprises: will our "friend" outburst tonight? Will he oscillate? Will he show a strong flickering, or is he "boringly" constant tonight?

The data of our dwarf novae observing programme are partly published, but most are still being analysed. Hopefully, they will help to answer some of the above-mentioned questions. However, they certainly also pose new problems; e.g. when we detected in VW Hyi a hump in the light-curve which repeats every 111 min. during outburst, while its orbital period is only 107 min.! What is the physical meaning of another period, 4 per cent longer than the orbital? A new feature—unexpected, observed, not understood. Science is like the old Greek legendary snake Hydra with her nine heads. If you cut one off, two new heads grow.



Spectrogram of the dwarf nova BV Cen, taken by J. Breysacher on April 4, 1976 with the Echelec spectrograph. Dispersion 124 Å/mm, exposure 50 min. The hydrogen lines Hß and Hγ are visible in emission and show a double structure. This structure is variable in a time scale of a few hours. The emission lines originate in the disc, while the narrow absorption lines correspond to the red stellar companion.