OTHER LATE-TYPE BINARIES WITH SYMBIOTIC CHARACTERISTICS

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In principle, we can learn about symbiotic star phenomena by studying analogous systems which exhibit similar spectral peculiarities or possess evolutionary paths which parallel known loci of the symbiotics. Three such binary systems of note are the Zeta Aur, Ba II and RS CVn binaries.

The Zeta Aur binaries (1970 Wright, in Vistas in Astron. 12, 149) are comprised of a late type supergiant (K or M) plus an early type dwarf star (late O - late B). These particular binaries also undergo atmospheric eclipses which permit study of the extended outer atmosphere of the late type star. Recent IUE observations have reveal quite pronounced P Cygni profiles in the Mg II resonance lines near 2800A in these stars (Stencel et al. 1979 Ap. J. 233, 621) indicating an extensive amount of material interacting with the B star radiation field. Similar P Cyg Mg II profiles have also been found in some symbiotic stars (paper by Stencel, Michalitsianos and Kafatos at this meeting), suggesting a common stellar wind interaction occuring. In addition, studies by Chapman (1981 Ap. J. in press) of the eclipse of Zeta Aur itself showed evidence for an accretion shock cone surrounding the hot star and opening out of the system. Evidence for this was best seen near secondary minimum in C IV and Mg II. It may be profitable to look for similar effects in symbiotics. Comments on possible similarities between Zeta Aur and symbiotic systems also appear in David Allen's (1975) book on Infrared Astronomy.

It has recently been recognized that the Ba II stars (G-K giants with large s-process element overabundances) may generally have white dwarf companions (McClure et al. 1980 Ap. J. 238, L35; Bohm-Vitense 1980 Ap. J. 239, L79). As an example, the mild Ba II star 56 Peg shows a far UV continuum (40,000K) under a forest of symbiotic like emission features (Si II through N V, including O IV] and N III]). Is it possible that these highly evolved objects (orbital periods are lengthy) are the results of symbiotic events where substantial mass transfer occurs?

And what precedes the symbiotic phase in binary star evolution? A scenario by Blair et al. (1981 Astron. & Astrophys. - in press) notes that RS CVn binaries ( K0 IV + G-F IV-V ) are of such short period that the K subgiant cannot evolve much more without filling its Roche limit. The stars SZ Psc and HR 5110, among others, may be at this critical juncture. If the rapid mass transfer envisioned by Paczynski (1970 in Mass Loss From Stars, ed. M. Hack, p. 237) obtains, the binary could be transformed in a few years into a hot degenerate object plus a giant star, with a multi-year orbital period. But the space density of RS CVn systems is as high as their evolutionary age is low, and either very few systems have yet undergone this transformation (HR Sge?) or other factors limit the efficiency with which this scenario will work to produce eruptive symbiotics.
Discussion following Stencel

PLAVEC: A comment on the P Cyg profiles in Zeta Aur. We find very similar P Cyg line with identical velocities in the interacting early type binaries Beta Lyr and KX And, suggesting that it does not matter whether the material comes over in a wind from a cool supergiant or from Roche lobe overflow. P Cyg profiles arise from interaction associated with accretion on to the hotter star, although a B5 V cannot itself provide the necessary energy for a stellar wind. We see the outflow as a consequence of the accretion. In Beta Lyr, as in Zeta Aur, wind speeds of 150-200 km/sec are seen.

STENCHEL: If that's the case, as seems reasonable, should we see stronger phase variation of the P Cyg profiles?

PLAVEC: The emission line formation region apparently exceeds the occultation zone by a large amount. In SX Cas we have evidence for formation of the emission far from either component.

STENCHEL: I would suggest the secondary minimum spectrum of AG Peg should show interesting effects such as are seen in Zeta Aur and 32 Cyg.
A COMPARISON BETWEEN SYMBIOTIC STARS AND CATAclySMIC VARIABLES

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The cataclysmic variables are close binary systems consisting of a late-type star transferring mass to a normal white dwarf via either (1) an accretion disk, or (2) an accretion column constrained by the magnetic field of the white dwarf. The observational properties of a white dwarf plus an accretion disk or column are distinctive and difficult to mask. As the symbiotic variables do not display these properties, I conclude that the accreting star in them is either (1) not a normal white dwarf, or (2) not accreting via a disk or accretion column.
Discussion following Robinson

KAFATOS: Some UV line profiles in RX Pup show a double structure, with splitting of about 200 km/sec, while the optical Balmer lines show 2000 km/sec P Cyg profiles. Is this consistent with a disk about a white dwarf?

ROBINSON: I don't wish to rule out subdwarfs (radii about 10 R_wd); these are acceptable to me.

STENCHEL: What is the evolutionary status of such subdwarfs?

ROBINSON: Either it started off as a white dwarf and acquired a permanently burning shell and is moving backwards along the CSPN cooling sequence, or it is the same thing going the other way.

ALLEN: I'd like to see RR Tel and RT Ser explained in the same way. What makes the difference in timescales?

ROBINSON: You can't use an RT Ser light curve to prove a thermonuclear runaway, since Bath has provided a counter-example. But my question about novae was not aimed at RT Ser and RR Tel types, but rather wondering where the fast novae go to.

WEBBINK: It may be significant that none of the slow novae, like RR Tel, has more than one observed outburst, suggestive of wind accretion.