GENERAL DISCUSSION ON THE PHYSICS OF SYMBIOTIC STARS

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ABSTRACT. This paper reviews the general discussion on the physics of symbiotic stars.

R. Webbink led this discussion, which opened when H. Nussbaumer wondered if disc accretion leads naturally to bipolar outflows and coronae (among other high energy phenomena). Webbink and M. Livio replied that calculations of discs in cataclysmic variable systems (CVs) suggest that coronae do form in discs. S. Kenyon and P.-L. Selvelli said that winds are observed in other systems known to possess discs, such as CVs, T Tauri stars, and the FU Orionis variables. A disc wind is required to understand line profiles in F Ori objects, but not for CV's or T Tauri stars. Disc winds may still be important for CVs, but have not been demonstrated observationally.

The discussion then moved on to a consideration of interacting winds. B. Yudin commented that we generally think of mass transfer from the cool star to the hot star, rather than the reverse. Webbink remarked that in the case of AG Dra, the observations suggest that the hot component is always quite luminous and wondered if a hot star wind might prevent accretion of needed material from the cool companion. R. Stencel suggested that instabilities in the interaction region might lead to some accretion.

As the next topic, Webbink noted that the observations regarding mass loss rates and infrared excesses indicated that many D-type symbiotics contain extreme asymptotic giant branch (AGB stars) near the end of their red giant evolutionary phase, and asked if these stars (i) were normal and (ii) if they then could give us any information concerning the late stages of single star evolution. These questions provoked a lively discussion. D. Allen commented that the single star counterparts to the Mira symbiotics are obscured *IRAS* sources and questioned whether there are enough D-types for a statistically significant sampling of single star evolution. P. Whitelock commented that the obscuration events observed in Mira symbiotics complicate the interpretation, and said (in response to a question by O. Regev) that single Miras have much smaller events (if they have them at all). A. Magalhaes remarked that the semi-regular variable L_2 Puppis displays activity similar to that observed in the Mira symbiotics described by Whitelock, but Whitelock emphasized that normal Miras do not display such behavior. Nevertheless, I think it is important to understand the events in L_2 Puppis and to determine if they have any relation to the obscuration events observed in Mira symbiotics.

Livio continued the debate by asking if red giants can lose mass more rapidly than would be estimated by a simple Reimers law (for example). R. Tylenda reminded the audience that the transition from a normal AGB star into a planetary nebula is believed to be achieved as a result of a ''superwind" which transforms a Mira variable into an OH/IR star

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and then into a planetary nebula nucleus. Allen noted that OH/IR stars possess mass loss rates of roughly 10^{-4} $M_{\odot}$ yr^{-1} and suggested H1-36 as an example of an OH/IR star which just happens to have a hot white dwarf companion star.

Changing topics, Webbink pointed out that the radial velocity data collected by Garcia and Kenyon demonstrate that reliable orbits can now be obtained for the cool components and cautioned that published analyses of orbital solutions based on emission line radial velocities are far from convincing. Given the complicated emission line profiles, Webbink asked, how is it possible to determine accurate mass ratios for symbiotic stars? M. Slovak said that reasonable radial velocity solutions can be obtained using the wings of strong emission lines in CVs, but Webbink noted that lines in CVs are certainly formed in or near the disc, while the location of the line-emitting region in symbiotics is not as obvious. Stencel agreed, and suggested that emission lines might move with the cool component in some objects. Chochol followed by commenting that the centroid of a broad, variable emission line is rather difficult to determine whether it follows the motion of the cool component or the hot component. J. Mikolajewska proposed that since the eclipse behavior of He II in CI Cyg demonstrates an association with the hot component, one might begin with a detailed study of emission line velocities in this object. A. Michalitsianos replied that narrow, rather easily measured emission lines made SY Mus a good candidate for radial velocity observations. Several cautionary (pessimistic!) voices reminded the audience that it is (i) necessary to measure relative motions of various emission lines and red giant absorption lines very carefully (Nussbaumer), (ii) important to remember that the relative phases of radial velocity maxima of emission lines such as H I and He I are known to change with time (e.g., AG Peg - Kenyon), and (iii) essential to keep an open mind concerning the location and geometry of the ionized region and the importance of variability (Allen).

This fast-paced discussion closed with a plea from R. Viotti to compare high quality observational data with equally high quality models.