BOOK REVIEW

<u>INTERACTING BINARY STARS</u>

Jorge Sahade and Frank Bradshaw Wood, Pergamon Press, New York, New York, 1978. 186 pages; $16.80.

    Binary star astronomy has changed dramatically since the days when stellar doubles were viewed as separate stars connected by nothing more than gravitational attraction. Astronomers now recognize that close doubles are dynamic systems, whose evolution and whose current appearance are very much a product of their duplicity. It is now taken as fact that there are massive transfers of material between the components of many double systems, that this material is observed as streams, shells, and discs associated with double star systems, and that nova outbursts, most galactic x-ray sources, and a variety of other peculiar objects are a result of the interactions of the close binary stars.

    <u>Interacting Binary Stars</u> is a very good review of this topic. It is written by two acknowledged experts, who have contributed much to the field themselves. Sahade and Wood begin with a historical overview of eclipsing binary star study. They discuss Goodricke's 18th century observations of Algol, Russell's method of light curve solution, Struve's extensive spectroscopic investigations and their implications about the interacting nature of binary stars, and some very recent developments, including space astronomy and the application of computer technology to light curve solution.

    Next follows a chapter describing the "zero velocity surfaces" which are so important to understanding mass transfer. I found their explanation very understandable and their analogy to the Sun-Jupiter-Trojan asteroid configuration very elucidating.

    The analysis of light curves is given in sufficient detail for the non-specialist, and the appropriate references are cited for persons who wish to go further on their own. The authors describe Russell's method, rectification, nomographs, and simultaneous solution where rectification is not a separate step.

    Following is a chapter on the W Ursae Majoris systems which are late spectral type pairs so close that they have a common envelope of gas around them. There are many mysteries associated with this class of stars, not the least of which is the question of why there are so many of them.

    Observational evidence for gaseous structure is the topic of the fifth chapter. This is a fairly thorough description of the spectroscopic observations that revealed the presence of gaseous streams, circumstellar envelopes, and outer envelopes in the binary systems.

    Chapter six may be of special interest to visual observers for it deals with period changes. The three known types are the light-time effect due to the presence of a third star in the system, rotation of the line of apsides, and irregular changes thought to be related to mass transfer. The authors comment that "<u>since there are not enough professional astronomers to keep all the eclipsing systems under proper observation, this is a field where work of amateurs is of value</u>," and they mention the AAVSO and other amateur groups.

    The disturbed evolution of interacting binaries is discussed in chapter seven. Algol is a perfect example. In this system, we have a near main-sequence early-type star of great mass and a later-type evolved star of less mass. Since they are, presumably, the same age, one wonders why the less massive star evolved faster than the heavier one, when stellar evolution theory would predict just the opposite. The answer seems to be that during their past, the originally heavier star evolved toward gianthood and lost a large fraction of its mass to the originally less massive star, thus reversing the mass ratio. That is, the lighter, evolved star of today was the heavier star when the system was born.

The next chapter discusses observations from outside the earth's atmosphere in the ultraviolet and x-ray parts of the spectrum. I found especially interesting the effect of Doppler shift on the pulsation period of the x-ray component of a binary system. This gives a velocity curve, just like that resulting from optical radial velocity observations of the visible component. Putting both of them together gives the stellar masses.

Special groups of binary stars are described next. These include the RS CVns, the Wolf-Rayets, novae and dwarf novae, symbiotic stars, central stars in planetary nebulae, and stars (like VV Cep) with atmospheric eclipses. I found the authors' distinction between classification based on light-curve and based on type of system very helpful. Thus, a binary can have an Algol-like light-curve (minimal light changes outside of eclipse), without being an Algol-type system (near main-sequence star of early spectral type, accompanied by an evolved star of later spectral type).

The last chapter deals with individual stars of special interest: Algol, β Lyrae, U Cep, R CMa, and ε Aur. Fans of these particular systems will appreciate this chapter.

The book has 800 entries in its excellent bibliography. It has a short general-study and a star-name index. This latter has 171 entries, including variable star names, x-ray designations, nova names, and designation in the HD and HR catalogs.

This book nicely complements A. Batten's book, Binary and Multiple Systems of Stars, which appeared in the same series in 1973. It is written on a less technical level than V. P. Tsesevich's Eclipsing Variable Stars, also of 1973, which was reviewed in volume 3, number 2 of this journal. The back cover recommends Sahade and Wood's book for astronomers who are not binary star specialists and to amateur astronomers, and this reviewer heartily concurs.

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PROJECTS AND DEMONSTRATIONS IN ASTRONOMY

Donald Tatersfield, John Wiley & Sons, New York, 1979, 331 pages; $27.50.

This book is just what the title implies. However, a good mathematical knowledge and substantial knowledge of astronomy are required. There are 61 projects for you to solve, varying from orbital motion, celestial sphere, planets, sun, astronomical instruments, stars, galaxies and telescopes. Graphic solutions are included in the Appendix. Symbol references in the text are not noted on the diagrams and certain reference symbols in the text are different in the diagrams. However, the advanced student will find much of interest.

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